UNIVERSITY OF AL EXANDRIA
FACULTY OF AGRICULTURE
(SABA BASHA)

JOURNAL OF THE ADVANCES IN AGRICULTURAL RESEARCHES

VOLUME 20 (1) MARCH 2015
ISSN 1110 - 5585 / 1996
ISSUED AND PUBLISHED BY
FACULTY OF AGRICULTURE SABA-BASHA
ALEXANDRIA UNIVERSITY
P.O. BOX. 21531 BOLkLEY, ALEXANDRIA, EGYPT.

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Editorial Board

CONTENTS

The use of Dried Orange Pulp for Feeding Meat Rabbits

H. S. Zeweil, S. M. Zahran, M. H. Ahmed, K. I. Kamel*, W. M. Dosoky, Yasmin El-Gendy and M. Bahr

Department of Animal and Fish Production, Faculty of Agriculture (Saba Basha), University ofAlexandria, Alexandria, Egypt.
*Agriculture Research Center, Animal Production Research Institute, Cairo, Egypt.
Corresponding author: hszeweil@yahoo.com

ABSTRACT : This study aimed to evaluate the growth performance, carcass traits and digestibility coefficients of growing rabbits fed different levels of orange pulp. Orange pulp was replaced for barley in the basal diet at 4 levels (0, 7.5, 15 and 30 %). A total number of 36 growing V-line rabbits at 7 weeks of age, with an average initial live body weight of 760.9 ± 33.9 g, were individually weighed and randomly assigned individually into four groups in a completely randomized design representing the four experimental groups. Each group was divided into three replicates of three rabbits each. All rabbits were kept under the same management and hygienic conditions and were housed in metal battery cages supplied with separated feeders. Diets were offered *ad-libitum* and fresh water was available all times from automatic nipple drinkers. The experimental period lasted for 42 days. The obtained results showed that barley replacement levels by dried orange pulp up to 30 % showed insignificant differences on the performance and carcass traits of growing rabbits when compared with the control diet. Also, there were insignificant differences in dry matter, organic matter, crude protein, crude fiber, and nitrogen free extract digestibility among the experimental diets and control diet, however, the digestibility coefficient of ether extract was recorded highest ($P \leq 0.05$) values for 7.5, 15 and 30 % substitution level of orange pulp when compared to the control diet. The nitrogen free extract digestibility recorded the lowest value with 30% substitution of orange pulp when compared to the control diet and other replacement levels of barley by dried orange pulp; however, the difference was not significant. Metabolizable energy (ME), total digestible nutrients (TDN) and digestible crude protein (DCP) recorded insignificant difference among control diet and 7.5, 15, and 30 % substitution levels of orange pulp. It could be concluded that barley replacement levels by dried orange pulp up to 30 % had no negative effects on growth performance, carcass and digestibility coefficients of nutrients.

Key words: Rabbits performance, orange pulp, carcass traits, digestibility

INTRODUCTION

The corn and barley considers main energy source in the rabbits and poultry diets. The available of them depends on some factors such as import of feedstuffs and uses it in some industrial as ethanol production. The agro-industrial processing was resulted some wastes as vegetable and fruit by-products. The fruit byproducts use as energy source in animal feed (Crickenberger, 1991) and these by-products are economical and environmentally sound way for food processors to reduce waste discharges and cut waste management cost. Selling by-products can also produce additional revenue. The active antioxidant compounds are flavonoids, isoflavones, flavones, anthocyanins, coumarins, lignans, catechins and isocatechins. In addition, some compounds found in natural foods such as vitamins C and E, β-carotene and α-tocopherol are known to possess antioxidant potential (Prior, 2003). Flavonoids is good for keeping human and animals healthy. Pectin is a kind for carbohydrate gel, a component of plant cell wall. And thus it has high water

absorption property and can use for treating diarrhea and its viscosity has significant health benefits. Citrus pulp contains flavonoids and pectin. Larrauri et al. (1996) reported that flavonoids which play role in reducing cholesterol because the structure of flavonoids contains numerous OH group which can supply H atoms to quench free radical, making it a strong antioxidant and anti-tumor activity meanwhile, may play a role in cancer, heart disease, circulation and Alzhemers' disease (Shahelian, 2005). Ascorbic acid is antioxidant act (Marcy et al., 1989). Oluremi et al. (2006) reported that content of Sweet Orange Rind for vitamin C was 3.88 mg/100 g *vs* zero mg/100 g for maize or barley. Hon et al. (2009) reported that sweet orange fruit pulp meal can be used as replacement feedstuff for maize in the ration of growing rabbits up to 20%. The main objective of present study was to evaluate the nutrient value of orange pulp as non-conventional sources for energy in growing rabbits feeding.

MATERIALS AND METHODS

Thirty-six healthy growing V-line rabbits of both sexes with initial weights of 760.9 ± 33.9 g were used for the study. The rabbits were randomly allocated to four treatments groups of 9 rabbits each. Each treatment was further sub-divided into 3 replicates of 3 rabbits. The rabbits were weighed at the beginning of the experiment to obtain their initial body weight and subsequently biweekly. The rabbits were housed in galvanized wire cages with flat deck (50 x 50 x 40 cm) three rabbits in each cage, in a well-ventilated building. A cycle of 16 hours of light and 8 hours of dark were provided throughout the experiment. Orange fruit pulp was collected fresh from Edfina Factory for nutritional products in Alexandria city, Alexandria governorate, Egypt. The orange pulp was sun dried for 48 h on concrete floor until it became crispy. It was grinded and three samples of it were taken for proximate chemical analysis according to AOAC (1995). Rabbits were fed experimental diets in a pellet form. Feed and water were provided *ad libitum* throughout the experimental period from 7 to 13 weeks of age by using high standard hygiene and careful management. Four pelleted experimental diets were formulated. Dried orange pulp was replaced for barley in the basal diet, some modifications were done in the composition of the basal diets to make the four experimental diets isonitrogenous and isoenergetic containing approximately 17% CP and 2570 Kcal/kg DE, at 4 levels (0, 7.5, 15 and 30 %). The control basal experimental diet and all experimental diets were formulated to cover all essential nutrient requirements for growing rabbits according to NRC (1977).

Ingredients and chemical composition of the experimental diets are shown in Table 1. At 13 weeks blood samples were collected from 3 rabbits from each treatment from the marginal ear vein in heparinzed tubes. Plasma were obtained by blood samples centrifugation for 20 min. at 4000 rpm and stored at -20º C in Eppendorf tubes until analysis. All tests; total lipids, total cholesterol, low density lipoprotein, high density lipoprotein, creatinine and uric acid, total antioxidant capacity (TAC) and lipid peroxide Malondialdehyde (MDA) were carried out using the commercial kits produced by Human (Max-Planck-Ring 21-D-65205 Wiesbaden, Germany). At the end of growing period (13

weeks of age) , three rabbits of 13 weeks of age were taken randomly from each treatment, fasted for 12 hrs, weighed, slaughtered by the cut-throat method and dressed to determine the percentage of dressing, head, fur and the relative visceral organs. All traits were calculated as percentage of the pre-slaughter weight. At 13 weeks of age, twelve male rabbits (three rabbits from each treatment) were randomly taken after the termination of fattening trial. Rabbits within each treatment were randomly housed individually in metabolic cages that allowed separation of feces and urine. A preliminary period of 7 days was followed by five days for measurements of actual consumed feed, feces and collection of feaces and urine. The rabbits were fed twice daily at 8 a.m. and 4 p.m. Water was available all time. Feces of each rabbit was collected quantitatively once a day before offering the morning meal at 8 a.m. Samples(100%) of daily feces of each rabbit were stored at -200C. The five days combined collection fecal samples were kept for routine analysis. Fecal samples were oven dried at 600C for 48 h (partial drying) then ground through a 1 mm screen on a wiley mill grinder. Samples were composite per treatment per animal for analysis. Representative samples of feed offered and feces of each rabbit were chemically analyzed for determinations of dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fiber (CF) and ash which were carried out according to A.O.A.C. (1995) methods. Nitrogen free extract (NFE) was determined by difference. Data were analyzed using one-way ANOVA of GLM procedure of SAS® (SAS Institute, 2000). Significant differences between means were detected using mew Duncan multiple range test (Duncan, 1955).

RESULTS AND DISCUSSIONS

Results presented in Table 2 showed the proximate analysis of dried orange pulp and barley. Data showed that dry matter, organic matter and nitrogen free extract contents were nearly equals. While, the crude protein of dried orange pulp in the present study was lower than crude protein of barley by 38.0 %. Also, it was found that crude fiber, ether extract and ash contents of dried orange pulp were higher than those in barley by 69.2, 26.1 and 23.2 %, respectively.

The obtained results on organic matter (OM) of dried orange pulp was found to be higher by 5.8 % than those obtained by Lemo*et al.* (1984) who found that the values of OM of dried orange pulp was 90.57. Also, ether extract (EE) contents in dried orange pulp were higher by 51.9 % than those obtained by Oluremi*et al.* (2007) who found that EE of dried orange pulp was 2.35 %. In contrast, crude protein (CP) of dried orange pulp in the present study was lower than those obtained by Madrid *et al.* (2002), Oluremi*et al.* (2006 and 2007) who reported that CP content of dried orange pulp ranged from 9.3 to 11.4 %. Also, ash content in the present study was decreased by 12.2 % than those obtained by Ibrahim *et al.* (2011) which recorded value of 5.02 %. The proximate composition of dried orange pulp shows that it can be nutritionally evaluated as a possible substitute for barley in rabbit diets. The energy content of dried orange pulp was 2648 Kcal/kg as compared to energy content of barley 2761

Kcal/kg (Table 2) which suggests that this dried orange pulp can be classified as energy feed. Its high crude fiber (CF) content (9.05%) may be an advantage in rabbit nutrition since this livestock species requires a higher dietary crude fiber (minimum requirement of 9%) recommended by Spreadbury and Davidson (1978) than poultry and swine. The results presented by Hon *et al.* (2009) showed that the crude fiber was 9.68 %, fractions of dried orange pulp contain 3.28% acid detergent lignin (ADL). This indicated that the fiber component of dried orange pulp contains more of digestible carbohydrates than indigestible.

The average live body weights of growing rabbits as affected by different levels of dried orange pulp under hot summer conditions are presented in Table 3. It is clearly shown that no significant differences in body weight could be detected in initial body weight at 7 weeks of age. From 7 weeks of age and up to the end of the growing period at 13 weeks of age, non-significant differences were observed. Rabbits reared under stressful summer conditions and fed diets containing different levels of dried orange pulp had the nearly the same body weight values as compared with those fed control diet throughout the whole experimental period. Insignificant progressive increases in body weight with the increases of barley replacement levels by dried orange pulp up to 15 % as compared to the control group or with the highest level of substitution (30 %). Barley replacement levels by dried orange pulp at 7.5 and 15 % increased live body weight by 3.2 % as compared with the control group; however, insignificant decrease in live body weight was obtained with 30 % replacement level reached to 1.5 % as compared with the control group. The significant improvement in live body weight of dried orange pulp treated groups may be due to the anabolism of animal (Abo-El-Ezz*et al.,* 1984). It was noticed that daily weight gain of rabbits given barley replacement levels by dried orange pulp up to 15 % non-significantly improved daily weight gain by 4.6 % as compared with the heat stressed control group. On the other hand, the high replacement level (30 %) resulted in non-significant deterioration reached to 2.1 % from control group.

The results presented in Table 3 showed that the improvement in daily weight gain was due to the insignificant improvements in feed conversion ratio compared with the control group, and may be due to the biological function of dried orange pulp which have some extracts such as polyphenols, anthocyanine and hydrolysable tannine which act as antimicrobial and cause sterilization of gastrointestinal tract (Abdel-Azeem, 2005), or to tannin (one component of orange pulp) affect by reducing intestine movement which may lead to better nutrients absorption, which is reflected on body weight gain (Ismail, 2003).

Results presented in Table 3 showed insignificant effect of dried orange pulp on daily feed intake as compared to the control group. In addition, data in Table 3 showed that there was a non-significant variation in feed conversion ratio, the major target of producers. It is noticed that heat stressed control rabbits had the worst feed conversion values during the whole experimental period. Feed conversion ratios were insignificantly improved by dried orange pulp up to 15 % barley replacement in rabbit diets, with one exception since the

group received high level of dried orange pulp showed insignificant deterioration in feed conversion ratio as compared to the control group or the other experimental groups. Also, it was observed that rabbits fed on 7.5 % dried orange pulp instead of barley had the best feed conversion ratio. Dried orange pulp at 7.5 and 15 % barley replacement insignificantly improved feed conversion ratio by 6.1 and 1.7 % as compared with control group. Digestive disorders of growing rabbits were prevented by dried orange pulp, moreover severity of diarrhea was not observed by orange pulp inclusion in the diet. But generally, it was observed that no mortality was recorded during the feeding trial. This suggests that, up to 30 % barley replacement by dried orange pulp did have any adverse effect on the rabbits. They did not show any signs of distress. This shows that dried orange pulp up to 30 % barley replacement in rabbit diets can be used as an alternative dietary energy feed resource. The same results were obtained by Hon *et al.* (2009) on growing rabbits. The antioxidant capacity of citrus was correlated both to vitamin C and phenolics. Aside from citrus pulps, the peels are also good sources of bioactive compounds and minerals, and can be explored for their health promoting values in food products (Barros *et al.,* 2012).

Including dried orange pulp instead of barley in the rabbit diets did not affect carcass traits as compared to the control group (Table 3). No significant differences were observed in dressed weight percent and organs relative weight. Results of dressed weight were in harmony with final live body weight. Insignificant differences were detected in digestibility coefficients of dry matter, organic matter, crude protein, crude fiber and nitrogen free extract; however, significant improvements in digestibility coefficients of ether extract were recorded with different levels of orange pulp replacement as compared with the control group. Also, digestible Energy (DE), total digestible nutrients (TDN) and digestible crude protein (DCP) recorded insignificant difference among control diet and 7.5, 15, and 30 % substitution levels of orange pulp.

Conclusively, the result of this study have shown that up to 30 % dietary barley in rabbit diet can be replaced with sun dried orange pulp without negative effects on the performance of rabbits. As a high energy source like barley, its inclusion in rabbit feed formulation would help to reduce the cost of feed. It is therefore, suggested that its practical abundance should be exploited as a significant leap to reduce the high demand on barley, its accompanying high cost and its direct effect on the cost of finished table meat product.

Table (1): Composition and chemical analyses (%) of the xperimental diets (as fed)

Ingredients (%)	Control	Orange pulp (%)		
		7.5	15	30
Berseem hay	30.20	29.93	29.85	29.60
Barley	20.00	18.50	17.00	14.00
Orange pulp	-----	1.500	3.000	6.000
Corn yellow	14.80	15.00	15.00	15.00
Wheat bran	10.00	10.00	10.00	10.00
Soybean meal (44%)	19.60	19.67	19.75	20.00
Molasses	3.000	3.000	3.000	3.000
Limestone	1.000	1.000	1.000	1.000
Di-calcium-Phosphate	0.300	0.300	0.300	0.300
Salt	0.500	0.500	0.500	0.500
Vit. and min. mix.	0.300	0.300	0.300	0.300
Lysine	0.150	0.150	0.150	0.150
Methionine	0.150	0.150	0.150	0.150
Total Chemical analyses(%)	100.0	100.0	100.0	100.0
Dry matter	89.19	89.11	89.21	89.13
Organic matter	81.56	81.41	81.54	81.36
Crude protein (CP)	17.20	17.18	17.17	17.11
Crude fiber (CF)	11.34	11.39	11.41	11.51
Ether Extract (EE)	2.800	2.82	2.82	2.83
Ash	7.630	7.70	7.67	7.77
NFE	50.22	50.02	50.14	49.91
NDF	36.37	36.41	36.42	36.49
DE (Kcal / kg)	2574.02	2572.4	2571.8	2568.5

NFE = Crude protein+ Crude fiber+ Ether Extract-Dry matter

Digestible energy (DE) of the experimental diets was calculated according to the equation described by **Cheeke*et al.* (1987)** as follows: DE (K/kg) = 4.36-0.0491×NDF% NDF = 28.924+0.657× CF%

Table (2): Proximate chemical composition of dried orange pulp and barley (on dry matter basis).

Items	Dried orange pulp	Barley
Dry matter, %	92.82	91.60
Organic matter, %	95.83	96.60
Crude protein, %	7.93	12.80
Crude fiber, %	9.05	5.35
Ether extract, %	3.57	2.83
Ash, %	4.41	3.58
Calcium, %	1.10	0.03
Phosphorus, %	0.45	0.36
NFE	67.86	67.70
NDF	34.87	28.00
DE (Kcal / kg)	2648	2761

Digestible energy (DE) of the tested materials was calculated according to the equation described by **Cheeke*et al.* (1987)** as follows: DE (K/kg) = 4.36-0.0491×NDF% NDF = 28.924+0.657× CF%

Table (3): Growth performance, carcass traits, digestibility coefficients of nutrients and nutritive values of V-line rabbits fed on the experimental diets.

Parameters	Control	Orange pulp (%)		
		7.5	15	30
Growth performance:				
Initial body weight, g	760.1 ± 50.1	761.7 ± 39.5	763.3 ± 26.1	758.3 ± 33.7
Final body weight, g	2339.4 ± 88.0	2413.3 ± 67.2	2415.0 ± 82.9	2304.4 ± 75.3
Daily weight gain, g	28.2 ± 1.5	29.5 ± 0.9	29.5 ± 1.1	27.6 ± 1.0
Daily feed intake, g	97.2 ± 1.0^{ab}	95.3 ± 1.1^{b}	99.7 ± 3.0^{a}	96.3 ± 2.1^{ab}
Feed conversion ratio	3.44 ± 0.18	3.23 ± 0.11	3.38 ± 0.14	3.49 ± 0.12
Digestibility coefficients:				
Dry matter, %	66.74 ± 0.34	66.02 ± 0.95	65.72 ± 0.48	65.20± 0.55
Organic matter, %	65.4 ± 2.8	65.6 ± 1.1	64.9 ± 1.9	64.5 ± 3.0
Crude protein, %	76.6 ± 2.3	76.9 ± 1.9	76.4 ± 77.2	77.2 ± 3.5
Ether extract, %	56.7 ± 3.7^{c}	63.8 ± 2.1^{b}	65.0 ± 1.9^{b}	67.0 ± 2.0^{a}
Crude fiber, %	30.8 ± 6.3	33.9 ± 1.9	32.8 ± 4.1	34.9 ± 6.6
Nitrogen free extract, %	70.8 ± 3.0	69.2 ± 0.9	72.3 ± 1.0	66.9 ± 2.5
Nutritive values:				
TDN,%	54.8 ± 2.4	55.8 ± 1.0	56.1 ± 0.9	55.0 ± 2.6
DCP,%	13.2 ± 0.4	13.2 ± 0.3	13.1 ± 0.4	13.3 ± 0.6
ME(Kcal/kg)	2293.2 ±101.8	2335.8 ± 40.7	2348.5± 39.7	2300.8 ± 110.3
Carcass traits:				
Dressed weight, %	59.7 ± 0.5	60.1 ± 0.8	59.6 ± 0.4	60.6 ± 0.6
Heart, %	0.57 ± 0.02	0.48 ± 0.05	0.64 ± 0.02	0.51 ± 0.05
Liver, %	5.16 ± 0.58	5.24 ± 0.48	6.11 ± 0.50	4.85 ± 0.16
Spleen, %	0.05 ± 0.01	0.06 ± 0.01	0.05 ± 0.00	0.05 ± 0.00
Head, %	9.6 ± 0.4	9.2 ± 0.3	9.0 ± 0.5	9.0 ± 0.3
Fur, %	13.7 ± 0.8	13.9 ± 0.5	14.2 ± 0.2	13.7 ± 0.6

a-c Means in the same row bearing different superscripts differ significantly ($p \leq 0.05$) TDN= Total digestible nutrients DCP Digestible crude protein ME= Metabolisable energy, ME was calculated according to Forbes (1985). ME = TDN × 41.85.

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الملخص العربي

أستخدام مخلفات البرتقال فى تغذية أرانب التسمين

حسن زويل ، سليمان زهران ، محمد حسن ، كامل ابراهيم* ، وليد دسوقى ، ياسمين مؤمن ، موسى بحر

قسم الانتاج الحيواني والسمكى – كلية الزراعة (سابا باشا) – جامعة الاسكندرية – مصر

*مركز البحوث الزراعية – معهد بحوث الانتاج الحيوانى– القاهرة – مصر

تهدف الدراسة الحالية لتقييم أداء النمو ، صفات الذبيحة ، معاملات هضم العناصر الغذائية فى الأرانب النامية التى تتغذى على مستويات مختلفة من مخلفات البرتقال. تم احلال مخلفات البرتقال المجفف بدلا من الشعير عند أربعة مستويات من الاحلال (صفر ، ٧.٥ ، ١٥ ، ٣٠ %) . أستخدم ٣٦ أرنب نامى من نوع V-line عمر ٤ أسابيع بمتوسط وزن ابتدائى ٧٦٠.٩ جم تم وزنها وتوزيعها عشوائيا على أربع مجاميع فى تصميم نظام عشوائى متكامل مكونا أربع مجاميع تجريبية. كل مجموعة قسمت على ثلاث مكررات وبكل مكررة ٣ أرانب. جميع الحيوانات تم وضعها تحت نظام رعاية وظروف صحية واحدة . وتم تربية الحيوانات فى أقفاص معدنية مزودة بغذايات منفصلة بكل قفص . تم تقديم العليقة بصفة دائمة وكان ماء الشرب متوفر باستمرار باستخدام حلمات الشرب. وقد أستمرت التجربة لمدة ٤٢ يوم . وكانت أهم النتائج المتحصل عليها أنه يمكن أستبدال مخلفات البرتقال المجفف محل الشعير حتى نسبة ٣٠ % بدون أختلافات معنوية فى معدل الأداء وصفات الذبيحة مقارنة بمجموعة الشاهد (الكونترول). أيضا لم تلاحظ أاختلافات معنوية فى معامل هضم المادة الجافة ، المادة العضوية ، البروتين الخام ، الألياف الخام وكذلك المستخلص الخال من النيتروجين بين المجاميع التجريبية ومجموعة الشاهد. بينما وجد أن معامل هضم المستخلص الايثيرى كان الأعلى معنويا عند نسب أستبدال ٧.٥ ، ١٥ ، ٣٠ % مقارنة مع مجموعة الشاهد. سجل معامل هضم المستخلص الخال من النيتروجين أقل قيمة مع نسبة أستبدال ٣٠ % مقارنة مع مجموعة الشاهد والمجاميع التجريبية الأخرى ولكن لم تكن الفروق معنوية. لم يظهر أختلافات فى الطاقة الممثلة والعناصر الغذائية الكلية المهضومة والبروتين المهضوم لجميع نسب الاستبدال (٧.٥ ، ١٥ ، ٣٠ %) مقارنة بمجموعة الشاهد. وعموما تخلص الدراسة الى أنه يمكن أستبدال الشعير بمخلفات البرتقال الجافة حتى ٣٠ % حيث وجد أنه لا يوجدأى آثار سلبية على معدلات أداء الأرانب والذبيحة ومعاملات هضم العناصر الغذائية .

Effect of Mineral, Organic and Bio- Fertilization on Yield and Quality of Parsley (*Petroselluinam sativam*, L.)

[*]Radwan, F. I .,[*] A. I. Abido,[**] E. H. Shaben and Drakhshan I. saeed*
* plant production Dept., Fac. Agric. (Saba Basha) Alexandria University, Egypt
** Medicinal and Aromatic Res. Dept, A. R. C. Alexandria, Egypt, Div. of Medicinal and Aromatic plants

ABSTRACT : Two field experiments were carried out at the Experimental Farm of the Faculty of Agriculture (Saba Basha), Alexandria University, at Abees region, Alexandria. Egypt during the seasons of 2012/2013 and 2013/2014 to study the effect of NPK fertilizers, organic manure levels and biofertilizers on the growth parameters, chemical composition, and majors compounds of the essential oil of Parsley (*Petroselinum sativum*, L.). The applied experimental design was randomize complete blocks design with three replicates. The main results could be summarized as follows: (1) The fertilization treatments differently affected the mean values of all studied characters, (2) The application with organic manure (2 ton)/fed + 50% NPK+ Cerealine + phoshorein and organic manure (4 ton)/fed + 50% NPK + Cerealine + phosphorein significantly increased plant height, leaf area index, fresh and dry weight at two cuts as well as chlorophyll a & b, chemical composition (N, P and K%) and Vitamin C content during both seasons. (3) However, the application organic manure 2 ton org/fed + 75% NPK + phosphorein gave the highest of major's compounds (apiol, myristien, B- pinene and B- phellandrene %) during 2012/2013 season. This investigation suggests the need for more studies concerning the effect of NPK fertilizer organic manure and biofertilization on Parsley plant under different environments using different types of soil to reach the optimum combination to achive the best yield.

Key words: Mineral, Organic, biofertilization, Parsley**,** major's compounds oil.

INTRODUCTION

Petroslinum sativum Mill (parsley) Fam. *Apiaceae* is a widely cultivated herb used extensively for garnishing and seasoning foods, and for production of an essential oil. Fresh parsley is one of the most popular green herbs. The mature seed is steam distilled to produce parsley seed's, oil and parsley herb oil comes from the plant bearing immature seeds. Parsley herb oil has flavor more like the fresh leaves and is in greater demand than seed oil, which is often distilled from aged seed of low germinability (Simon *et al.,* 1984). The root may, also, be harvested for use as a medicinal herb. Parsley combines well with most foods except sweets. It has a mild taste blends other flavors together, and has a high nutrient's content and used in medicinal, household cosmetic and fragrance (Rashed, 2002).

Fertilization is one of the most important factors limiting the productivity of plants. The intensive use of expensive mineral fertilizers in recent gears results in environmental pollution problems. However, Chemical fertilizers at extremely high rates for along period decreased the potential activity of microflora and the stability of soil organic matter (Hussien, 1995). Additionally, organic manures are in the form of compost, animals manure, farmyard manure (FYM) and green manure organic materials are generally added to soils to improve their physical and chemical properties. They enhance the soil fertility by their composition of macro and microelements, amino acid, organic acids, sugars and organic matter (Abou El- Fadl *et al*., 1968). Furthermore, biofertilization is an important factor being used to produce products without some mineral fertilizer that cause environmental pollution problems, and high

rates of it leads to decrease the potential activity of microflora and the mobility of organic matters. Hence, the attention has been focused on the researches of bio- fertilization to safe alternative to specific chemical fertilizers. Biofertilizers play vital role for increasing the number of microorganisms and accelerate certain microbial process in the rhizosphere of inoculated soil of plants which can change the available forms of some nutrients tobe plants (Kandeel *et al*., 2001, Rashed, 2002; Mohamed and Abdu, 2004).

This research, however, is an attempt to find out the best fertilization treatments (chemical fertilizer, organic manure and biofertilizer) on the vegetative growth and chemical composition of psarley (*Petroselinum sativum*, Mill).

MATERIALS AND METHODS

Two filed experiments were carried out at the Experimental Farm of Faculty of Agric. (Saba Basha) Alexandria University, at Abees region, Alexandria, Egypt, during, the two growing seasons of 2012/2013 and 2013/2014 to study the effect of fertilization treatments (chemical fertilizer, organic manure and bio- fertilization) on growth and chemical composition of parsley(*Petroselinum sativum* Mill) plants. The experimental design was a complete randomized block design with three replicates.

The parsley seeds were sown on November 11^{th} and 14^{th} in the two growing seasons, respectively. The plots area of each was 4 square meters (2.0m ×2.0m) with 3 rows, the distance between the rows was 50 cm and 10 cm between plants.

The chemical fertilizers were applied as ammonium sulphate (20.5%N), calcium superphosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O) at the rates of (100, 100 and 50 kg/fed, respectively) which are the recommended dose.

The used biofertilization of bacteria were phosphorein (*Bacillusmegatheruim phosphorus* dissolving bacteria P.D.B.), cerealine *(Azospirillum Lipoferum* and *Azotobacter chroococcum*) which supplied by National Research Center. The inoculation, with phosphorein and cerealine was preformed by coating parsley seed with each product individually using a sticking substance (Arbic gum at 5%) just before sowing.

The organic fertilization (Sheap manure) was carried at the rates of 2 and 4 tons/fed, which were applied through the soil preparation before sowing.

The recommended dose of NPK was divided in two equal parts, the first one was applied one month after sowing and the second one was applied after the first cut.

The tested treatments were conducted as follows:
F_1: 100% NPK (control).
F_2: 75% NPK + cerealine.

F_3: 50% NPK + cerealine + phosphorein.
F_4: Organic manure (2 ton/fed) + 75% NPK.
F_5: Organic manure (2 ton/fed) + 75% NPK + cerealine.
F_6: Organic manure (2 ton/fed) + 75% NPK + phosphorein.
F_7: Organic manure (2 ton/fed) + 50% NPK + cerealine+ phosphorein.
F_8: Organic manure (4 ton/fed) + 75% NPK.
F_9: Organic manure (4 ton/fed) + 75% NPK + cerealine.
F_{10}: Organic manure (4 ton/fed) + 75% NPK + phosphorein.
F_{11}: Organic manure (4 ton/fed) + 50% NPK + cerealine+ phosphorein.

The physical and chemical characteristics of the experimental soil and used sheep manure composition are given in Tables (1) and (2). The soil was ananlyzed according to be methods deseribed by Page *et al*. (1982)

Table (1): The physical and chemical properties of the experimental soil in 2012/2013 and 2013/2014 seasons

Soil properties	Values	
	2012/2013	2013/2014
A- Particle size distribution (%)		
Sand	15.00	14.80
Silt	42.00	42.20
Clay	43.00	43.00
Soil texture	Clay loam	Clay loam
B- Chemical properties		
pH (1:1)	7.90	7.80
EC (1:1) dS/m	2.20	2.10
1- Soluble cations (1:2) (Cmol/kg soil)		
K^+	0.90	0.95
Ca^{++}	4.15	4.20
Mg^{++}	3.10	3.15
Na^{++}	8.10	8.20
2- Soluble anions (1:2) (Cmol/kg soil)		
CO^-_3+ HCO^-_3	2.70	2.60
CL^-	11.50	11.70
SO^-_4	0.50	0.48
Calcium carbonate, %	7.70	7.80
Organic matter, %	1.00	0.90
Total nitrogen, %	0.45	0.47
Avaliable Phosphorus (mg/kg)	3.70	3.80
Avaliable K (mg/kg)	162.3	170.1

Also, the chemical analysis of the organic manure was carried out according the method of Jackson (1967).

Table (2): Analysis of the applied organic manure (sheep manure)

pH	7.5
O.M (%)	23.20
O.C (%)	21.00
Total (N%)	2.20
Total (P%)	1.15
Total (K%)	1.45
C/N ratio	11.5:1

At harvest dates on January 7th and February 6th in the two season, guarded plants were randomly taken from each plots and the following characteristics were recorded:

1. Plant height (cm).
2. Fresh and dry weights of aerial parts/plant (g).
3. Leaf area index (cm^2).
4. Chlorophyll (a and b), mg/g fresh weight were determined in fresh leaves samples of the fifth leaf from top at harvest and after 30 days for parsley, using the method by Moran (1982).
5. The N, P and K contents were determined in the acid digested solution which was prepared according to Hach *et al.* (1985) using a mixture of hydrogen peroxide and sulfuric acid (4:10).

- Elements extraction was made on a known weight of the dried samples (0.2 mg).
- Nitrogen was determined using the microkjeladhl method according to Black (1983).
- Phosphorus was determined colorimetrically using the method described by Jackson (1967) and Potassium was estimated using flame photometer method according to Richards (1954).

1. Vitamin (C) content was determined in filtered juice samples and expressed as (mg) ascorbic acid/100 ml fresh juice as described by (A.O.A.C., 1965).
2. The percentage of major constituents (Apiole, myristiein, ß- pinene, and ß- phellandrene) were estimated by measuring the peak area of the different compounds of the chromatogram according to Heftman (1967) and Gunther and Joseph (1978).

The obtained data were, statistically, analyzed for ANOVA, and L.S.D. values were calculated to test the differences between the studied treatments according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

A- Growth parameters and yield:

The obtained results, given in Tables (3 and 4) cleared, that fertilizer treatments exhibited a significant effect on all estimated traits in both seasons.

Application of (F_6) treatment organic manure (2 ton)/fed + 50% NPK + cerealine + phosphorein and (F_{11}) organic manure (4 ton)/fed + 50% NPK + cerealine + phosphorin significantly, increased plant height, leaf area index, fresh and (g), dry weight (g) at two cuts as well chlorophyll a, b in both seasons. It could be concluded that this positive effect on growth characters and chlorophyll a, b in response to sheep manure levels, may be attributed to increasing maentration in plant tissues (Opera and Asigebu 1996). Also, the phosphate solubilizing bacteria (phasphorein) and nitrogen fixing (cerealine) may increase the synthesis of endogenous phytothormones i.e. IAA, GAs and CKs which play an important role in formation of a big active root system which allow more nutrients, uptake. The previous results agree, more or less, with the findings of Rashed (2002) on parsley, Gad (2001) on *Anelthum graveolens*; Mohammad *et al*. (2012) on *pimpinella anisum*; Abdel- Latif. (2002) on *Caruim carvi* and Kandeel *et al.* (2001) and Mohamed and Abdu (2004) on *Foeniculum vulgare*.

B- Chemical composition and vitamin (C):

The data in Table (4) showed that all treatments of fertilization, affected chemical composition (N, P and K%) and vitamin, (C) content in both seasons. It is clear from data that the highest mean values of chemical composition (N, P and K%) and vitamin (C) content, resulted from the treatments of (F_7) 2 ton organic manure/fed + 50% NPK + cerealine + phosphorein and (F_{11}) 4 ton/fed organic manure + 50% NPK + cerealine+ phosphorein in both seasons.

The increment of chemical composition (N, P and K%) and vitamin (C) content of plant's leaves using the treatments of organic manure and half dose of NPK and biofertilization; may be attributed to increase in the occupancy root zone of plant as a results of adding fertilization treatments which reflected on nutrients uptake by plants and confirm the previous of vegetative growth. Similar results, more or less were obtained by Kandeel *et al*. (2001) and Abou El- Maged *et al*. (2008) on fennel; Rashed (2002) on *Petroselinium sativum*, Likwise the results showed significant differences for organic manure + biofertilization in the both seasons, which gave the greatest values for all chemical composition.

C- Major components percentage of essential oil:

The effect of fertilization treatments on essential oil majors compounds (Apiol, Myristien, ß. Pinene and ß- Phellandrene) percentages are shown in Table (5). The results indicated that using fertilization treatments had significant effect on the studied majors compounds percentage of parsley oil. The application of 2 tons organic manure fed + 75% NPK + phosphorein; gave the highest percentage of majors compounds in 2012/2013 season. Similar results were reported by Darzi *et al* (2011) on anisum and Ismail *et al*. (2009) on majoram plant.

Table (3) : Effect of fertilization treatments on vegetative growth at two cut during 2012/2013 and 2013/2014 seasons

Treatments	Plant height (cm)				Leaf area index (cm^2)				Fresh weight (g)			
	2012/2013		2013/2014		2012/2013		2013/2014		2012/2013		2013/2014	
	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
F_1: NPK (control)	27.23c	27.67d	25.00d	27.23ed	5.20c	3.71c	4.90b	2.98c	138.33i	124.00d	130e	140c
F_2: 75% NPK + Cerealine	24.23g	25.17g	24.67d	24.53g	5.40c	3.90b	4.95b	3.38b	163.33e	150.00b	190.5b	150b
F_3:50%NPK+Cerealine+ phosphorein.	27.17c	25.17g	24.67d	27.17d	5.81b	4.40b	5.10b	3.50b	198.33d	130.00c	170c	153b
F4: organic manure (2ton/fed) + 75% NPK	27.47b	26.17f	24.33e	27.73c	4.67d	3.10d	4.70c	3.17b	125.00b	110.00e	160cd	146c
F_5: organic manure (2ton/fed)+75% NPK+ cerealine	27.64b	28.17c	27.83b	26.77e	4.70d	3.15d	4.55c	3.20b	216.67cb	140.00b	190c	154b
F_6: organic anure(2ton/fed)+75%NPK+ phosphorein	26.37d	28.83b	27.33b	27.37cd	5.21b	4.30b	5.15b	3.45b	211.67c	150.00b	180c	144c
F_7: organic anure(2ton/fed)+50%NPK+ Cerealine+ phosphorein	28.77a	2967a	29.44a	28.97a	5.20a	5.00a	5.50a	4.10a	231.67a	161.16a	215a	165a
F_8: organic manure (4ton/fed)+75%NPK	25.73f	26.33f	25.83c	25.73f	5.75b	4.15b	5.11b	3.36b	156.67g	115.00de	155d	144c
F_9:Org.(4ton/fed)+75%NPK+ Cerealine	26.07e	26.83e	25.33c	26.07f	5.80b	4.20b	5.16b	3.26b	185.00d	135.c	195b	155b
F_{10}: organic manur(4ton/fed)+75%NPK+ phosphorein	23.30h	28.83b	24.67d	24.30g	5.90b	4.18b	5.10b	3.30b	195.33d	137.00c	155d	148b
F_{11}: organic manur(4ton/fed)+50%NPK+ Cerealine+phosphorein	28.90a	35.00a	30.00a	29.63a	6.00a	5.01a	5.51a	4.11a	225.33a	156.00a	170c	165a
L.S.D. (0.05)	0.25	0.30	0.40	0.45	0.35	0.40	0.30	0.40	10.30	9.10	9.30	8.90

* Means followed by the same letter (s) in each column are not significantly different at 0.05 level of probability.

Table (3) : Cont'd.

Treatments	Dry weight (g)				Chlorophyll (mg/g)			
	2012/2013		2013/2014		2012/2013		2013/2014	
	1st cut	2nd cut	1st cut	2nd cut	a	b	a	b
F_1: NPK + control	45.77e	38.38g	30.40f	34.70h	1.60d	0.39d	1.58d	0.48b
F_2: 75% NPK + Cerealine	46.53d	41.20c	55.60b	44.15b	1.62c	0.31e	1.51f	0.33d
F_3:50%NPK+Cerealine+ phosphorein.	42.07g	39.80d	50.70c	35.90g	1.65c	0.39d	1.55e	0.36c
F4: organic manure (2ton/fed) + 75% NPK	55.83b	40.15d	51.8c	52.60c	1.70bc	0.40d	1.60d	0.39c
F_5: organic manure (2ton/fed)+75% NPK+ Cerealine	52.80b	41.20c	35.70g	36.70f	1.75bc	0.50b	1.58d	0.48b
F_6: organic manure (2ton/fed)+75%NPK+ phosphorein	56.33b	40.60c	40.70e	38.90e	1.74bc	0.52b	1.55e	0.49b
F_7: organic manure (2ton/fed)+50%NPK+ Cerealine+ phosphorein	62.80a	53.38a	71.20a	54.41a	2.18a	0.60a	1.90a	0.62a
F_8: organic manure (4ton/fed)+75%NPK	42.43g	36.30f	42.60d	40.60d	1.74bc	0.42d	1.66c	0.52b
F_9:Org.(4ton/fed)+75%NPK+ Cerealine	56.73b	41.70c	35.40g	36.40f	1.78b	0.46c	1.72b	0.48b
F_{10}: organic manure (4ton/fed)+75%NPK+ phosphorein	49.47c	37.40	34.70g	33.90i	1.72bc	0.40d	1.68c	0.50b
F_{11}: organic manure (4ton/fed)+50%NPK+ cerealine+phosphorein	62.07a	54.20a	71.70a	54.15a	2.20a	0.16a	1.92a	0.63a
L.S.D. (0.05)	1.20	1.00	1.20	1.00	0.10	0.03	0.03	0.03

* Means followed by the same letter (s) in each column are not significantly different at 0.05 level of probability.

Table (4) : Chemical composition (N, P and K percentages) and vitamin (C) as influenced by fertilization treatments during 2013 and 2014 seasons

Treatments	N%		P%		K%		Vitamin (C) Mg/100ml fresh Juice	
	2013	2014	2013	2014	2013	2014	2013	2014
F_1: NPK (control)	2.60d	2.75d	0.590.gh	0.602ef	2.37e	2.45e	107.08p	109.30f
F_2: 75% NPK + Cerealine	2.75cd	3.10c	0.600eg	0.617d	2.58d	2.50e	109.10eb	110.20ef
F_3:50%NPK+Cerealine+ phosphorein.	2.77cd	3.20c	0.595f	0.605e	2.60d	2.65d	109.50e	110.70def
F4: organic manure (2ton/fed) + 75% NPK	2.56e	2.90d	0.585h	0.595f	2.67d	2.70d	110.30de	111.40cde
F_5: organic manure (2ton/fed)+75% NPK+ Cerealine	2.80bcd	2.30c	0.610de	0.622d	2.81c	2.85c	111.70de	112.20cde
F_6: organic manure (2ton/fed)+75%NPK+ phosphorein	3.10b	3.60b	0.635b	0.650b	2.87bc	2.90c	112.30d	112.80cd
F_7: organic manure (2ton/fed)+50%NPK+ Cerealine+ phosphorein	3.50g	4.20a	0.660a	0.670a	3.35a	3.50a	130.40a	135.40a
F_8: organic manure (4ton/fed)+75%NPK	2.85bc	3.50b	0.620cd	0.635c	2.67d	2.70d	112.90d	113.40c
F_9:Org.(4ton/fed)+75%NPK+ Cerealine	2.90bc	3.50b	0.590gh	0.604ef	2.96b	3.20b	117.90c	120.50b
F_{10}: organic manure (4ton/fed)+75%NPK+ hosphorein	3.00b	3.70b	0.630bc	0.650b	2.97b	3.20b	120.30b	122.40b
F_{11}: organic manure (4ton/fed)+50%NPK+ Cerealine+phosphorein	3.90a	3.30a	0.670a	0.680a	3.40a	3.55a	132.70a	136.30a
L.S.D. (0.05)	0.20	0.25	0.012	0.010	0.015	0.012	2.40	2.30

* Means followed by the same letter (s) in each column are not significantly different at 0.05 level of probability.

Table (5): Effect of fertilization treatments on major components (%) in Parsely oil of second season (2013/2014)

Treatments	Apiol (%)	Myristicin (%)	B- Pinene (%)	B- Phellandrene (%)
F_1: NPK + control	17.2e	31.5d	12.5g	5.1cb
F_2: 75% NPK + Cerealine	17.5de	32.4c	12.3g	5.3b
F_3:50%NPK+Cerealine+ phosphorein.	17.4de	33.2c	14.1c	5.3b
F4: organic manure (2ton/fed) + 75% NPK	17.9c	33.4c	14.2c	5.8e
F_5: organic manure (2ton/fed)+75% NPK+ Cerealine	18.3b	34.2b	14.8b	5.9a
F_6: organic manure (2ton/fed)+75%NPK+ phosphorein	18.8a	35.3a	15.1a	6.00a
F_7: organic manure (2ton/fed)+50%NPK+ Cerealine+ phosphorein	18.4b	35.3a	13.7d	5.9a
F_8: organic manure (4ton/fed)+75%NPK	17.9c	34.2b	12.8f	5.2b
F_9:Org.(4ton/fed)+75%NPK+ Cerealine	17.2e	34.3b	12.7f	5.4b
F_{10}: organic manure (4ton/fed)+75%NPK+ phosphorein	17.3e	33.5c	12.7f	5.1cb
F_{11}: organic manure (4ton/fed)+50%NPK+ Cerealine+phosphorein	17.3	33.6c	13.2e	5.1cb
L.S.D. (0.05)	0.35	0.42	0.30	0.25

* Means followed by the same letter (s) in each column are not significantly different at 0.05 level of probability.

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الملخص العربي

تأثير التسميد المعدني والعضوي والحيوي على محصول وجودة البقدونس

[*]فتحي إبراهيم رضوان . [*]على إبراهيم على عبيدو . [**]السيد حسن شعبان

[*]درخشان اسماعيل سعيد

* قسم الإنتاج النباتي . كلية الزراعة سابا باشا . جامعة الإسكندرية . مصر

* قسم بحوث النباتات الطبية والعطرية – مركز البحوث الزراعية – شعبة إنتاج وتكنولوجيا النباتات الطبية والعطرية.

أجريت تجربتان حقليتان خلال موسمي الزراعة ٢٠١٢/٢٠١٣ ، ٢٠١٣/٢٠١٤ لدراسة تأثير التسميد الكيماوي ومعدلات السماد العضوي والحيوي على صفات النمو الخضري الحيوي الكيماوي ومكونات محتوي الزيت لنبات البقدونس وقد استخدم في هذه التجارب التصميم الإحصائي القطاعات العشوائية الكاملة لثلاث مكررات.

ويمكن تلخيص أهم النتائج فيما يلي:

– أدى استخدام معاملات التسميد لتأثيرات معنوية مختلفة على أعلى متوسط لقيم جميع الصفات المدروسة أيضاً.

– أدى إضافة المعاملة (٧) ٢ طن سماد عضوي/فدان + ٥٠% نتروجين فوسفور بوتاسيوم + سيريالين + فوسفورين إلى زيادة معنوية لارتفاع النبات، دليل المساحة الورقية، الوزن الطازج والجاف عند حشتين بالإضافة إلى كلوروفيل أ، ب والمكونات الكيميائية (نتروجين، فوسفور، بوتاسيوم%) محتوي وفيتامين سي.

– أيضا أدى إضافة المعاملة (٦) ٢ طن سماد عضوي/فدان + ٧٥% نتروجين فوسفور وبوتاسيوم + فوسفورين إلى ارتفاع مكونات محتوى الزيت (النسبة المئوية للمكونات) في الموسم الأول ٢٠١٢/٢٠١٣.

نوصي باستخدام ٢ طن سماد عضوي /ف + ٥٠ + ٥٠+ ٢٥ك/ف من سلفات النشادر وسوبر فوسفات الكالسيوم وسلفات البوتاسيوم على التوالي + سيريالين + فوسفورين للحصول على أفضل نمو وجودة نبات البقدونس.

Response of Some Physiological, Yield Characters and Seed Quality of Sunflower to Mineral, Organic and Biofertilizers

[1]Radwan, F. I ., [1]M. A. Gomaa, [2]F. A. El- Kady and [2]Nevein L. A. Gerges

1- Plant Production Dep., Faculty of Agriculture (Saba Basha) Alexandria University, Egypt.
2- Agricultural Research Center, Sakha, Kafr El- Sheikh, Egypt.

ABSTRACT : Two field experiments were carried out at the Experimental Farm of Sakha Agricultural Research Station. Agricultural Reseach Center, Kafr El- Sheikh, Egypt during the two growing seasons 2011 and 2012 to study the response of some physiological, yield characters and seed quality of sunflower "*Helianthus annulus*, L." C.V. Sakha 53 to mineral organic and biofertilizers. The applied experimental design was randomized complete blocks with four replications.

The obtained results could be summarized as follows, (1) The results showed significant differences due to applied 20 kg N/fed + 30 m^3 compost on leaf area/plant, dry matter accumulation/plant at all sampling dates days to full flowering, head diameter, 100- seed weight, seed yield (g)/plant and seed yield (kg)/fed. The highest seed yield/fed viz (2091.29 and 1961.84 kg/fed were obtained by application of 20 kg N/fed + 30 m^3 compost during both seasons (2) Application of 20 kg N/fed + 20 m^3 compost + Cerealine was the best combination to obtain the highest values of plant height at harvest and head diameter compared with fertilized by 10 kg N/fed. However, oil% and oil yield was increased significantly because of application 20 kg N/fed + 30 m^3 compost in both seasons. The present investigation suggests the need for more studies concerning the effect of mineral, organic and bioferlitization as well as applying NPK on sunflower plants under different environmental conditions using different types of soil especially newly reclaimed soil, to reach the optimum combination the achieve to best yield and quality of seed oil content.

Key words: sunflower, mineral (NPK), organic, biofertilizer, yield, oil yield

INTRODUCTION

Sunflower (*Helianthus annuus*, L.) is one of the most important annual crops of the world grown for edible oil. It received considerable attention in Egypt due to its short growing season and it can be grown well under the low fertility soils in the newly reclaimed areas. So, sunflower could be one of the main suggested oil crops to solve edibled vegetable oil shortage in the country. Seeds contain 24-49% oil and cake contains 25- 35% of protein (Henen, 2011).

Nutrition is essential for plant life and yield, therefore mineral fertilization is a common agronomic practice that leads to improve productivity. Mineral fertilization includes several elements, however, nitrogen and phosphorus are among the macro- elements that used on fertilization (Abou- Khadrah *et al*., 2002, Mohamed, 2003).

The organic manure is known to improve the properties of soil by increasing the limited moisture holding capacity. In addition, it can change the chemical properties of soil through lowering pH and extensively their beneficial effects are known for long time. Application of organic matter provide many essential nutrients needed by crop plants. The increase in crop yield due to using of animal manure have been imperative many times as resulted mainly from the nitrogen, phosphorus or potassium or the combination of the three elements (Awad, 2004, Aowad and Mohamed, 2009).

In addition, biofertilization is one of the most important factors used to product free from mineral fertilizer that cause environmental pollution and high rates of it lead to decrease in the potential activity of micro flora and the mobility of organic matters. Hence, the attention has been focused on the researches of bio-fertilization to safe attention for the chemical fertilizers (Namvar *et al*., 2012). Also, bio- fertilizers play vital role for increasing the number of microorganisms and accelerate certain microbial process in the rhizosphere of inoculated soil plants can change the available form of nutrients into plants (Abou- Khadrah *et al*., 2002; Bassal, 2003; El- Temssah, 2008).

Inoculation of Biofertilizers significantly affected plant height and total chlorophyll content. Biofertilizers also, significantly increased yield attributers viz. stem diameter, weight of seeds, filled seed/capitulum and 100- seed weight (g), as well as seed weight, biological yield and oil content. The combined inoculation of phosphate dissolving bacteria (PSB) + vesicular abuser mycoeehyizea (VAM) + Azotobacter recorded higher values of these Parameters as compared to PSB + Azotobacter and VAM + Azotobacter inculcation (Patra *et al*., 2013).

Therefore, the objective of this study is the evaluating the effect of mineral, organic and bio- nitrogen fertilizer treatment on some growth attributes yield and its component of sunflower crop.

MATERIALS AND METHODS

Two field Experiments were carried out at the Experimental Farm of Sakha Agricultural Research Station, Agricultural Research Center, Egypt during the two consecutive summer seasons, 2011and 2012. The applied experimental desing was randomized complete blocks with four replicates. The treatments were

1. 10 kg N/fed.
2. 20 kg N/fed.
3. 30 kg N/fed.
4. 10 kg N/fed + 20 m^3 compost.
5. 10 kg N/fed + 30 m^3 compost.
6. 10 kg N/fed + 20 m^2 compost + Cerealine.
7. 10 kg N/fed + 20 m^3 compost + Rizobacterin.
8. 20 kg N/fed + 20 m^3 compost.
9. 20 kg N/fed + 30 m^3 compost.
10. 20 kg N/fed + 20 m^3 compost + Cerealine.
11. 20 kg N/fed + 20 m^3 compost + Rizobacterin.

Analyzis of chemical and physical properties of the experimental soil site (0 to 30 cm depth) is shown in Table (1) and were carried out according to the methods reported by Page *et al*. (1982).

Table (1): Physical and chemical properties of the experimental soil (average of two seasons)

Sand (%)	Silt (%)	Clay (%)	Soil texture	pH	EC (dS/m)	$CaCO_3$ (%)	Total N (%)	Available P(mg/kg)
19.05	37.75	43.20	Clay	8.11	3.90	2.40	0.08	11.00

Table (2): Analysis of the applied organic manure (compost)

pH	EC	C/N	N%	P%	K%	Fe mg/kg	Mn mg/kg	Zn mg/kg
7.5	2.90	1:12.06	1.58	1.49	1.78	4935	435	206

Organic manure (compost) at the two rates was added during soil preparation before planting in both seasons. Analysis of organic manure are presented in Table (2). Prior to sowing seed inoculation was carried out using the biofertilizer with (N2- fixing) i.e Cerealine and Rhizobacterine: An Inoculate for all crops containing of Azospuillum lipofeuim and Bacillus polymx produced by Ministry of Agriculture, Egypt. Inoculation was performed by mixing seeds with the 400g/fed Cerealine and Rhizobacterin rates using Arabic gum (Arabic gum 5%).

Nitrogen fertilizer was applied in the form of urea (46% N) at the rates of (10, 20 and 30 kg N/fed), after the thinning and before the first irrigation after planting. Phosphorus fertilizer was applied in the form of calcium super phosphate (15.5% P_2O_5) as treatments with land preparation.

Each plot consisted of 5 ridges 3m long and 60 cm apart with 30 cm space between plant. The size two rows were used for determing seed yield and its components.

The seed were sown in 7th and 3th of july of the two successive growing seasons 2011 and 2012. In the first and second seasons sunflower was preceded by wheat "*Treticum aestivum,* L.".

Hoeing was practiced before the first and second irrigation. The plant were thinned to secure one plant per hill after 10 days from planting other cultural practices for growing sunflower were conducted as recommended were, growth attributes agronomic characters, yield and its components oil% and oil yield/fed. were recorded from the two middle redges.

A- Growth characters

Five guarded plants, from each plot were taken at 30, 45 and 60 days after sowing (DAS). The following data were recorded for each sample.

1. Leaf area (LA)/plant/(dm^2)
2. Dry matter accumulation (g/plant)
3. Days to full flowering
4. Plant height at harvest (cm)
5. Stem diameter (cm)
6. Head dimater (cm)

B- Yield and yield components

At harvest two guarded plants were taken from the 2nd and 3rd ridges in each plots to determine the following parameters:

1. 100- seed weight (g).
2. Seed yield (g/plant).
3. Seed yield (kg/fed).

D- Oil% and oil yield/fed

Oil percentage was determined using duplicat seed sample each of about two grains. Seed samples were dried in oven at 85 ℃ to 90℃ for 24 hours. After weighting the seed samples were subjected to a constant pressure of 20000 pounds/square inch using a carve laboratory press which was described and used by A. O. A. C. (1980).

Approximately 70% of the oil in the seed was extracted. The crushed seeds were then placed in avail with solvent petroleum ether stopper and allowed to stand a dry at 33℃. Two changes of solvent were applied at 24 hours intervals. Then the seed residue was dried for one hour. Then oven dried for 24 hour at 85℃ to 90℃ and weighted. The loss in weight of seeds removed by pressing and solvent extraction and oil% was then calculated as follows. In sample was calculated and then content was determined as follows

$$\text{Oil \%} = \frac{\text{Weight of oil}}{\text{Weight of seed}} \times 100$$

Oil yield (kg)/fed: was determined by multiplying seed yield (kg/fed) by seed percentage.

All data collected were subjected to standard statistical analysis according to Gomez and Gomez (1984) using the computer program (IRRISaT). The treatment were compared using. Duncan's multiple range test (L.S.D.).

RESULTS AND DISCUSSION

A- Growth Characters:

The data of leaf area/plant and dry matter accumulation g/plant at the three sampling dates of sunflower as affected by bio- organic and mineral nitrogen are presented in Table (2).

The data indicated that a significant effect of all sampling dates in both seasons. The highest values of leaf area/plant and dry matter accumulation produced from 20 kg N/fed + 30 m^3 compost in the two seasons. In addition effect on the dry matter/plant in the first simple for both seasons. Applying 10 kg N/fed, alone gave the lowest values for these characters. Also, the results revealed that nitrogen is necessary to more vegetative growth, hence the leaf area/plant and dry matter of sunflower continued to increase as the plant advanced in age until the last sampling data. These results may be due to the fact that nitrogen fertilizer is an essential element, which plays a prominent role in building newliving staff, increase in size of successive leaves which improved translocation of assimilates. The role of nitrogen fertilizer on structure of protein molecule, which necessary for biological activity and improvement of plant metabolism as well as growth of stem

and leaves. In addition to compost intended to serve as soil amendment is applied in order to improve soil fertility (Namvar *et al*., 2010). Similar results were reported by Abou- Khadrah *et al*. (2002) and Aowas and Mohamed (2009).

Also, results presented in Table (3) show a significant response to bio-organic and mineral nitrogen fertilizer on (number of days to full flowering, plant height at harvest, stem and head diameter). Application of 20 kg N/fed + 20 m^3 compost + Cerealine recorded the highest plant height and stem diameter, as well as application 20 kg N/fed + 30 m^3 compost gave the highest values for days to full flowering and head diameter is in both seasons, while applying 10 kg N/fed, gave the lowest values of all the characters. Such increase in this characters due to apart of recommended mineral nitrogen + compost with biofertilizer synergistic effect on subsequent plant growth and cause bacterial development as Cerealine inoculants to gave biological N2- fixation, which improve plant growth and head diameter. Similar results were reported by Bassal (2003) and Dhanasekar and Dhandapani (2012).

B- Yield and its components:

Application of mixture of 20 kg N/fed + 30 m^3 compost were significantly increased all these characters i.e. 100- seed weight, seed yield, g/plant and seed yield, kg/fed during both seasons in comparison with the 10 kg N/fed, Table (4). It could be concluded that the lowest values come from fertilization with 10 kg N/fed. These findings might be the attributed to more adsorption of nutrition with reflect more growth substance more cell division and enlargement more of tissues and organs and plant elongation. Also, the nitrogen and compost may be increase the synthesis of endogenous photohormones which plays in formation of a big active root system allow more nutrients uptake. The previous results agree, more or less, with the finding of Abou- Khadrah *et al.* (2002), Bassal (2003) and El- Sadek (2005).

D- Seed oil and oil yield/fed:

Data presented in Table (4) showed that there were significant differences, due all these treatments. The highest oil % and oil yield/fed were produced by applying 20 kg N/fed + 30 m^3 compost in both seasons while the lowest oil % obtained by 30 kg N/fed and oil yield/fed obtained by 10 kg N/fed respectively. This may be due to the increased of oil and oil yield. It was noted that the application of higher doses of nitrogen decrease oil yield/fed, the seed yield was increase to a level that may compensate for the reduction and oil content. Similar results were reported by Mohamed (2003) and zadah (2010).

CONCLUSION

High quantity and quality production of sunflower: *Hehanthus annuus,* L. cv. Sakha 53 were obtained at the applying of 20 kg N/fed + 30 m^3 compost and 20 kg N/fed + 20 m^3 compost + Cerealine. Sunflower "*Helianthus annuus*, L. cv. Sakha 53, can be grown under these treatments for their high seed yield and oil content under conditions of Sakha Agricultural Research Center or in other similar areas.

Table (2) : Leaf area/dm2 plant, dry matter accumulation (g/plant) as influenced by mineral organic and biofertilization in 2011 and 2012 seasons

Treatments	Leaf area Days after sowing						Dry matter accumulation Days after sowing					
	2011			2012			2011			2012		
	30	45	60	30	45	60	30	45	60	30	45	60
F1:10Kg N/fed	14.42i	25.29b	53.58i	11.36b	21.74f	52.71i	22.69f	70.38b	113.97i	20.82g	69.29h	104.39i
F2: 20kg N/fed	17.49ef	32.98.d	65.28e	15.28d	30.06e	63.52e	30.16c	81.11e	124.24f	27.56e	76.24e	119.86e
F3:30kg N/fed	22.05b	37.75be	71.59b	19.89b	36.89b	69.98b	38.69a	86.48b	137.07b	35.17f	84.08ab	128.58b
F4: 10kg N/fed+ 20m^3 compost	15.93b	27.84g	55.69h	12.81g	24.13b	55.72b	24.21f	74.38g	119.06b	22.90ef	71.27g	108.93h
F5: 10kg N/fed+ 30m^3 compost	17.76e	30.31e	59.76f	14.36c	27.48f	58.65f	26.63d	77.24f	122.81g	24.95d	74.21f	112.66f
F6: 10kg N/fed+ 20m^3 compost+ Cerealine	17.19f	28.47f	57.32g	13.54f	25.33g	57.34g	25.43de	74.25g	120.37b	24.22de	72.24g	110.99g
F7: 10kg N/fed+ 20m^3 compost + hizobacterine	16.67g	28.44f	56.21h	12.91g	24.84gh	56.79g	24.34ef	74.46g	119.43h	22.79f	71.27s	108.93h
F8: 20kg N/fed+ 20m^3 compost	19.46d	37.63c	68.41d	17.98c	33.54d	68.47cd	34.15b	83.22d	129.59c	31.29b	80.26d	123.28d
F9: 20kg N/fed+ 30m^3 compost	22.66a	41.59a	76.46a	20.95a	39.56a	73.89a	40.32a	89.46a	140.21a	36.04a	85.50a	131.38a
F10: 20kg N/fed+ 20m^3 compost+ Cerealine	20.63c	38.59b	71.20b	19.99b	35.62c	69.37bc	35.29b	84.61c	135.44c	32.52d	83.05bc	125.95c
F11: 20kg N/fed+ 20m^3 compost+ Rhizobacterine	20.22c	37.54c	69.29c	19.76b	33.83d	68.16d	34.78b	83.81c	133.01d	31.76b	81.65bc	123.65d
F test	*	*	*	*	*	*	*	*	*	*	*	*

*** indicate P < 0.05 Means designated by the same letter within columns are not significant differences at 5% level according to Duncan's multiple range test.**

Table (3) : Number of days to full flowers, plant height, stem and head diameter as influenced by mineral, organic and biofertilization in 2011 and 2012 seasons

Treatments	Number of days to Full flowering		Plant height at Harvest (cm)		Stem diameter (cm)		Head diameter (cm)	
	2011	2012	2011	2012	2011	2012	2011	2012
F1:10Kg N/fed	55.00de	55.25d	177j	175.50j	2.20f	2.03b	17.65g	18.45f
F2: 20kg N/fed	56.50c	56.50c	194.33f	189.71e	2.80d	2.68e	21.80d	22.15de
F3:30kg N/fed	58.00ab	58.25ab	200.57b	195.53c	3.60ab	3.80ab	23.25ab	23.08ab
F4: 10kg N/fed+ 20m^3 compost	55.50d	55.75d	179.83i	177.80i	2.43e	2.25g	20.98f	21.68e
F5: 10kg N/fed+ 30m^3 compost	56.50c	56.50c	182.10i	178.80b	2.70d	2.48f	21.55de	21.75e
F6: 10kg N/fed+ 20m^3 compost+ Cerealine	55.75cd	56.00cd	184.57g	181.13f	2.63d	2.73e	21.45e	22.55cd
F7: 10kg N/fed+ 20m^3 compost + Rhizobacterine	56.00cd	56.25c	183.13b	179.83g	2.63d	2.52f	21.33e	22.00c
F8: 20kg N/fed+ 20m^3 compost	57.25bc	57.50b	196.97d	195.57c	2.98c	2.93d	22.13e	22.70bc
F9: 20kg N/fed+ 30m^3 compost	58.50a	58.50a	195.27c	192.93d	3.45b	3.55c	23.52a	23.35a
F10: 20kg N/fed+ 20m^3 compost+ Cerealine	57.50b	57.75b	201.60a	198.47a	3.70a	3.85a	23.25ab	23.15ab
F11: 20kg N/fed+ 20m^3 compost+ Rhizobacterine	57.75b	58.00ab	198.63c	196.60b	3.50b	3.68c	23.05b	23.23a
F test	**	**	**	**	**	**	**	**

***** indicate P < 0.05 Means designated by the same letter within columns are not significant differences at 5% level according to Duncan's multiple range test.

Table (4) : 100 seed weight (g), seed yield (g), seed yield (kg/fed), oil% and oil yield (kg/fed) as influenced by mineral, organic and biofertilization in 2011 and 2012 seasons

Treatments	100 seed weight (g)		Seed yield g/plant		Seed yield (kg/fed)		Oil%		Oil yield (kg/fed)	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
F1:10Kg N/fed	6.99e	6.47f	37.48h	36.20f	1311.10h	1266.49f	45.72b	44.25b	599.98b	560.42h
F2: 20kg N/fed	7.55de	7.39c	45.00f	43.60d	1574.37f	1525.39d	45.36b	43.40c	714.13f	662.02g
F3:30kg N/fed	8.61b	8.83b	54.70c	54.08c	1808.78c	1891.86c	42.25d	40.62e	773.25d	778.70
F4: 10kg N/fed+ 20m^3 compost	7.64de	7.41e	44.58fg	41.68e	1539.38fg	1458.22e	44.25c	44.20b	681.18g	644.54b
F5: 10kg N/fed+ 30m^3 compost	7.81d	7.95d	46.42e	43.93d	1624.05e	1536.96d	45.95b	44.28b	746.25e	680.55f
F6: 10kg N/fed+ 20m^3 compost+ Cerealine	8.61b	8.14d	46.28e	41.00d	1619.35e	1504.39d	44.28c	43.11c	716.96f	648.54gh
F7: 10kg N/fed+ 20m^3 compost + Rhizobacterine	8.64b	8.47c	45.53ef	42.68e	1592.91ef	1493.20e	45.39b	44.06bc	725.02ef	658.35g
F8: 20kg N/fed+ 20m^3 compost	7.93ed	8.51bc	50.50d	53.70c	1766.76d	1877.75c	44.16c	42.35d	784.23d	795.65d
F9: 20kg N/fed+ 30m^3 compost	9.88a	9.95a	59.78a	56.08a	2091.29a	1961.84a	47.46a	45.12a	953.15a	873.92
F10: 20kg N/fed+ 20m^3 compost+ Cerealine	9.05b	8.78bc	57.27b	55.38b	2003.82b	1937.35b	44.27c	42.29d	925.23b	832.99c
F11: 20kg N/fed+ 20m^3 compost+ Rhizobacterine	8.49bc	8.68bc	57.45b	55.08b	1999.45b	1926.85b	45.09c	44.20b	901.93c	850.51b
F test	**	**	**	**	**	**	**	**	**	**

* indicate P < 0.05 Means designated by the same letter within columns are not significant differences at 5% level according to Duncan's multiple range test.

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الملخص العربي

استجابة بعض الصفات الفسيولوجية والمحصولية وجودة البذور في عباد الشمس للأسمدة المعدنية والعضوية والحيوية

[١]فتحي إبراهيم رضوان . [١]محمود عبد العزيز جمعة . [٢] فهمى عبد العزيز القاضي – [٢]نيفين لطفي جرجس

١- قسم الإنتاج النباتي – كلية الزراعة – سابا باشا – جامعة الإسكندرية

٢- مركز البحوث الزراعية – سخا– كفر الشيخ

أجريت تجربتان حقليتان بالمزرعة البحثية بسخا – مركز البحوث الزراعية خلال عامي ٢٠١١، ٢٠١٢ لدراسة استجابة بعض صفات النمو والمحصول ونسبة ومحصول الزيت في عباد الشمس صنف سخا ٥٣ للأسمدة المعدنية والعضوية والحيوية حيث صممت التجربة بالقطاعات العشوائية الكاملة مع أربع مكررات.

وأوضحت النتائج المتحصل عليها كما يلي:

– أوضحت النتائج اختلافات معنوية لإضافة ٢٠ كجم نتروجين + ٢٠م^{٣} سماد كمبوست على المساحة الورقية/نبات وتراكم المادة الجافة عند جميع بيانات العينات، عدد الأيام حتى اكتمال التزهير قطر الساق، وزن ١٠٠ بذرة، محصول البذور (جم)/ نبات ومحصول البذور(كجم)/فدان. ارتفاع محصول البذور كانت (٢٠٩١–١٩٦١.٨٢كجم/فدان) نتجت بواسطة إضافة ٢٠ كجم نتروجين + ٣٠م٣ سماد الكموست خلال الموسمين.

– إضافة ٢٠ كجم نتروجين/ فدان + ٢٠م٣ كمبوست + السيريالين أعطت أفضل تداخل أدى إلى ارتفاع قيم كلاً من ارتفاع النبات عند الحصاد وقطر الرأس مقارنة بالتسميد بـ ١٠ كجم نتروجين/فدان كما أن النسبة المئوية للزيت ومحصول الزيت زادت معنوياً بسبب إضافة ٢٠ كجم نتروجين/فدان + ٣٠م^{٣} كمبوست في كلا الموسمين.

– يقترح البحث الحالي الحاجة إلى دراسات متعددة لتأثير الأسمدة المعدنية، العضوية والحيوية مع إضافة النتروجين والفوسفور والبوتاسيوم تحت شروط بيئية مختلفة باستخدام أنواع مختلفة من الأراضي خاصة الأراضي الجديدة المستصلحة للحصول على التداخل الأعظم للحصول على أفضل محصول وجودة محتوى الزيت للبذور.

Effects of Stocking Density and Green Water on Some Performance of European Sea Bass Fry (*Dicentrarchus labrax* L.) During Post – weaning Period

Essa, M.A[1].,Omar[2], E. A., Srour[2], T. M., AbdElaty[1], B.S., Zahran[1], S.A.
1. Aquaculture Division, National Institute of Oceanography and Fisheries, Egypt
2. Animal and Fish Production Dept., Faculty of Agriculture (Saba Basha), Alexandria Univ., Egypt

ABSTRACT: There are many problems facing the marine aquaculture in Egypt.This is due to the lack of availability of information on the care of these conditions inside the fish hatchery, which achieve higher growth rates and survival. So targeting the current study, which was conducted in NIOF Marine Hatchery, National Institute of Oceanography and Fisheries, El-Max Research Station, Alexandria. The present study aims at evaluate the stocking densities (12 fry/aquaria & 25 fry / aquaria) and add moss (Chlorella or Nannochloropsis) on some growth performance and benefit from food and condition factor and chemical composition of sea bass of fry has been included each transaction on the duplicates and the average weight of sea bass *D. labrax* fry(0.48 g / fry) in the beginning where they were fed on diet containing 57% protein, with a daily average of 5% of the total live weight of the fish. The results indicated that at lower stocking density (12 fry / aquaria) in the Empty water from algae showed significantly ($p \leq 0.05$) better growth performance and feed efficiency compared with water genitive algae. It may be concluded that the addition of both green water Chlorella and moss Nannochloropsis has no Influence on the performance of the fry of sea bass *(Dicentrarchus labrax L.*) during the post-weaning period.

Key words: *Dicentrarchus labrax*, stocking density, green water, growth performance

INTRODUCTION

Aquaculture has attained a considerable level of production, but it is not enough to cover the demand of worldwide consumers. Hatcheries play an important role in the development of this sector as supplies of fry demand fish (Prado *et al*., 2010). Availability of fingerlings from the hatcheries has been one of the most critical factors for commercial success in marine fish farms. European sea bass (*Dicentrarchus labrax L.*) is a marine species of great economic importance, particularly in Mediterranean aquaculture. The market demand is great and as a result, the price for fresh *D. labrax* has increased markedly over the past decade due to the desirable and quality attributes of this fish. consequently, its farming is considers to be a profitable business. Egypt produces 19,027 tons of *D. labrax* (representing 1.4% of the total fish production) by catch from the Mediterranean has fluctuated between 266 tons in 1991 to 969 tons in 2011, also from north lakes about 344 tons, and *D. labrax* production from aquaculture sector about 17714 tons (GAFRD, 2011).Identification of environmental and management key parameters for larval rearing is important for optimizing juvenile fry production in marine fish culture (Terje *et al*., 2006). European Sea bass (*Dicentrarchus labrax*) and sea bream (*Sparus aurata*) are the most important teleost fish for aquaculture not only in the Mediterranean area, but also in Egypt (Farnies *et al*, 2001 and Essa, 2012).In Egypt, It is an economically important cultured fish species, but low level of marine fish fry rearing technology resulting in high mortality and low quality of fry (Essa, 2012).Density is one of the most deterministic factors in larvae culture, affecting social interactions such as aggressiveness, hierarchical

phenomena and cannibalism, resulting in variations in size, survival and growth performance in fish populations (Hatziathanasiou *et al*., 2002). Effect of several densities on Sea bass growth, survival rate and feed conversion ratio have been tested by Santos *et al*.(2010) and the results showed that, increased density levels in *D. labrax* tanks reduced feed intake, survival and growth performance .

Nowadays, the life cycle of some species (sea bream, sea bass, turbot) is under control due to important improvements in zoo technics, nutritional quality of the prey and hygienic conditions of the rearing system. Survival, growth rates and quality of the fingerlings have improved considerably during the last few years. Nevertheless, new efforts are necessary to decrease the cost per juvenile produced. Efforts should be directed towards the optimization of the rearing procedure and the variability and predictability of the results (Planas and Cunha, 1999). In general, a little information is available on the effects of sea bass fry rearing factors such as nutritional practices as green water supplementation. These mentioned factors collectively have great effect on the growth performance, water quality and subsequently affect fish production (Rotllant *et al*., 1997). The objective of larval rearing is to produce high-quality and healthy juvenile fish. The management of the rearing environment, stocking density and feeding regime are the most important aspects of this activity. The aim of the work, the effects of some important aspects of problems larvae culture, including the green water and stocking densities of marine sea bass post weaning larvae, on growth performance, feed utilization, survival and chemical composition parameters.

MATERIALS AND METHODS

This work was conducted through the period (June-August 2013), at Fish Rearing Laboratory, Aquaculture Division, El-Max Research Station, National Institute of Oceanography and Fisheries (NIOF), Alexandria, Egypt. This work was designed to study the effect of two stocking densities (12 fry/ aqaria&25 fry/ aquaria) of post weaning larvae supplemented with green and normal water, on growth performance of European sea bass fry *Dicentrarchus labrax*.

Fish sampling: European sea bass (*D. labrax*) fry with an initial weight of 0.48±0.025 g/larvae were obtained from Marine Fish Hatchery (El Anfoshy), National Institute of Oceanography and Fisheries (NIOF), Alexandria.

Fish diet : The composition and chemical analysis of the prepared diet of 57.54% crude protein was formulated as shown in Table (1).The fry were fed five times daily at a rate of 5% of total biomass.

Table (1): Ingredients (%) and chemical composition (%) of experimental diet used during the present study

Ingredient	Diet
Fish meal (70%)	54
Corn gluten meal	15
Soybean meal	7
Wheat meddling	6
Fish oil	9
Mineral and vitamin premix	2
Vitamin C	0.5
Mono-calcium phosphate	0.5
Lysine	2
Methionine	1
Yeast extract (Diamond V XPC®)	1
Garlic extract (Garlen®)	1
Bactozyme®	1
Chemical analysis (%)	
Dry matter(%)	95.77
Crude protein(CP)	57.54
Ether extract (E.E)	16.30
Ash%	14.50
Crude fiber(CF)	1.24
Nitrogen free extract (NFE)	10.42
Gross energy(kcal/100g) (GE)*	494.30
P/E ratio (mg CP/kcal)	116.40

* GE= Gross energy (kcal/100g), calculated on the basis of 5.65, 4.12 and 9.45 kcal GE/g, NFE and lipid, respectively (NRC, 1993).

Management: Eight glass aquaria were used during the present study in which the collected fry was distributed and acclimated in the aquaria which sized (70 ×30 × 40 cm) supplied with air blower system connected with fin air stone. All aquaria were filled with aerated filtered seawater 50 l / aquaria.

The water temperature, dissolved oxygen and pH was measured using thermometer (YSI Professional Series Instrument, USA), salinity (Portable Refract meter operating Instructions – model GG-201/211) and total ammonia (YSI ECO Sense® 9300 photometer, England). The water quality parameters were adjusted at temperature 25±2 C^{o}, Dissolved Oxygen (DO) 6±1mg/l with 90% - 100% saturation, pH 7.9-8.2 and salinity 30 ±2 ppt. The water was changed at a rate of 50% once daily.

Experimental design: In aquaria 2×2 factorial design, all fish were divided into two main groups, the first main group was included stocking density (12 fry /aquaria) and the second main group was included stocking density (25 fry / aquaria) with in each the previous two main group they were divided to other two sub groups, the first group normal seawater, the second group was, the rearing green water is seeded with microalgae such as Chlorella or Nannochloropsis.

Fry rearing: Fry rearing was performed according to Saillant *et al*. (2002).The water was exchanged with flow rate 50% daily. The fry were fed five times daily

with two hours intervals at a rate of 5% body weight. The water quality parameters were monitored daily for optimum water temperature, dissolved oxygen, pH and salinity. The aquaria were siphoned and cleaned, then filled with clear water supplemented with green water. At 15th day of experiment, the growth performance was evaluated each 10 days regularly until the end of experiment as the following.

Evaluation of growth and feed utilization performances

The growth performance parameters were calculated according. Total weight was determined to the nearest 0.1 milligrams (Sartorius CP224S – Sartorius AG, Germany), total length was determined to the nearest mmillimeter and the fish immediately returned to their aquaria conditions and the feed amounts were adjusted and corrected according to their weight. The feed utilization parameters were determined according to Castel and Tiews (1980).

Statistical analysis: Factorial analysis (2×2) of the experimental treatments in triplicate result was conducted according to SPSS (version 16.00). Duncan's multiple range tests, Duncan (1955) were carried out to test the significance level among means of treatments.

RESULTS AND DISCUSSION

One of the key aspects of successful large-scale production is determining the optimum fry stocking densities. Larval and fry density studies for sea bass have not been conducted, although some work has been done on evaluating the effect of larval and juvenile densities on growth (Hatziathanasiou *et al.*, 2002; Marte, 2003; Abdel-Rahman *et al*, 2003).

1-Growth performance, Survival Rate and Condition factor (K) of sea bass(*D. labrax*)fry as effected by stocking density ,green water treatments to reduce its effect and the is interaction

The growth performance in weight and length of sea bass, *D. labrax*, under different densities with normal and green water treatments during post weaning period (70 days) are shown in Tables (2 and 3).

1.1- Effect of stocking densities

Regardless of the effect of marine water type, normal or green, in rearing experimental aquaria, the results in Table (2) indicated that, the sea bass fry reared at low density (12 fry/ aquaria) showed the highest growth performance (final body weight, total and individual daily gain, specific growth rate as well as relative growth rate) parameters compared with counterpart in the high density,(25 fry /aquaria). The same trend was observed in the percentage of survival which achieved highest value (83.34 %) at low density conditions compared with those reared under high-density conditions (54.00 %), and the differences were significant (P ≤0.05).

The results obtained for the growth performance parameters in sea bass fry length, described in Table (3),also demonstrated excellence in sea bass fry group reared in low population density compared with counterpart in the high density. The differences between two treatments were not significant evidence that the condition factor(K) ,which is a measure of the fish health and determine

the extent of suitable environmental conditions for the growth and living fish (Lagler,1956)–in both treatments was very tight (1.16 VS 1.18).
Concerning the effects of stocking density on growth performance of *D. labrax*, it is indicated that stocking density has been shown to have an adverse effect on growth performance and survival rate of fry during post weaning period. This might be due to the increase in stocking density results in increasing stress. This effect based on the assumption that coping with stress increases the fish's overall energy demand, which is then unavailable for growth(Leatherland and Cho 1985) reported that, in case of low stocking densities fish may not form shoals and feel comfortable. Also these findings were supported by(Irwin *et al*.,1999; Ma *et al*., 2006; Omar *et al*., 2006; and Essa *et at.,* 2012).in other fish species who reported that, growth is inversely related to stocking density and this is mainly attributed to stress and social interactions. Negative effects of higher densities were reported also by (Salama, 2007) who found that, survival rate of Asian sea bass, Lates calcarifer (28%) was significantly higher at a stocking density of 20 fry/l, which was 2 – 3 times better than at higher fry density. Also, Jodun *et al.* (2002).found that Atlantic sturgeon Acipenseroxy rinchus reared at the lower density had significantly higher mean weight and length at the end of the trial.

1.2- Effect of green water and its interaction with fry stocking density

Regardless of the effect of sea bass fry stocking density, in rearing experimental aquaria, the results in Table (2) indicated that, the sea bass fry reared under green water conditions showed the lowest growth performance (final body weight, total and individual daily gain, specific growth rate as well as relative growth rate) parameters compared with counterpart in the normal water. The same trend was observed in the percentage of survival which achieved highest value (68.66 %) at normal water conditions compared with those reared under green water conditions (62.42 %), and the differences were insignificant ($P \leq 0.05$).

The results obtained for the growth performance parameters in sea bass fry length, described in Table (3), also demonstrated superiority in sea bass fry group reared under normal marine water conditions compared with counterpart in the green water. The differences between two treatments were not significant evidence that the condition factor(K) –which is a measure of the fish health and determine the extent of suitable environmental conditions for the growth and living fish (Lagler,1956)–in both treatments was very tight (1.21 VS 1.13).

Concerning the effects of green water on growth performance of *D. labrax* fry, it is indicated that green water does not have an effective impact on growth performance and survival rate of fry during post weaning period. This may be due to most marine fish fry are visual feeders and feeding success of fry at various rearing period depends on the provision of suitable food, the rearing environment, and on the visibility and adequate density of the prey . Several papers have discussed the beneficial effect of adding microalgae to newly hatched marine larvae in rearing tanks in order to improve larval growth and survival These papers discuss the effect of micro-algae on the nutritional and behavioral aspects of fish larvae. Some fish larvae take up substantial amounts of micro-algae during the initial days after hatching (Van der Meeren, 1991; Reitan *et al*., 1993; Marte, 2003; Roca and Main, 2012) which may be used as a food source (Tamaru *et al*., 1994). Therefore, it can be concluded that the green

water is important in marine newly hatched larvae more than in advanced fry. So sea bass fry in the present study achieved the best results in the case of normal marine water use.

From the results of Interactions between stocking density and green water in Tables (2, 3) it could be concluded that, to possess the best growth in weight and length performance parameters and survival rate for sea bass fry, *D. labrax,* under different densities with normal and green water treatments during post weaning period, taken into account the following

1-When rearing marine fish sea bass fry must use appropriate density but not high with no green water use (only normal marine water) at this stage of life, post weaning period.

2-The green water is important in marine newly hatched larvae stage more than in advanced fry.

2- Feed and Nutrient utilization parameters of sea bass(*D. labrax*) fry as effected by stocking density ,green water treatments to reduce its effect and the is interaction

The feed utilization parameters, feed intake(FI) , feed conversion ratio(FCR), protein efficiency ratio(PER), protein productive value(PPV), energy retention(ER) and energy utilization(EU), of sea bass, D. labrax, under different densities with normal and green water treatments during post weaning period (70 days) are shown in Table (4) .

2-1-Effect of stocking densities

Regardless of the effect of marine water type, normal or green, in rearing experimental aquaria, the results in Table (4) indicated that, the sea bass fry reared at low density (12 fry/ aquaria) showed the best feed utilization parameters compared with counterpart in the high density, (25 fry/ aquaria) (11.77 g, 3.28, 0.55%, 11.21%, 6.57% and 11.20% vs 11.27g, 4.54, o.39%, 8.25%, 4.53% and 8.32%, respectively).Only the differences between two treatments in ER and EU were significant (P≤0.05) .Concerning the effects of stocking density on feed utilization parameters of D. labrax, it is indicated that stocking density has been shown to have an adverse effect on feed utilization parameters of fry during post weaning period. These results are consistent with the results of superiority in growth performance of sea bass fry group reared under low-density conditions, which reflect that stocking density is considered to be a main rearing factor affecting fry growth and production in Mariculture systems. Also these findings were agreed with Bjornsson (1994), Yousif (2002) and Omar *et al.*(2006) who reported that, higher stocking densities, beyond the optimum levels, may lead to reduction of growth rate, increase of feed conversion ratio and lowering of survival rate.

2-2- Effect of green water and its interaction with fry stocking density

Regardless of the effect of sea bass fry stocking density, in rearing experimental aquaria, the results in Table (4) indicated that, the sea bass fry reared under green water conditions showed the worst feed utilization parameters compared with counterpart in the normal water, excluding feed intake, and the differences were significant (P≤ 0.05) only in FI and EU parameters. This is probably due to the above mentioned that, the green water

Table (2): Growth performance and survival rate of sea bass(*D. labrax*)fry as effected by stocking density ,green water treatments to reduce its effect and the interaction

Treatments	Initial weight (g/fish)	Final weight (g/fish)	Weight gain (g/fish)	ADG* (g/fish/day)	SGR** (%/day)	RGR*** (%)	Survival rate (%)
Stocking density(SD)							
Low Density (LD)	0.48±0.01	4.20^{a}±0.53	3.75^{a}±0.53	0.054a±0.10	3.08^{a}±0.19	891.62±118.94	83.34^{a}± 2.34
High Density (HD)	0.50 ±0.01	3.00^{b}±0.02	2.48^{b}±0.02	0.035b±0.0	2.52^{b}±0.03	582.83±12.07	54.00b± 1.15
Green water(Gw)							
Normal(N)	0.50± 0.01	4.07^{a}±0.62	3.57^{a}±0.63	0.051±0.01	2.96±0.26	835.55^{a}±149.95	68.66a±9.16
Green water(G)	0.50± 0.01	3.15^{b}±0.11	2.65^{b}±0.12	0.038±0.01	2.64±0.08	638.900^{a}±35.42	62.42b ±5.20
SD*GW							
LD * N	0.48±0.03	5.14^{a}±0.03	4.67^{a}±0.01	0.067^{a}±0.00	3.42^{a}±0.06	1092.69^{ab}±49.4	83.34± 8.34
LD * G	0.48±0.01	3.30^{b}±0.15	2.83^{b}±0.15	0.040^{b}±0.00	2.76^{b}±0.08	690.550^{b}±39.61	70.83±4.17
HD *N	0.52±0.01	3.00^{c}±0.04	2.48^{c}±0.04^{c}	0.035^{c}±0.00	2.51^{c}±0.04	578.405^{b}±14.52	54.00±2.00
HD * G	0.51±0.02	2.99^{c}±0.01	2.48^{c}±0.03^{c}	0.035^{c}±0.00	2.52^{c}± 0.06	587.250^{b}±24.99	54.00± 2.00

ADG*=Average daily gain, SGR**=Specific growth rate, RGR***=relative growth rate.

Table (3): Condition factor (K) of sea bass (*D. labrax*) fry as effected by stocking density ,green water treatments to reduce its effect and the interaction

Treatments	Initial length (cm)	Final length (cm)	Condition factor (K value)
Stocking density(SD)			
Low Density (LD)	3.36±0.02	7.15±0.36	1.16±0.11
High Density (HD)	3.36±0.03	6.33±0.04	1.180±0.03
Green water(GW)			
Normal water (N)	3.36±0.02	6.95±0.45	1.21±0.11
Green water (G)	3.35±0.03	6.52±0.09	1.13±0.03
SD*GW			
LD * N	3.33±0.00	7.63±0.57	1.19±0.26
LD * G	3.40±0.00	6.66±0.07	1.12±0.08
HD * N	3.40±0.00	6.28±0.05	1.21±0.05
HD * G	3.31±0.02	6.38±0.02	1.14±0.01

2-2- Effect of green water and its interaction with fry stocking density

Regardless of the effect of sea bass fry stocking density, in rearing experimental aquaria, the results in Table (4) indicated that, the sea bass fry reared under green water conditions showed the worst feed utilization parameters compared with counterpart in the normal water, excluding feed intake, and the differences were significant (P≤ 0.05) only in FI and EU parameters. This is probably due to the above mentioned that, the green water is important in marine newly hatched larvae more than in advanced fry. So sea bass fry in the present study achieved the best results in the case of normal marine water use.

From the results of Interactions between stocking density and green water in Table (4) it could be concluded that, to possess the best feed utilization parameters for sea bass fry, D. labrax, under different densities with normal and green water treatments during post weaning period, taken into account the following:

1-When rearing marine fish sea bass fry must use appropriate density but not high with no green water use (only normal marine water) at this stage of life, post weaning period.

2-The differences were significant (P≤0.05) only in FI, ER and EU between two treatments.

Table (4):Feed and Nutrient utilization parameters of sea bass(*D. labrax*) fry as effected by stocking density ,green water treatments to reduce its effect and the interaction

Treatments	Feed take (g/fish)	FCR	PER (%)	PPV (%)	EU (%)
Stocking Density(SD)					
Low density (LD)	11.77±0.75	3.28±0.38	0.55±0.06	11.21±1.29	11.2±1.51
High density (HD)	11.27±0.96	4.54±0.39	0.39±0.03	8.25±0.86	8.32±0.73
Green water(GW)					
Normal (N)	11.05±0.84	3.27±0.35	0.55±0.06	11.51±1.11	11.62±1.25
Green water (G)	11.98±0.83	3.55±0.41	0.39±0.04	7.95±0.72	7.89±0.55
SD *GW					
L D* N	11.51±0.00^{a}	1.67±0.01	0.65±0.00	13.4±0.10	13.74±0.22^{a}
LD * G	11.03±1.5^{b}	2.88±0.34	0.45±0.04	9.03±0.77	8.64±0.75^{c}
HD * N	9.60±0.00^{b}	2.87±0.07	0.45±0.01	9.64±0.65	9.49±0.55^{b}
HD *G	12.92±0.00^{a}	3.21±0.06	0.33±0.01	6.86±0.35	7.14±0.39^{c}

*Feed conversion ratio (FCR) - Protein efficiency ratio (PER) - Protein productive value (PPV %) - Energy utilization (EU)

3- Chemical composition parameters of sea bass (D*. labrax*) fry as effected by stocking density, green water treatments to reduce its effect and the is interaction

3-1 Effect of stocking densities

Regardless of the effect of marine water type, normal or green, in rearing experimental aquaria, the results in Table (5) indicated that, the sea bass fry reared at low density (12fry / aquaria) showed the best chemical composition parameters compared with counterpart in the high density,(25fry/ aquaria) (28.78, 62.31, 19.01, 18.53 and 530.88 vs 28.92, 60.18, 19.48, 20.40 and 523.36 for dry matter, crude protein, ether extract, ash and gross energy, respectively).Only the differences between two treatments in ether extract, ash and gross energy were significant (P ≤0.05). These results are consistent with the results of growth and feed utilization.

3-2 Effect of green water and its interaction with fry stocking density

Regardless of the effect of sea bass fry stocking density, in rearing experimental aquaria, the results in Table (5) indicated that, the sea bass fry reared under normal marine water conditions showed the best chemical composition parameters compared with counterpart in the green water, and the differences were significant (P ≤0.05) only in ether extract, ash and gross energy content. This is probably due to the above mentioned that, the green water is important in marine newly hatched larvae more than in advanced fry. So sea bass fry in the present study achieved the best results in the case of normal marine water use.

From the results of Interactions between stocking density and green water in table (5) it could be concluded that, to possess the best chemical composition parameters for sea bass fry, *D. labrax*, under different densities with normal and green water treatments during post weaning period, taken into account the following:

1-When rearing marine fish sea bass fry must use appropriate density but not high with no green water use (only normal marine water) at this stage of life, post weaning period.

2-The differences were significant (P≤ 0.05) only in ether extract, ash and gross energy content between two treatments.

Table (5): Chemical composition parameters of sea bass (D*. labrax*) fry as effected by stocking density ,green water treatments to reduce its effect and the is interaction

Treatments	Dry matter (%)	Crude protein (%)	Ether extract (%)	Ash (%)	Energy content (kcal/100g)
Initial	27.76±0.23	53.65±0.21	15.68±0.54	21.54±0.02	504.33±045
Stoking Density(SD)					
Low-density (LD)	28.78± 0.63	62.31±0.41	19.01±1.29	18.53±1.73	530.88±0.47
High-Density (HD)	28.92±0.82	60.18±0.86	19.48±0.64	20.40±0.24	523.36±0.45
green water(GW)					
Normal (N)	29.26±0.68	62.29±0.43	19.84±0.84	18.12± 1.48	538.60±0.22
Green Water(G)	28.44±0.70	60.19±0.86	18.65±1.08	20.86±0.42	515.64±0.30
SD*GW					
LD * N	29.76±0.56	62.95±0.37	21.2^{a} ±0.42	15.55^{c}±0.11	555.41^{a}±0.05
LD * G	27.81±0.40	61.66±0.24	16.80^{c}±0.11	21.52^{a}±0.09	506.36^{c}±0.11
HD * N	28.76±1.42	61.64±0.34	18.4^{b} ±0.43	20.67^{b}±0.24	521.79^{b}±0.42
HD * G	29.07±1.40	58.74±0.38	20.5^{a} ±0.34	20.22^{b}±0.43	524.93^{b}±0.43

CONCLUSION

From the results of the present study we can concluded that showed mostly better growth performance, feed utilization and survival in lower stocking density (12fry / aquaria) than higher stocking density(25fry/ aquaria). It may be concluded that the addition of both green water, Chlorella or Nannochloropsis has no effect on the performance of the fry of sea bass during the post-weaning

ACKNOWLEDGEMENT:

The authors gratefully acknowledge all staff of fish breeding and rearing lab, NIOF; Alexandria, for their help and supporting during the experiment period.

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الملخص العربي

تأثير الكثافة العددية والمياه الخضراء على بعض معايير الأداء ليرقات أسماك القاروص البحرية أثناء مرحلة ما بعد الفطام

محمد عبد الرازق عيسى[١]–إجلال على عمر[٢]– طارق محمد سرور[٢]

باسم سعد عبد العاطى[١] – سيد احمد عبدالنبي زهران[١]

١- المعهد القومى لعلوم البحار والمصايد – شعبة تربية الاحياء المائية – الأسكندرية

٢- قسم الإنتاج الحيوانى والسمكى – كلية الزراعة (سابا باشا) – جامعة الأسكندرية

هناك العديد من المشاكل التى تواجه الإستزراع السمكى البحرى فى مصر هذا يرجع الى عدم وفرة المعلومات عن ظروف رعاية هذه السمكة داخل المفرخات والتى تحقق أعلى معدلات نمو وإعاشة. لذا استهدفت الدراسة الحالية والتى أجريت بالمفرخ السمكى البحرى لمدة ٧٠ يوم بمحطة بحوث المكس التابعة للمعهد القومي لعلوم البحار والمصايد–فرع الاسكندرية ليرقات أسماك القاروص بهدف تأثير الكثافة العددية لكثافتين مختلفتين (١٢ يرقة /حوض& ٢٥يرقة / حوض) وإضافة طحلب (كلوريلا & نانوكلوربسس) علي بعض معايير النمو والإستفادة من الغذاء ومعامل الحاله والتركيب الكيماوى ليرقات أسماك القاروص وقد شملت كل معاملة على مكررتين وكان متوسط وزن يرقات القاروص (٠.٤٨ جرام/ يرقة) فى البداية حيث تم تغذيتها على عليقة تحتوي على ٥٧٪ بروتين و بمعدل يومي قدره ٥٪ من إجمالي الوزن الحي للأسماك. وأشارت النتائج الى أن الكثافة الاقل (١٢ يرقة /حوض) فى الماء الخالى من الطحالب أظهرت أن لها تأثير معنوى على النمو، والاستفادة الغذائية فى اسماك القاروص خلال مرحلة ما بعد الفطام ويمكن الاستنتاج أيضا أن إضافة كلا من طحلب الكلوريلا وطحلب النانوكلوربسس ليس له ثأثير على أداء يرقات أسماك القاروص خلال مرحلة ما بعد الفطام .

Response of Tomato Plant to Compost Application and Inoculation with Mycorrhizal Fungi Under Salt Stress Conditions

Altome, M.M. Maher G.Nessim. Magda A. Hussein and I. I. Abou el seoud
**Soil and Agriculture Chemistry Department, Faculty of Agriculture (Saba Basha), Alex. University

ABSTRACT : Pot experiments using calcareous soil, were carried out to study the influence of irrigation with diluted seawater on tomato (Strain B) plants growth as affected by compost application and mycorrhhiza inoculation during summer 2011 season. Four different irrigation water salinity levels (0.44, 2.70, 6.20, 12.50 dS/m), three different mycorrhizal treatments (control, *Glomus macrocarpium, Glomus intraradices*) and three compost rates (0, 20, 40 g/kg soil) were used. Dry matter production in shoots of tomato plants was significantly decreased by increasing water salinity. Tomato plants were, adversely, affected only by high water salinity levels (6.20, 12.50 dS/m). However, a substantial increase in shoot dry weight of tomato plant of salt stressed tomato was observed with the compost application and arbuscular mycorrhiza fungi (AMF) inoculation. The N and P contents in shoot tomato plants were significantly increased as salinity increased from 0.44 to 6.20 dS/m. Sodium ion content was significantly increased with increasing the salinity of irrigation water from 0.44 to 12.5 dS/m. On another hand, K content decreased with increasing water salinity. Sodium reduced the contents and uptake of potassium due to ion antagonism. The enhancement in Mn, Zn, Cu, and Fe acquisition or increasing of shoot, dry wehight due to AMF inoculation was more pronounced with *Glomus macrocarpium* than *Glomus intraradiaces* under saline conditions. This is further confirmation that compost application and mycorrhizal inoculation are beneficial for tomato plant grown under adverse conditions such as salinity stress.
Key words: Mycorrhiza fungi , compost, salinity water, irrigation water, calcareous soil

INTRODUCTION

Tomato (*Lycopersicon esculentum* L.) is considered a major vegetable crop in many parts of the world and mostly grown under irrigation, both in protected and open field conditions (Al-Karaki, 2006). Tomato is a moderately sensitive to salinity. It is necessary to conduct the extensive research on growth conditions under moderate salinity to produce vegetative growth.

Nevertheless, salinization of soil is a serious problem and is increasing steadily in many parts of the world, particularly in arid and semi-arid areas. At present, out of 1.5 billion hectares (ha) of cultivated land around the world, about 77 million ha (5%) is affected by excess salt content (Sheng *et al*., 2008). Salt accumulates in soil predominantly as a result of strong winds, high temperatures that cause rates of evaporation to exceed precipitation near coastal areas, utilization of salt-rich industrial wastewater for irrigation, over-pumping of groundwater, excessive use of chemical fertilizers and intensive crop production (Singh *et al*., 2011).

The effect of salinity on plant growth has been salt studies in different tomato cultivars. Salinity adversely affected the vegetative growth of tomato (Adler and Wilcor, 1987). It had also been reported that high salinity reduces the fresh and dry weights of shoots and roots of tomato plants (Omar *et al.,* 1982). Incorporating or applying factors that enable plants to better withstand salt stress could help improve crop production under saline conditions.

Arbuscular mycorhizal fungi (AMF) widely occur in saline soils (Aliasgharzadeh *et al.,* 2001). Salinity negatively affects the formation and function of mycorrhiazl symbiosis (Juniper and Bott, 1993). The root colonization by AMF involves a series of morphphysiological and biochemical events that are regulated as well as by environmental factors. The improving salt tolerance of arbuscular-mycorhizall-inoculated plants, are still unclear, although, the improved nutrition uptake may be one of the reasons (Poss *et al.,* 1985). In recent years, some studies have indicated that AMF can enhance the plant growth and uptake of nutrients, decrease yield losses of tomato under saline conditions and improved salt tolerance of tomato (Abdel Latef and Chaoxing, 2011). The use of organic composts in agricultural areas is increasing because these improve soil health and nutrient status (Pandey and Shukla, 2006). Varindepal *et al*., (2006) reported that, incorporation of organic compost decreased P adsorption, maximum buffering capacity, bonding energy, and increased P concentration in solution. Herencia *et al.* (2007) demonstrated that long-term use of organic compost in greenhouse soil improved soil fertility, the use of organic fertilizer resulted in higher soil organic matter, soil N content, and available P and K. Kavvadias *et al*. (2011) reported that organic matter application to soil can resulted in some beneficial soil chemical and physical characteristics, such as increases in organic matter, organic carbon, major nutrients (e.g N, K), water-holding capacity and porosity. Hence, this study was conducted to determine if inoculation of seedling with endo mycorrhiza (VAM) fungi and amendement with compost alleviates soil salinity stress on growth and mineral acquisition of tomato cultivar.

MATERIALS AND METHODS

Surface calcareous soil sample (0-15 cm) was taken from El-Zohoor village (Banger El-Sokhar) which is a new reclaimed soil. The sample was air-dried, ground to pass through 2mm sieve and thoroughly mixed before using. The characteristics of this soil are presented in Table1. The methods used for soil analysis were those described by Page *et al*. (1982)**.**

The used compost sample is representative of the compost produced in Egypt, and it was analyzed according to method outlined by Page *et al*. (1982). The chemical and physical properties of the compost are presented in Table 2.

Four different saline irrigation water (0.44, 2.7, 6.2 and 12.5 dS/m) were prepared by dilution of the sea water using distilled water. The chemical properties of the used saline irrigation water are presented in Table 3. Tap water was used as the control (0.44 dS/m).

Two arbuscular-mycorrhizal (AM) species belonging to the genus *Glomus* were used in this study. These species were *Glomus macrocarpium* and *Glomus intraradiaces*. The first species was obtained from Department of Plant Nutrition at Göttingen-University Germany and the second one was supplied from Department of Plant Pathology at Hanover University in Germany. The spores of mycorrhizae *Glomus spp* (mixed) was isolated from the soil by wet sieving and decanting method as described by Gerdemann and Nicolson (1963).

Table (1). Some initial soil physical and chemical characteristics of the experimental soil

Soil properties	Value
Partical-size distribution	
Sand %	51.62
Silt %	25.50
Clay %	22.88
Texture class	Sandy
pH (1:1 Soil:Water)	Loam
EC (1:1 Soil:Water), dS/m	8.10
Total $CaCO_3$ %	1.66
Water soluble cations, meq/L	32.0
Ca^{2+}	
Mg^{2+}	7.20
Na^{+}	0.20
K^{+}	9.90
Water soluble anions, meq/L	0.42
$CO_3^{=}$	
HCO_3^{-}	n.d.
Cl^{-}	6.30
$SO_4^{=}$	3.80
	8.02

n.d.= not detected

Table (2). Chemical analysis of the compost sample

Characters	Value
pH (1:2)	7.02
EC (1:2), dS/m	4.10
O.M, %	52.80
Total P, %	0.44
Total N, %	0.92
Water soluble cations, meq/L	
Ca^{2+}	18.20
Mg^{2+}	9.80
Na^{+}	6.50
K^{+}	2.30
Water soluble anions, meq/L	
HCO_3^{-}	10.20
Cl^{-}	13.00
$SO_4^{=}$	13.60

A pot experiments were carried out at the green house of the Faculty of Agriculture (Saba bacha), Alexandria University, Egypt during 2011 growing season using plastic pots. The pots were 30 cm deep and 13cm in diameter with holes in their bottom, The pots were filled with 1 kg of air- dried soil leaving the upper 5 cm without soil. Seeds of tomato (Strain B) were planted in each pot. This experiment was designed as split – split plot with three replicates. The main plots were for irrigation water salinity types (0.44, 2.7, 6.2 and 12.5 dS/m), the sub plots for compost rates (0, 20 and 40 g/kg soil) and the sub sub plots for mycorrhiza inoculation (without, *Glomus intraradiaces* (GC) and *Glomus macrocarpium* (GM)). About fifty grams of inoculum *Glomus intraradiaces* and 100 ml of an inoculum suspension (involving spores and colonized root segments) for the other species *Glomus macrocarpium*, were placed 2 cm below the seeds.

Table (3). The chemical characteristic of saline irrigation water

Paremeter	Water Salinity, (dS/m)		
	2.7	**6.2**	**12.5**
pH	8.08	8.18	8.89
Water soluble cations, meq/L			
Ca^{2+}	1.32	2.86	4.60
Mg^{2+}	2.3	4.60	8.10
Na^{+}	23.0	52.8	106.5
K^{+}	0.83	1.91	3.85
Water soluble anions, meq/L			
HCO_3^{-}	11.7	20.8	34.40
Cl^{-}	11.88	38.3	46.10
$SO_4^{=}$	4.50	6.90	45.10

Four seeds of Tomato were planted into each pot and after two weeks from emergence the plants were thinned to two plants. The experiment was carried out in a sunlight green-house with natural light, a day/night temperature 30 ºC /22 ºC , and a relative humidity 50-70%. The soil of each pot was fertilized with 200 mg N kg^{-1} soil in the form of $(NH_2)_2CO$ (46% N), 410 mg/ kg^{-1} soil in the form of K_2SO_4 (48% K_2O) and 200 mg P_2O_5 kg^{-1} soil (15.5% P_2O_5) in the form of Ca $(H_2PO_4)_2$. All pots were irrigated every day to keep the soil at 70% of its field capacity by regular weighing of pots. After 7 weeks of growth, shoot of plants were taken from each pot and washed with running tap water, and then with distilled water. The samples were air dried for few hours and then oven dried at 70 ºC for 48 hours, grounded after recording the dry weight of the plant parts (shoot). After dryness, the plant samples were milled well and kept in plastic container for chemical analysis. Samples of the dried plant material (0.5 g) were wet-digested with H_2SO_4 - H_2O_2 digest (Lowther, 1980) and the P, K, Na, Cu, Zn, Mn and Fe were determined in the digested solution, according to Jackson (1973). Phosphorus was measured in the digested solution using vanado-molydate color reaction according to the

method described by Jackson (1973). Potassium and sodium were measured in the digested suspension using flamephotometer. The micronutrients were determined by atomic absorption spectrophotometer. Also, nitrogen content was determined by micro-Kjeldahl method according to Bermner and Mulvaney, (1982). All data were subjected to analysis of variance or regression analysis according to Snedecor and Cochran (1972) and L.S.D test at 0.05 level of probability was used to compare between means.

RESULTS AND DISCUSION

The obtained results in (Table 4). revealed that the average shoot dry weight of tomato plant due to compost and AMF inoculation was significantly decreased gradually by increasing salinity of irrigation water. The significance of soil salinity on agricultural yield is enormous as stated by Tester and Davenport (2003). The salinity generally affects the establishment growth and development of plants leading to losses in productivity (Mathur *et al*., 2007). This effect was pronounced in plants grown under higher salinity levels of irrigation water (6.2 and 12.5 dS/m) as compared with the control.

Table (4). Mean effects of irrigation water salinity, compost rate and mycorrhiza incoluation on shoot dry weight of tomato plant

Treatments	Dry weight, (g/pot)
Salinity levels, dS/m	
0.44	5.01
2.70	4.60
6.20	4.41
12.50	4.13
$LSD_{0.05}$	0.037
Compost rate, g/kg soil	
0	4.31
20	4.57
40	4.74
LSD0.05	0.022
Mycorrhiza inoculation	
Without	3.77
GC	4.86
GM	4.98
$LSD_{0.05}$	0.033

The direct effects of salts on plant growth may involve: (*a*) reduction in the osmotic potential of the soil solution that reduces the amount of water available to the plant causing physiological drought (Feng *et al*., 2002; Jahromi *et al*., 2008); (*b*) toxicity of excessive Na and Cl ions towards the cell (Feng *et al*., 2002); and (*c*) nutrient imbalance in the plant caused by nutrient uptake and/or transport to the shoot leading to ion deficiencies (Adiku *et al.* 2001). Gunies *et al*.(1996) reported that under saline conditions, the plants failed to maintain the required balance of organic and inorganic constituents leading to suppress the plant growth. This result is in line with those obtained by Ahmed *et al*., (2001) on *Ambrosia maritime*, Arshi *et al.* (2002) on senna plants, Shalan *et al*. (2006) on *Majarana hortensis*, L. and Abdel-Mawgoud *et al*. (2010) on green bean plants.

To deal with irrigation by saline water and minimize crop loss, scientists have searched for incorporating or applying factors that enable plants to better withstand salt stress such as compost application and or AMF inoculation which could help to improve crop production under saline conditions.

Data concerning the effect of compost application rates showed that, the highest significant values of shoot dry weight of tomato plant produce from 40 g compost /kg soil. The shoot dry weight of tomato plants gradually increased by increasing compost rate (Table 5). It has been demonstrated that the application of compost to soil improves some physical properties such as porosity, water-holding capacity and bulk density. It also promotes buffering capacity of the soil and increases the percentage of organic matter and cation exchange capacity (Soheil *et al*., 2012). Likewise, the organic composts improve soil health and nutrient status (Pandey and Shukla, 2006). Varindepal *et al*., (2006) reported that, incorporation of organic compost decreased P adsorption, maximum buffering capacity, bonding energy, and increased P concentration in solution. Kavvadias *et al*. (2011) reported that organic matter application to soil can lead to some beneficial soil chemical and physical characteristics, such as increases in organic matter, organic carbon, major nutrients (e.g N, K), water-holding capacity and porosity. The obtained results are in line of those obtained by Vendrame *et al*.(2005) on some ornamental plant and Atif *et al*.(2008) on *zinnia elegans.*

Table (5). The interaction effect between irrigation water salinity (S) and compost rate (C) on shoot dry weight of tomato plants

Irrigation water salinity, dS/m	Compost rate (g/kg soil)	Dry weight (g/pot)
0.44	0	4.579
	20	5.089
	40	5.361
2.7	0	4.167
	20	4.707
	40	4.928
6.2	0	4.433
	20	4.348
	40	4.440
12.5	0	4.045
	20	4.119
	40	4.238
$LSD_{0.05}$		0.092

The application of organic matter to saline soils or soil irrigated with saline waters can have different effects such as speeding up of NaCl leaching, decrease of the exchangeable sodium percentage and electrical conductivity and increase of water infiltration (El- Shakweer, *et al*., 1998). The beneficial effect of OM have been attributed to release root exudates such as organic acids which regulate soil pH and decrease the harmful effect of increasing salt concentration of soil and to improve soil physical properties and nutrient availability (Deluca and Deluca 1987).

The second approach is the inoculation with arbuscular mycorrhizal fungi. The results in Table 6 indicated that, the inoculation of AM fungi caused in significant increase in shoot dry weight per pot when compared to the uninoculated plants at all levels of irrigation water salinity and and compost rates.The *Glomus macrocarpium* was more effective than *Glomus intraradiaces*. Mycorrhizal colonization is common in tomato plants and well documented a mycotrophic plant (Kubota *et al*., 2005). Many studies were conducted to assess the response of tomato seedlings with the inoculation of AMF. The inoculated seedlings showed better performance due to its higher shoot fresh weight (Oseni *et al*., 2010). Arbuscular mycorrhizal fungi promote salinity tolerance by employing various mechanisms, such as enhancing nutrient acquisition (Al-Karaki and Al-Raddad, 1997), producing plant growth hormones, improving rhizospheric and soil conditions (Lindermann, 1994), altering the physiological and biochemical properties of the host (Smith and Read, 1995) and defending roots against soil-borne pathogens (Dehne, 1982). In addition, AMF can improve host physiological processes like water absorption capacity of plants by increasing root hydraulic conductivity and favourably adjusting the osmotic balance and composition of carbohydrates (Ruiz -Lozano, 2003).

With regard to the interaction between salinity of irrigation water and compost rate, data presented in Table (5) revealed that compost rates under salinity stress significantly increased shoot dry weight of tomato plant compared to that without compost. The interaction between irrigation water salinity and mycorrhizal inoculation (SxM) had a significant effect on shoot dry weight, (Table 6). The highest value of shoot dry weight was obtained through 0.44 dS/m irrigation water with GM inoculation, while the lowest value was obtained with 12.5 dS/m irrigation water salinity without AMF inoculation. The interaction between compost rate and mycorrhizal inoculation (CxM) had highly significant effect on dry weight (Table 7).The highest value of shoot dry weight was obtained due to applying 40 g compost per kg soil with *Glomus macrocarpiu.*

The second-order interaction between irrigation water salinity, compost rate and mycorrhizal inoculation (S x C x M) had significant effect on shoot dry weight (Fig 1). The highest value of dry weight was obtained from 0.44 dS/m irrigation water salinity, 40 g compost/kg soil and *Glomus macrocarpium.*

The dry weight of tomato shoot (Y) without mycorrhizal inoculation was regressed against the irrigation water salinity (X_1), and compost rate (X_2). The regression equation for the relationship was:

$$\mathbf{Y = 3.961 - 0.071\ X_1 + 0.010\ X_2}$$

$$\mathbf{R^2 = 0.868^{**} \qquad P < 0.01}$$

The comparison of the slopes of each variable in the equation (0.071: 0.01) gives a quantitative estimate for the efficiency of one variable to the other. Thus the efficiency of salinity irrigation water and compost rate would be equal to (1: 0.141). The dry weight of tomato shoot (Y) With *Glomus macrocarpium* inoculation was also regressed with the two variables. The regression equation for the relationship was:

Table (6).The interaction effect between irrigation water salinity (S) and Mycorrhiza inculation (M) on shoot dry weight of tomato plants

Irrigation water salinity, dS/m	Mycorrhiza oculation	Dry weight (g/pot)
0.44	Without	4.233
	GC	5.325
	GM	5.470
2.7	Without	3.827
	GC	4.963
	GM	5.011
6.2	Without	3.435
	GC	4.617
	GM	4.836
12.5	Without	3.265
	GC	4.531
	GM	4.606
$LSD_{0.05}$		0.133

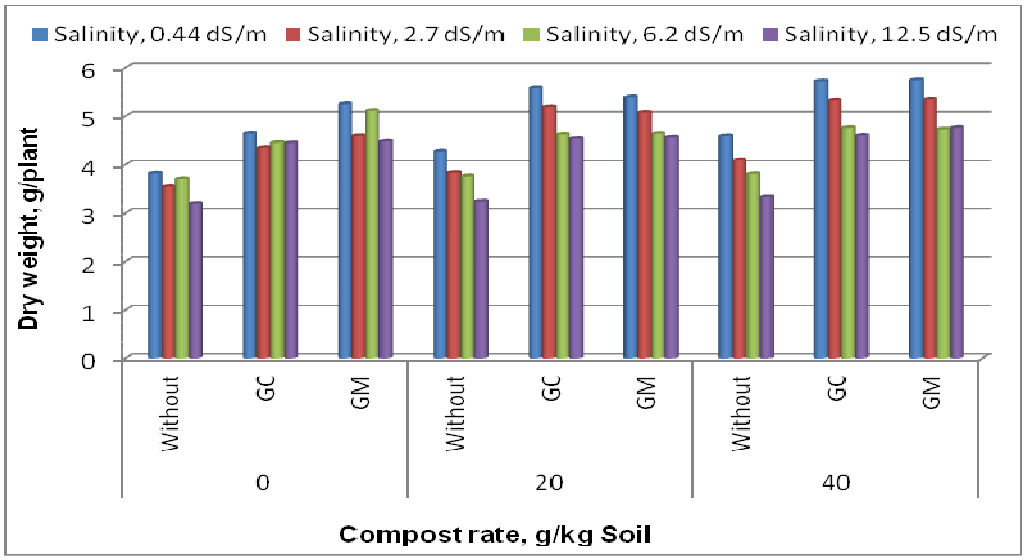

Fig (1): The effect of irrigation water salinity, compost rate and mycorrhizal inoculation on dry weight of shoot tomato plant

Table (7). The interaction effect between compost rate (C) and Mycorrhiza inculation (M) on shoot dry weight of tomato plants

Compost rates,g/kg soil	Mycorrhiza inoculation	Dry weight (g/pot)
0	Without	3.574
	GC	4,477
	GM	4.865
20	Without	3.780
	GC	4.991
	GM	4.923
40	Without	3.961
	GC	5.110
	GM	5.154
$LSD_{0.05}$		0.110

the dry weight of tomato shoot (Y) with *Glomus intraradiaces* inoculation was regressed with salinity irrigation water (X_l) and compost rates (X_2) and the regression equation for the relationship was:

$$\mathbf{Y = 4.868 - 0.061\ X_1 + 0.016\ X_2}$$

$$\mathbf{R^2 = 0.709 \qquad P < 0.01}$$

Thus the efficiency of irrigation water salinity: compost rate would be equal to 0.061: 0.016 or 1: 0.262. These analyses indicated that dry weight of tomato shoot was strongly affected by both variables especially by irrigation water salinity.

The effects of compost rate and mycorrhizal inoculation in relation to irrigation water salinity on elemental composition of tomato plant are presented in Tables (8, 10). The results in Table (8) represent the mean values of N, P, K, and Na contents. In the same table, the N, P contents of shoot tomato plants were significantly increased as salinity increased from o.44 to 6.2 dS/m. In Table the same Table, Na ion content was significantly increased with increasing the salinity of irrigation water from 0.44 to 12.5 dS/m. On the other hand the K ion content decreased with increasing water salinity up to 12.5 dS/m.

Gomea *et al*. (1996) reported an increase in Na concentration and decrease in K concentration in the leaves with increasing salinity. These results may be due to a possible antagonism between K and Na. This antagonism could be due to the direct competition between K and Na at the sites of ion uptake at plasmalemma. Accordingly, the increase in Na concentration in plant with salinity may be a result of the ability of plant to use Na to maintain an adequate osmotic potential gradient between the plant tissues and external solution (Glenn, 1987).

Table (8). Mean effect of irrigation water salinity, compost rate and mycorrhiza incoluation on nitrogen, phosphours, potassium and sodium contents in shoot of tomato plant

Treatments	Nitrogen	Phosphorus	Potassium	Sodium
%				
Salinity levels, dS/m				
0.44	2.78	0.131	0.735	1.35
2.70	3.00	0.151	0.717	1.46
6.20	3.15	0.165	0.693	1.59
12.50	2.92	0.164	0.653	1.70
$LSD_{0.05}$	0.105	8.98E-03	0.014	0.040
Compost rate, g/kg soil				
0	2.75	0.141	0.684	1.42
20	2.96	0.146	0.698	1.52
40	3.17	0.171	0.717	1.64
LSD0.05	0.049	4.58E-03	N.S.	0.039
Mycorrhiza inoculation				
Without	2.96	0.141	0.676	1.45
GC	2.96	0.156	0.733	1.57
GM	2.97	0.162	0.690	1.57
$LSD_{0.05}$	N.S.	5.31E-03	9.72E-03	0.040

Regarding the effect of compost rate on N, P, k and Na contents of shoot of tomato plant in Table 8, the increment of these nutrients could be attributed to their availability in compost which increased with increasing compost rates. Also,

this may be due to the ability of organic matter in rendering soil nutrients more available and chelating of these elements. This helps to increase the respiration rate, metabolism and growth of plant that causing the plant required to more nutrients from soil and fertilizers. Similar results were obtained by Shehata (2001) and Ewais *et al*. (2005).

The present study showed also, an increase in the contents of N, P, K, and Na in the shoot of mycorrhizal fungi inoculated plants than in the shoot of the uninoculated plants (Table 8). AM inoculated plants recorded higher contents of N, P, K, and Na elements and this may be due to AM hyphae net work which is substantiated by the observed increase in nutrients content (Bolan *et al*., 1994). The interaction between salinity of irrigation water and mycorrhizal inoculation (SxM) had significant effect on N contents in shoot tomato plants (Table 9). The highest value of N content was obtained through 6.2 dS/m irrigation water salinity with *Glomus macrocarpium,* while the lowest value was obtained through o.44 dS/m irrigation water salinity without mycorrhizal inoculation.

Table (9).The interaction between irrigation water salinity (S) and ycorrhiza inculation (M) on nitrogen content (%) in shoot of tomato plant.

Irrigation water salinity dS/m	Mycorrhiza	N %
0.44	Without	2.709
	GC	2.866
	GM	2.768
2.7	Without	2.967
	GC	3.029
	GM	3.089
6.2	Without	3.067
	GC	3.124
	GM	3.247
12.5	Without	3.102
	GC	2.815
	GM	2.844
$LSD_{0.05}$		0.172

Data in Table (10) revaled the average values of the micronutrients (Fe, Zn, Mn and Cu) contents in shoot of tomato plants as affected by irrigation water salinity, compost rates and mycorrhizal inoculation. It is clear that Zn, Mn and Cu contents in shoots of tomato plants were significantly increased as salinity of irrigation water increased from 0.44 to 6.2 dS/m. Table (10) showed also, the effect of compost rates on Fe, Zn, Mn and Cu in shoot of tomato plant. The results showed that there werehighly significance variations in Zn, Mn and Cu contents. The highest values of Fe, Zn, Mn and Cu were produced with 40 g compost /kg soil. Data in Table 10 showed that inoculation with AM fungi significantly increased Fe, Zn, Mn and Cu contentsin shoot of tomato plant as compared to the non-mycorrhizal tomato plants. The inoculation with *Glomus macrocarpium* was more effective than with *Glomus intradiaces* for Zn, Mn and Cu.

The interaction between salinity of irrigation water and compost rate (S x C) had significant effect on Zn content in shoot tomato plants (Table 11). The highest value of Zn was obtained through 6.2 dS/m irrigation water salinity using 40g compost / kg soil, while the lowest value of Zn was obtained through 0.44 dS/m irrigation water salinity without compost. Also, the interaction between compost rates and mycorrhizal inoculatin (C x M) significantly effectd Zn and Mn contents in shoot of tomato plants (12). The highest values of Zn and Mn were obtained through 40 g compost /kg soil with *Glomus macrocarpium.*

Salinity interferes with nitrogen (N) acquisition and utilization by influencing different stages of N metabolism, such as NO_3 ion uptake and reduction and protein synthesis (Frechill *et al.,* 2001). Application of AMF can help in better assimilation of nitrogen in the host plant. Giri and Mukerji (2004) recorded higher accumulation of N in shoots of mycorrhizal *Sesbania grandiflora* and *S*. aegyptiaca than in non-mycorrhizal control plants. The extra radical mycelia take up inorganic nitrogen from the soil in the form of nitrate and assimilated it via nitrate reductase, located in the arbuscule-containing cells (Kaldorf *et al.,* 1998). Cliquet and Stewart (1993) observed increased of N uptake in an AMF inoculated plant due to a change in N metabolism brought about by changes in the enzymes associated with N metabolism (Mathur and Vyas, 1996). Severals studies have reported that improved N nutrition may help to reduce the toxic effects of Na ions by reducing its uptake and this may indirectly help in maintaining the chlorophyll content of the plant.

Table (10). Mean effect of irrigation water salinity, compost rate and mycorrhiza incoluation on iron, zinc, manganese and copper contents in shoot of tomato plants

Treatments	Iron	Zinc	Manganese	Copper
mg/kg D.W.				
Salinity levels, dS/m				
0.44	270.04	89.48	40.89	49.44
2.70	213.19	103.04	47.67	53.56
6.20	228.78	113.74	53.33	58.44
12.5	207.30	102.22	46.59	51.78
$LSD_{0.05}$	N.S.	1.868	2.278	0.655
Compost rate, g/kg soil				
0	245.69	94.81	41.97	50.56
20	213.78	101.00	47.11	52.28
40	230.00	110.56	52.28	57.08
LSD0.05	N.S.	1.465	1.65	0.659
Mycorrhiza inoculation				
Without	144.67	85.06	39.08	44.86
GC	295.14	105.83	46.67	54.69
GM	249.67	115.47	55.61	60.36
$LSD_{0.05}$	42.16	1.916	1.14	1.145

When Na or salt concentration in the soil is high, plants tend to take up more Na resulting in decreased K uptake. Na ions compete with K for binding sites essential for various cellular functions. Potassium plays a key role in plant metabolism. It activates a range of enzymes, and plays an important role in stomatal movements and protein synthesis. High concentrations of K are required in protein synthesis as is used in the binding of tRNA to the ribosomes (Blaha *et al.,* 2000). These functions cannot be replaced by Na ions (Giri *et al.,* 2007).

Mycorrhizal colonization can enhance K absorption under saline conditions (Giri *et al.,* 2007; Zuccarini and Okurowska, 2008) while, it can decrease Na translocation to shoot tissues. Na uptake may also be influenced by the synthesis and storage of polyphosphate (Olrovich and Ashford, 1993) as well as by other cations, particularly K (Giri *et al.,* 2003).

Arbuscular mycorrhizal fungi also improve micronutrient acquisition by increasing the surface area of soil explored by mycorrhizal roots and increasing the solubility of metals by producing metal-chelators (Szaniszlo *et al.* 1981). AMF improves the absorption of copper (Gildon and Tinker, 1983), zinc (Faber *et al.*, 1990; Gildon and Tinker, 1983) and iron (Al-Karaki, 2006).

Table(11).The interaction effect between irrigation water salinity(S) and compost rate (C) on Zinc content in shoot of tomato plants

Irrigation water salinity, dS/m	Compost rate (g/kg soil)	Zn (mg/kg D.w.)
0.44	0	80.33
	20	84.67
	40	103.45
2.7	0	93.67
	20	102.00
	40	113.45
6.2	0	105.67
	20	113.78
	40	121.78
12.5	0	99.56
	20	104.22
	40	103.56
$LSD_{0.05}$		6.214

Table (12). The interaction effect between compost rate (C) and Mycorrhiza inculation (M) on zinc and manganese contents in shoot of tomato plants

Compost rates, g/kg soil	Mycorrhiza	Zn (mg/kg D.w)	Mn (mg/kg D.w.)
0	Without	81.75	33.00
	GC	94.08	39.16
	GM	108.58	53.75
20	Without	84.92	40.42
	GC	106.33	46.17
	GM	111.75	54.75
40	Without	88.50	43.83
	GC	117.08	54.67
	GM	126.08	58.33
$LSD_{0.05}$		6.671	3.983

CONCLUSION: The AM fungal represented by *Glomus macrocarpium or Glomus intraradiaces* with compost application can benefit against potentially salt stress conditions.The *Glomus macrocarpium* was more effective, in general, than *Glomus intraradiaces.* These is further confirmation that compost application and mycorrhizal symbiosis are especially beneficial for plant growth under soil salinity stress. Thus it is needed to develop more exact tests through more exploratory experiments on several tomato cultivares and AMF species to drive more pruise results when we irrigate with saline waters.

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الملخص العربي

استجابة الطماطم للتلقيح بفطر الميكوريزا وإضافة الكمبوست تحت حالة الإجهاد الملحي

محمد مصباح التومي – ماهر جورجي نسيم – ماجدة أبوالمجد حسين – اسلام إبراهيم أبوالسعود

قسم الأراضي والكيمياء الزراعية – كلية الزراعة – سابا باشا – جامعة الإسكندرية

تم اجراء تجربة اصص بأستخدام تربة جيرية لدراسة تأثير الري بمياه ملحية محضرة بتخفيف مياه البحر علي نباتات الطماطم (سلالة B) الملقحة بالميكوريزا مع إضافة الكمبوست خلال الموسم الصيفي ٢٠١١. وقد تم استخدام اربع مستويات من مياه الري (٠,٤٤ ، ٢,٧٠ ، ٦,٢٠ و ١٢,٥٠ ديسى سيمنز/ م) وثلاث معاملات ميكوريزا هى الكنترول (بدون ميكوريزا) ونوعين من الميكوريزا هما *Glomus macrocarpium* و *Glomus intraradiaces* وثلاث معدلات من الكمبوست (صفر ، ٢٠ و ٤٠ جم / كجم تربة). وكانت أهم النتائج هى إنخفاض إنتاج المادة الجافة معنويا للجزء الخضري للنباتات بزيادة ملوحة مياه الري . وقد تأثرت نباتات الطماطم بشدة بالمستويات العالية لملوحة مياه الري (٦,٢٠ و١٢,٥ ديسى سيمنز / م) . ومع ذلك فقد لوحظ زيادة فى المادة الجافة لنبات الطماطم المتأثره بملحية ماء الرى بسبب إضافة الكمبوست والتلقيح بالميكوريزا . كما زاد المحتوى من النيتروجين والفوسفور بصورة معنوية بزيادة ملوحة مياه الرى من ٠,٤٤ إلي ٦,٢٠ ديسى سيمنز / م. وقد زاد محتوى الصوديوم فى المادة الجافة لنبات الطماطم مع زيادة الملوحة فى ماء الرى من ٠,٤٤ إلي ١٢,٥٠ ديسي سيمنز / م. ومن ناحية أخرى فقد إنخفض محتوى النباتات من البوتاسيوم. فإمتصاص الصوديوم أدى الى إنخفاض البوتاسيوم بسبب ظاهرة التضاد. والزيادة فى تركيز المنجنيز والزنك والنحاس والحديد مع الزيادة فى المادة الجافة للجزء الخضري بسبب التلقيح بالميكوريزا و كان واضحا مع التلقيح بالميكوريزا *Glomus macrocarpium* أكثر من *Glomus intraradiaces* تحت ظروف الاجهاد الملحى. هذة النتائج تدعم أهمية إضافة الكمبوست والتلقيح بالميكوريزا لإفادة نباتات الطماطم النامية تحت ظروف صعبة مثل الإجهاد الملحى.

Improving Washington Navel Orange Fruits by Some Natural Pre-Harvest Foliar Applications A- Mineral Content, Yield and Fruit Quality

Ezz, Thanaa M. * , Aly, M. A.* , Ekbal, Z. A. Ahmed , Rehab, M. Awad* and Abd El-Gawad, M. G.****

*Plant Production Department - Faculty of Agriculture (Saba Basha) - Alexandria University

**Sabahia Horticulture Research Station, Alexandria – Agriculture Research Centre

ABSTRACT: This investigation was carried out during the two successive seasons of (2013 and 2014) on 20-years-old Washington Navel orange (*Citrus sinensis* L. *Osbeck*) trees budded on sour orange (*Citrus aurantium* L.) rootstock grown in clay soil in a private orchard at Kafr El-Dawar region, EL-Behira Governorate, Egypt, to improve mineral contents, yield and fruit quality by pre-harvest foliar applications with Putrescine at (2, 4 and 6 mM), Spermine at (2, 4 and 6 mM), Jasmine Oil at (0.04, 0.06 and 0.08 %), Thyme Oil at (0.04, 0.06 and 0.08 %), Garlic Extract at (1, 1.5 and 2 %), Clove Extract at (1, 1.5 and 2 %), Algaefol Extract at (1, 1.5 and 2 %), Jisamar Extract at (1, 1.5 and 2 %) and control (untreated trees).

Four foliar spraying were carried on trees from each treatment as follows, the first application was just at full bloom for Washington Navel orange trees. The second application was after 30 days from the first one, the third application was after 30 days from the second and the fourth application was before 45 days from the harvest date. The obtained results revealed that all foliar applications improved leaf mineral contents and increased yield as (number of fruits and weight kg per tree), average fruit weight compared with control, while it clearly decreased pre-harvest fruit drop during two seasons. Moreover, it improved TSS, acidity, vitamin C, TSS/Acid ratio, total sugars, reducing sugars and non-reducing sugars contents compared with the control. In addition, the two higher concentrations of all treatments were more effective than the low concentration on improving yield, mineral content and fruit quality of Washington Navel orange fruits.

Keywords: Washington Navel orange, Polyamines, Jasmine Oil, Thyme Oil, Garlic Extract, Clove Extract, Seaweed Extract.

INTRODUCTION

Citrus fruits occupy the first rank among economic fruit crops in Egypt as well as all over the world. Orange is the most important citrus crop in Egypt. Washington Navel orange (*Citrus sinensis* L. *Osbeck*) is one of the most popular citrus fruits in Egypt, for its delicious taste and nutrition, besides being rich in vitamin C and minerals. It has a significant importance not only in the local market but also for export. Under Egyptian conditions, it is a common practice to store mature Navel orange fruits on the trees for long time to delay harvest time but this cause some effect on flowering of the following season.

Several natural compounds have been used to retard ripening and extend fruit shelf life. For instance polyamines are group of natural compounds that are believed to have anti-senescence function by inhibition of the formation of enzymes essential to the synthesis of ethylene (Ke and Romani 1988). Association between the sprayed substances (especially putrescine) and ethylene has been recently reviewed and investigated (Pandey *et al*., 2000, Giovannoni, 2001 and Valero *et al*., 2002). In this sense, there is evidence of an interrelationship between ethylene and polyamines during fruit ripening and senescence (Pandey *et al.,* 2000). They play an inhibitory role on ethylene

production through inhibition of ACC synthetase and ACC oxidase (Apelbaum *et al.,* 1981, Lee *et al*., 1997), thus delaying ethylene emission. Polyamines have been reported to reduce softening, delay senescence and reduce decay in several fruits (Saftner and Baldi 1990, Kramer *et al*., 1991).

Jasmine and thyme oils some of these essential oils are effective in this respect, it may slow some vital processes such as, respiration while enhance juvenility, lowering consumption of sugars by hindering ethylene action and retarding the quick senescence of plant organs and in turn utilization of sugars (Paulin, 1986).

Use of natural components such as natural extract or herbal oils is one of the healthiest and safest methods to control postharvest diseases. Herbal essential oils include extensive secondary metabolites, which in most cases have antimicrobial, fungicidal, allelopathy, antioxidant and bio-regulating properties (Asghari *et al*., 2009). In the view of chemical, essential oils are complex components with different kinds of chemical substances including: hydrocarbons, alcohols, cetons, and aldehydes (zargari, 1992). Thymus essential oil is known to contain more than 40% of phenolic compositions (thymol and carvacrol), that have strong antiseptics effect. In addition to thymole, caffeic acid and thanin existing in essential oil can effectively prevent growth of bacteria, fungus and viruses. The highest value of thymole exists in *Thymus vulgaris*. According to GC analysis, *Thymus captatus* contains carvacrol that researchers pointed to its anti microbial property and inhibition activity of the existence of these two compounds (Karimi and Rahemi, 2009).

Plant extracts have effectively inhibited sprouting relative to control (El-Sharkawy, 1998). In recent reports (Avato *et al*., 2000) suggested that volatile compounds of garlic such as diallylmonosulfide, diallyldisulfide, and diallyltrisulfide were also found to have antimicrobial properties. The inhibitory activity of clove is due to the presence of several constituents, mainly eugenol, eugenyl acetate, beta-caryophyllene, 2-heptanone (Chaieb *et al*., 2007), acetyl-eugenol, alpha-humulene, methyl salicylate, iso-eugenol, methyl-eugenol (Yang *et al*., 2003), phenyl propanoides, dehydrodieugenol, trans-confireryl aldehyde, biflorin, kaempferol, rhamnocitrin, myricetin, gallic acid, ellagic acid and oleanolic acid (Cai and Wu, 1996).

Seaweed products exhibit growth-stimulating activities, and the use of seaweed formulations as biostimulants in crop production is well established. Biostimulants are defined as materials, other than fertilizers, that promote plant growth when applied in small quantities" and are also referred to as "metabolic enhancers" (Zhang and Schmidt, 1997). Seaweed components such as macro- and microelement nutrients, amino acids, vitamins, cytokinins, auxins and abscisic acid (ABA)-like growth substances affect cellular metabolism in treated plants leading to enhanced growth and crop yield (Reitz and Trumble, 1996).

Therefore, this investigation was carried out during the two successive seasons of 2013 and 2014 in order to study the effectiveness of pre-harvest spraying of Putrescine, Spermine, Jasmine oil, Thyme oil, Garlic Extract, Clove

extract, Algaefol extract and Jisamar extract treatments on mineral contents, yield and fruit quality of Washington Navel orange cultivar.

MATERIALS AND METHODS

This investigation was carried out during the two successive seasons of (2013 and 2014) on 20-years-old Washington Navel orange (*Citrus sinensis* L. *Osbeck*) trees budded on sour orange (*Citrus aurantium* L.) rootstock, to improve mineral content, yield and fruit quality by some natural pre-harvest foliar applications. Trees were growing in clay soil in a private orchard at Kafr El-Dawar region, EL-Behira governorate, Egypt. Trees received normal horticultural practices including: surface irrigation, fertilization, pruning, as well as pest and disease control. The trees were planted at (4.0 × 4.5) meters apart. At the beginning of this study, samples of soil were taken from (0-30, 30-60 and 60-90 cm depth) at 4 different sites of major parts of zone before adding any fertilizers to determine some physical and chemical characters of the soil. The obtained results are presented in Table (1). Soil orchard was clay with a water table about 125 cm far from the soil surface.

The orchard was fertilized at February of each experimental season, with organic manure at rate of (15) cubic meters per feddan. Besides, at March of each experimental season, the trees were fertilized with 200 kg ammonium nitrate (33.5 % N) and 100 kg potassium sulphate (48 % K_2O) per feddan. In addition, for each experimental season, at May the trees were fertilized with 100 kg ammonium nitrate (33.5 % N), at August the trees were fertilized with 200 Kg ammonium nitrate (33.5 % N) and 100 kg potassium sulphate (48 % K_2O) per feddan.

Table (1): Soil Analysis of the experimental orchard

Soil Depth (cm)	Texture	pH	E.C (dS/m)	Soil Content of Cations (meq/L)				Soil Content of Anions (meq/L)		
				K^+	Na^+	Ca^{+2}	Mg^{+2}	HCO_3^-	Cl^-	SO_4^{-2}
(0-30)	clay	7.74	1.03	0.45	5.90	2.50	1.50	2.32	2.25	2.78
(30-60)	clay	7.55	0.95	0.33	3.70	4.50	1.00	2.90	5.00	5.50
(60-90)	clay	7.45	1.00	0.29	3.90	4.00	2.00	2.90	5.50	1.79

Seventy five uniform trees distributed in the orchard were selected for this investigation. In April of the two growing seasons, twenty shoots from all over the outer circumference of each tree were tagged in order to secure leaf samples of the same age. Leaf samples were collected at two weeks intervals from each of the selected trees during August, 15 to August, 31 in both seasons. This experiment was laid-out in completely randomized design (CRD) with three replications. Each treatment was represented in three trees.

The following treatments were carried out:

1. Untreated trees (control).
2. Putrescine (2, 4 and 6 mM/L).
3. Spermine (2, 4 and 6 mM/L).
4. Jasmine Oil (0.04, 0.06 and 0.08 %).

5. Thyme Oil (0.04, 0.06 and 0.08 %).
6. Garlic Extract (1, 1.5 and 2 %).
7. Clove Extract (1, 1.5 and 2 %).
8. Algaefol Extract (1, 1.5 and 2 %).
9. Jisamar Extract (1, 1.5 and 2 %).

- Polyamines (Putrescine and Spermine) are obtained from TRADING DYNAMIC COMPANY – 5, El Wehda El Arabia St., Pyramides Way, Giza-Egypt.

- Jasmine oil and Thyme oil (commercial solution) are obtained from arrow companya public sector Company related to El Hawamdia Company for sugar refinement.

i. A concentration of 0.04 % was prepared directly by dissolving 1.5 cm^3 jasmine oil in 5 liters of water.
ii. Other concentrations of (0.06 % and 0.08 %) were prepared on the same basis.

Preparation of plant extracts

Plant materials were dried in the shade (clove peels and garlic bulbs) were washed with distilled water and dried in shade. They were finely grinded to powder. Fifty grams of each plant material in powder form was homogenized by laboratory blender in 200 ml of methanol (96%) and distilled water (20:80 v/v) for 10 min, and then left in dark glass bottles for 72 h for complete extraction. The extracts were filtered through thin cheesecloth sheets. The final extracts were collected separately in other dark glass bottles and exposed to 60℃ in water bath for 30 min for methanol evaporation. The collected extracts were then stored in a refrigerator at 5℃ until needed. Plant extracts was subjected to GC-MS analysis using a Gas Chromatograph (Table, 2) (Singh *et al*., 2005).

Table (2): Functional components of clove and garlic extracts by GC- MS analysis

Clove extract parameters	(%)	Garlic extract parameters	(%)
Eugenol	75.30	Diallyl sulfide	33.67
Eugenyl acetate	4.55	Diallyl disulfide	10.31
Beta-Caryophyllene	15.20	Allyl methyl sulfide	8.96
Alpha-Humulene	2.10	3-vinyl-1,2-dithiole-5-cyclohexene	28.19
Cadenine	1.05	Vinyl-1,2-thia-4-cyclohexene	10.26
2-Heptanone	0.90	Methyl sulfide	8.61
(E)-ß-Ocimene	0.30		
p-Allyl phenol	0.20		
Ą-Copaene	0.10		
Caryophyllene oxide	0.10		
Gallic acid	0.09		
Ellagic acid	0.08		
Oleanolic acid	0.03		

Four foliar spraying were carried out to trees from each treatment as follows: The first application was just at full bloom for Washington Navel orange trees. The second application was after 30 days from the first one, the third application was after 30 days from the second and the fourth application was

before 45 days from the harvest date. At harvest on maturity stage (late November), under the experimental conditions, the yield per tree was determined.

The following determinations were carried out:

1. Leaf mineral content:

Leaf samples were collected from each replicate. Leaf samples were carefully taken out washed with tap water followed by distilled water several time. The samples were oven dried at 70º C until constant weight and ground in stainless steel rotary mill, (0.3 g) of this dried samples was used for preparing the wet digestion procedure by using sulphoric acid and hydrogen peroxide (H_2O_2) as described by **(Evenhuis and Dewaard, 1980)**. The digested solution was kept in brown bottle until the determination of minerals.

Nitrogen and Phosphorus were determined colorimetrically according to (**Evenhuis, 1976)** and **(Murphy and Riley, 1962)**, respectively. Potassium was determined by flame photometer and calcium, magnesium, iron, manganese, zinc and copper by Perkin Elmer Atomic Absorption spectrophotometer model **305 B.** The concentration of nitrogen, phosphorus, potassium, calcium and magnesium were expressed as percent, while those of iron, copper, zinc and manganese were expressed as parts per million on dry weight basis.

2. Fruit drop:

To study the fruit drop percentages remainder fruits were calculated at June in both seasons through the following equation:

$$\text{Fruit drop \%} = \frac{\text{Number of Developed Fruitlets} - \text{Number of Remained Fruits}}{\text{Number of Developed Fruitlets}} \times 100$$

3. Yield:

Number of fruits per tree were calculated and total yield was determined as follows:

$$\text{Total Yield (kg/tree)} = \text{Number of Fruits} \times \text{Average of Fruit Weight}$$

4. Physical properties:

4. 1. Average fruit weight (g):

5. Chemical properties:

5.1. Total soluble solids percentage:

A hand refractometer was used to determine the total soluble solids percentage in fruit juice.

5.2. Vitamin C (Ascorbic Acid):

Vitamin C content was determined in fruit juice using 2,6- dichlorophenol-indo-phenol blue dye as mg ascorbic acid per 100 ml Juice. (**A.O.A.C., 1980)**.

5.3. Acidity percentage:

Fruit juice acidity was determined according to (**A.O.A.C., 1980)** by titration with 0.1 N sodium hydroxide using phenolphthalein as an indicator and expressed as citric acid percentage.

5.4. TSS/Acid ratio:

5.5. Sugars determination:

For sugars determination, the flesh of each fruit sample was cut into small pieces by a clean knife and mixed well. Five grams of the cut flesh were taken and extracted by distilled water according to (**A.O.A.C., 1980)**. The total sugars were determined calorimetrically using phenol and sulphuric acid according to (**Malik and Singh, 1980)**. The reducing sugars were determined by the Nelson arsenate-molybdate colorimetric method **(Dubois** *et al***., 1956)**. The non-reducing sugars were calculated by the difference between total sugars and reducing sugars.

Statistical analysis:

Data of the present study were subjected to the analysis of variance test (ANOVA) as completely randomized design (CRD). The least significant differences (LSD) at the 5% level of probability were calculated using a computer program Costat according to **Snedecor and Cochran (1980).**

RESULTS AND DISCUSSION

1. Leaf mineral content:

Data concerning the effect of some natural pre-harvest foliar applications on leaf mineral contents in Washington Navel orange trees in 2013 and 2014 seasons are shown in Tables (3 and 4). Statistical analysis of the present data indicated that, in both seasons, all foliar treatments caused a significant increase in leaf macro elements N, P, K, Ca and Mg compared with the control. Moreover, Garlic Extract at (1.5 and 2)%, Clove Extract at (1.5 and 2)%, Algaefol Extract at (1.5 and 2)% and Jisamar Extract at (1.5 and 2)% were more effective on increasing leaf macro elements than that other treatments, Table (3). These results might be attributed to the higher own content of these applications from pigments, antioxidants and nutrients which reflected on encouraging cell division and the biosynthesis of organic foods (Srimal, 1997; Norric *et al*., 2002 and Bruneton, 2011). The higher own content of seaweed extract from essential nutrients, organic compounds, enzymes, vitamins and natural hormones (Verkleij, 1992) could explain the present results. The beneficial effect of seaweed extract (SWE) on uptake of nutrients, resistance of plants to most stresses and the incidence of fungal and insect attack (Cassan *et al*., 1992) give another explanation. These results are in agreement with those obtained by Hegab *et al.* (2005) working on Balady orange and they found that leaf N, P and K content increased with increasing rates of algae extract. As well as Abd El-Motty *et al*. (2010), Mohamed *et al*. (2012), Mohamed and El-Sehrawy (2013) spraying different varieties of mango trees with seaweed extract (SWE). They reported that leaf content of N, P and K was significantly higher in the trees treated with Algae extract rather than non- application.

As for the micro elements iron, copper, zinc and manganese content, results in Table (4) for 2013 and 2014 seasons showed that, in both seasons, all foliar treatments caused a significant increase in leaf micro elements compared with the control. In addition, Putrescine at (6 mM), Spermine at (6 mM), Garlic Extract at (2 %), Clove Extract at (2 %), Algaefol Extract at (2 %) and Jisamar Extract at (2 %) were more effective on increasing leaf micro elements than that other treatments.

Table (3):Effect of some natural pre-harvest foliar applications on leaf macro elements percent (dry weight basis) of Washington Navel orange trees in 2013 and 2014 seasons

Treatments	N (%)		P (%)		K (%)		Ca (%)		Mg (%)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Control (Water Only)	1.37	1.33	0.14	0.15	0.40	0.41	1.94	1.46	0.27	0.25
Putrescine (2 mM)	1.75	1.82	0.16	0.18	0.46	0.48	2.17	1.95	0.31	0.30
Putrescine (4 mM)	1.76	1.89	0.18	0.20	0.50	0.52	2.35	2.10	0.32	0.31
Putrescine (6 mM)	1.82	2.00	0.19	0.22	0.53	0.55	2.63	2.30	0.34	0.33
Spermine (2 mM)	1.76	1.77	0.17	0.1 8	0.47	0.48	2.21	2.01	0.31	0.29
Spermine (4 mM)	1.78	1.85	0.18	0.20	0.51	0.52	2.43	2.12	0.33	0.31
Spermine (6 mM)	1.83	1.99	0.19	0.22	0.54	0.56	2.68	2.30	0.35	0.33
Jasmine Oil (0.04 %)	1.78	1.82	0.16	0.17	0.47	0.48	2.11	1.98	0.30	0.29
Jasmine Oil (0.06 %)	1.81	1.88	0.17	0.20	0.51	0.53	2.35	2.08	0.32	0.30
Jasmine Oil (0.08 %)	1.84	1.95	0.18	0.21	0.54	0.56	2.53	2.14	0.33	0.32
Thyme Oil (0.04 %)	1.79	1.81	0.16	0.18	0.48	0.48	2.16	2.03	0.30	0.39
Thyme Oil (0.06 %)	1.81	1.89	0.18	0.20	0.52	0.53	2.44	2.06	0.32	0.31
Thyme Oil (0.08 %)	1.85	1.97	0.19	0.21	0.55	0.56	2.58	2.18	0.34	0.32
Garlic Extract (1 %)	1.82	1.91	0.17	0.19	0.49	0.52	2.19	2.10	0.32	0.30
Garlic Extract (1.5 %)	1.87	1.98	0.19	0.20	0.54	0.55	2.49	2.23	0.35	0.31
Garlic Extract (2 %)	1.96	2.09	0.20	0.22	0.55	0.57	2.74	2.35	0.36	0.33
Clove Extract (1 %)	1.85	1.92	0.17	0.19	0.50	0.52	2.23	2.09	0.32	0.30
Clove Extract (1.5 %)	1.92	1.98	0.19	0.21	0.54	0.56	2.52	2.26	0.36	0.31
Clove Extract (2 %)	2.02	2.08	0.20	0.22	0.56	0.58	2.75	2.35	0.36	0.33
Algaefol Extract (1 %)	1.85	1.93	0.18	0.19	0.52	0.54	2.18	2.08	0.32	0.30
Algaefol Extract(1.5%)	1.92	2.02	0.19	0.21	0.55	0.58	2.56	2.25	0.33	0.31
Algaefol Extract (2 %)	2.04	2.08	0.20	0.22	0.57	0.60	2.71	2.39	0.36	0.32
Jisamar Extract (1 %)	1.87	1.94	0.18	0.19	0.52	0.54	2.19	2.10	0.32	0.29
Jisamar Extract (1.5 %)	1.93	1.99	0.19	0.20	0.56	0.58	2.58	2.30	0.34	0.31
Jisamar Extract (2 %)	2.05	2.09	0.20	0.21	0.57	0.61	2.74	2.41	0.36	0.32
LSD at $_{0.05}$	0.06	0.05	0.01	0.01	0.02	0.05	0.12	0.10	0.01	0.01

In harmony with these results are those obtained by Mohamed and El-Sehrawy (2013) spraying "Hindy Bisinnara" mango trees with seaweed extract (SWE) twice, thrice or four times at 0.0, 0.1, 0.2 and 0.4 %. They found that, application of seaweed extract (SWE) spraying via leaves at 0.1 to 0.4 % significantly was accompanied with stimulating the leaf content of Mg, Zn, Fe and Mn rather than non-application. The promotion was significantly associated with increasing seaweed extracts concentrations.

2. Fruit drop:

Data of studying the effect of some natural pre-harvest foliar applications on pre-harvest fruit drop percentage of Washington Navel orange trees are listed in Table (5). Results showed that, in both seasons, all treatments caused a significant decrease in pre-harvest fruit drop percentage compared with the control. Moreover, in the two seasons of this study, the statistical analysis showed that Putrescine at 6 mM, Spermine at 6 mM, Garlic Extract at 2 % and Clove Extract at 2 % were more effective on decreasing pre-harvest fruit drop than that of other treatments. The positive influence on decreasing fruit drop by the sprayed substances in our study in obvious. It is well established that plant growth regulators are involved in control of abscission (Sexton and Robersts, 1982). Ethylene accelerates mature citrus fruit abscission, and as previously mentioned that putrescine inhibits ethylene production, this might explain its effect on decreasing fruit drop.

Table (4): Effect of some natural pre-harvest foliar applications on leaf micro elements content (part per million) of Washington Navel orange trees in 2013 and 2014 seasons

Treatments	Fe (ppm)		Cu (ppm)		Zn (ppm)		Mn (ppm)	
	2013	2014	2013	2014	2013	2014	2013	2014
Control (Water Only)	144.93	143.66	29.25	28.56	38.90	39.10	19.68	18.92
Putrescine (2 mM)	151.23	150.90	32.14	32.16	41.46	41.71	22.73	20.91
Putrescine (4 mM)	152.70	152.00	33.41	33.55	42.26	42.56	23.80	23.08
Putrescine (6 mM)	153.90	153.43	36.05	36.32	43.50	43.68	24.61	24.47
Spermine (2 mM)	151.26	150.86	31.54	31.75	41.43	41.78	22.91	22.04
Spermine (4 mM)	152.53	151.90	33.14	33.00	42.08	42.86	24.16	23.43
Spermine (6 mM)	153.86	153.26	36.12	36.32	43.06	43.76	24.88	24.45
Jasmine Oil (0.04 %)	150.40	149.90	31.06	30.64	40.21	40.91	22.73	21.35
Jasmine Oil (0.06 %)	151.30	150.76	32.44	32.72	41.95	42.16	23.89	23.17
Jasmine Oil (0.08 %)	152.63	151.83	35.63	35.77	42.81	43.20	24.70	24.64
Thyme Oil (0.04 %)	150.03	150.00	30.92	30.78	40.03	40.40	22.73	22.21
Thyme Oil (0.06 %)	151.36	150.93	32.16	32.16	41.88	42.20	23.98	23.60
Thyme Oil (0.08 %)	152.70	152.50	35.02	35.49	42.83	43.26	24.61	24.64
Garlic Extract (1 %)	152.06	151.53	32.86	33.00	41.83	42.33	23.09	23.43
Garlic Extract (1.5 %)	153.00	152.96	35.35	35.35	42.75	43.08	24.34	24.47
Garlic Extract (2 %)	153.50	153.82	36.60	36.88	43.61	44.00	24.97	25.51
Clove Extract (1 %)	152.13	151.56	32.86	32.58	41.73	41.81	23.35	23.69
Clove Extract (1.5 %)	152.76	152.50	35.63	35.69	42.58	42.93	24.34	24.81
Clove Extract (2 %)	153.40	153.25	36.74	36.88	43.68	43.95	24.88	25.86
Algaefol Extract (1 %)	152.06	151.86	35.77	33.00	41.46	41.52	23.62	23.43
Algaefol Extract (1.5%)	153.00	152.82	35.91	35.63	42.71	42.88	24.25	24.47
Algaefol Extract (2 %)	153.70	153.26	36.74	36.74	43.71	43.98	24.79	25.51
Jisamar Extract (1 %)	151.93	151.06	32.86	32.72	41.31	41.13	23.80	24.47
Jisamar Extract (1.5 %)	153.20	152.86	35.91	36.05	42.60	42.71	24.37	24.99
Jisamar Extract (2 %)	154.00	153.85	36.88	37.02	43.73	44.03	24.70	25.51
LSD at $_{0.05}$	0.87	0.63	1.04	0.77	0.51	0.52	1.62	1.16

In addition, Jasmine oil may slow some vital processes, such as respiration while enhance juvenility and retarding the quick senescence of plant organs (Paulin, 1986). These results are in agreement with those obtained by Abd El-Motty *et al.* (2010) spraying Keitte mango trees with algae extract at (0.5, 1 and 2%) at full bloom stage. They reported that seaweed extract

treatments were very effective in reducing fruit drop comparing with the control. Zaghloul *et al*. (2011) spraying activated jasmine oil on Navel orange trees and they found that the highest rate of jasmine oil (0.06%) clearly decreased pre-harvest fruit drop. Moreover, Kassem *et al.* (2012) spraying Washington Navel orange trees with Putrescine and they found that all spray treatments decreased fruit drop.

Table (5): Effect of some natural pre-harvest foliar applications on pre-harvest fruit drop (%), fruit weight (gm) and yield as (No. of fruits per tree and kilograms per tree) of Washington Navel orange trees in 2013 and 2014 seasons

Treatments	Pre-harvest Fruit Drop (%)		Fruit Weight (g)		No. of Fruits per Tree		Yield (kg) per Tree	
	2013	2014	2013	2014	2013	2014	2013	2014
Control (Water Only)	11.76	11.72	199.33	201.00	295	296	58.79	59.47
Putrescine (2 mM)	8.54	8.78	219.33	219.66	328	329	71.92	72.18
Putrescine (4 mM)	7.17	6.89	221.33	222.00	331	329	73.32	73.97
Putrescine (6 mM)	6.34	6.42	226.33	226.66	334	335	75.75	76.02
Spermine (2 mM)	8.65	8.79	218.33	219.66	327	332	71.40	72.04
Spermine (4 mM)	7.95	8.11	221.33	223.00	332	332	73.40	74.02
Spermine (6 mM)	6.85	6.74	226.66	227.00	335	336	75.94	76.43
Jasmine Oil (0.04 %)	9.29	9.34	210.33	211.66	318	320	66.94	67.65
Jasmine Oil (0.06 %)	8.42	8.57	227.33	228.00	326	327	74.11	74.57
Jasmine Oil (0.08 %)	7.52	7.57	232.00	232.33	332	333	76.94	77.36
Thyme Oil (0.04 %)	9.16	8.95	209.66	210.00	320	322	67.18	67.49
Thyme Oil (0.06 %)	8.24	8.09	225.00	226.00	326	329	73.34	74.27
Thyme Oil (0.08 %)	7.22	7.37	230.33	231.66	334	335	76.92	77.52
Garlic Extract (1 %)	8.85	8.35	210.66	211.33	322	325	67.90	68.72
Garlic Extract (1.5 %)	7.24	7.12	215.33	216.66	324	325	69.83	70.48
Garlic Extract (2 %)	6.66	6.28	219.00	219.66	326	328	71.32	71.98
Clove Extract (1 %)	8.57	8.65	211.00	211.33	323	324	68.15	68.39
Clove Extract (1.5 %)	7.20	7.02	216.33	217.00	325	326	70.21	70.80
Clove Extract (2 %)	6.66	6.72	220.33	220.66	327	328	71.95	72.36
Algaefol Extract (1 %)	8.57	8.29	213.66	214.00	323	324	69.07	69.19
Algaefol Extract (1.5%)	7.20	7.28	218.33	219.33	326	326	71.10	71.57
Algaefol Extract (2 %)	7.02	7.64	218.66	218.66	326	329	71.29	71.86
Jisamar Extract (1 %)	8.87	8.93	213.66	214.00	325	326	69.51	69.76
Jisamar Extract (1.5 %)	7.73	7.99	219.00	219.33	326	326	71.31	71.49
Jisamar Extract (2 %)	6.78	6.95	220.66	221.66	329	330	72.66	73.13
LSD at $_{0.05}$	0.96	0.99	20.24	10.84	7.35	7.30	4.49	3.68

3. Yield:

Data in Table (5) illustrated fruit yield as number of fruits per tree and kilograms per tree, in 2013 and 2014 seasons. Results showed that all spraying treatments significantly increased yield as number of fruits per tree and kilograms per tree compared with control in both seasons of study. In addition, in two seasons of this study, the statistical analysis showed that the treatments

of Putrescine at 6 mM, Spermine at 6 mM, Jasmine Oil at 0.08 % and Thyme Oil at 0.08 % were more effective in increasing yield as number of fruits per tree and kilograms per tree compared with other treatments. The great benefits of these plant extracts, seaweed extracts, polyamines and essential oils on the yield were mainly attributed to their positive action on enhancing growth and nutritional status of the trees in favour of producing higher number of fruits. Also, the increasing yield by seaweed extract (SWE) spraying may be due to association with its hormonal substances present especially cytokinins (better mobilization photosynthesis). These results are in agreement with those obtained by Hegab *et al.* (2005) spraying Balady oranges with algae extract (0.125, 0.25 and 0.50%) and they reported that crop yield increased with increasing rates of algae extract. Moreover, Abd El-Motty *et al*. (2010), Mohamed *et al.* (2012), Mohamed and El-Sehrawy (2013) sprayed seaweed extract on different varieties of mango. They reported that seaweed extract treatments improved yield as number of fruits or weight (kg)/tree.

In addition, Saleem *et al.* (2008) worked on 'Blood Red' sweet orange to study the effect of aqueous solutions (0.01 mM) of putrescine, spermidine, spermine and the mixture of all three (0.001 mM each) were sprayed on to whole trees during full bloom. They found that polyamines (PAs) significantly increased yield/tree. Zaghloul *et al*. (2011) spraying activated jasmine oil on Navel orange trees and they found that the highest rate of jasmine oil (0.06%) significantly increased yield as number of fruits and weight kg/tree when compared with the other concentrations. So, it seems recommended to use activated jasmine oil on Washington Navel to increase yield.

4. Physical properties:

4. 1. Average fruit weight:

Data of the present investigation in Table (5) showed the effect of pre-harvest spraying treatments on average fruit weight of Washington Navel orange trees, in 2013 and 2014 seasons. In both seasons of study, results showed that all treatments significantly increased average fruit weight compared with control. In addition, in two seasons of this study, the statistical analysis showed that Putrescine at 6 mM, Spermine at 6 mM, Jasmine Oil at (0.06 and 0.08)% and Thyme Oil at (0.06 and 0.08)% were more effective in increasing average fruit weight compared with other treatments. In accordance with these results are those previously found by Ali *et al.* (2010) working on Canino apricots cultivar and they reported that spraying polyamines (Put) and (Spm) commonly increased fruit weight compared to control. In other studies, similar results were obtained by Abd El-Motty *et al.* (2010), Mohamed *et al.* (2012), Mohamed and El- Sehrawy (2013) spraying seaweed extract on different varieties of mango. They reported that seaweed extract treatments improved fruit weight (g) comparing with the control. In addition, these results agreed with those obtained by Zaghloul *et al*. (2011) spraying activated jasmine oil on Navel orange trees and they found that the highest rate of jasmine oil (0.06%) significantly increased the average of fruit weight.

5. Chemical properties:

5.1. Total soluble solids:

Data concerning the effect of various treatments on fruit total soluble solids content of Washington Navel orange, in 2013 and 2014 seasons are

showed in Table (6). Results showed that in both seasons, all treatments caused a significant increase in total soluble solids percentage compared with the control. Moreover, the statistical analysis showed that, in 2013 and 2014 seasons, Jasmine Oil at 0.08 %, Thyme Oil at 0.08 %, Clove Extract at 2 %, Algaefol Extract at 2 % and Jisamar Extract at (1.5 and 2)% were more effective on increasing fruit total soluble solids percentages than other treatments.

Table (6): Effect of some natural pre-harvest foliar applications on total soluble solids, acidity, TSS/Acid and vitamin C of Washington Navel Orange fruits in 2013 and 2014 seasons

Treatments	TSS (%)		AC (%)		TSS/Acid (%)		Vitamin C (mg/100 mljuice)	
	2013	2014	2013	2014	2013	2014	2013	2014
Control (Water Only)	10.00	10.16	1.33	1.33	10.60	10.70	52.70	52.31
Putrescine (2 mM)	11.16	11.33	0.97	1.03	12.36	12.68	57.42	57.42
Putrescine (4 mM)	11.33	11.56	0.93	0.92	12.73	13.14	58.60	58.84
Putrescine (6 mM)	11.83	12.26	0.88	0.86	13.44	14.15	60.57	60.80
Spermine (2 mM)	11.50	11.60	0.97	0.97	13.07	12.93	57.03	57.26
Spermine (4 mM)	11.50	11.90	0.93	0.87	12.77	13.72	59.00	58.76
Spermine (6 mM)	11.66	12.13	0.88	0.86	13.15	14.15	60.96	61.20
Jasmine Oil (0.04 %)	11.00	11.63	1.10	1.04	11.14	13.06	56.24	56.24
Jasmine Oil (0.06 %)	11.66	11.86	1.02	0.90	11.62	13.74	58.60	58.68
Jasmine Oil (0.08 %)	12.33	12.33	1.00	0.84	12.08	14.34	61.36	61.27
Thyme Oil (0.04 %)	11.33	11.43	1.11	1.03	11.40	12.94	55.84	55.85
Thyme Oil (0.06 %)	12.00	12.13	1.00	0.90	11.95	14.15	58.60	58.68
Thyme Oil (0.08 %)	12.16	12.40	0.99	0.84	11.88	14.70	60.96	61.12
Garlic Extract (1 %)	11.50	11.56	0.96	0.96	12.87	13.14	56.64	56.63
Garlic Extract (1.5 %)	11.66	11.80	0.91	0.89	13.25	13.83	57.82	58.37
Garlic Extract (2 %)	11.83	12.00	0.86	0.84	13.75	14.28	59.00	58.91
Clove Extract (1 %)	11.66	11.66	0.92	0.96	13.03	13.51	57.03	57.26
Clove Extract (1.5 %)	11.83	11.96	0.91	0.90	13.48	14.08	57.82	57.97
Clove Extract (2 %)	12.00	12.13	0.86	0.83	13.89	14.50	59.00	58.99
Algaefol Extract (1 %)	11.50	11.80	0.96	0.93	12.86	13.60	56.24	56.24
Algaefol Extract (1.5%)	11.66	12.06	0.95	0.89	13.25	14.36	58.21	58.60
Algaefol Extract (2 %)	12.00	12.30	0.89	0.83	14.16	14.75	59.78	60.02
Jisamar Extract (1 %)	11.66	11.76	0.96	0.96	13.10	13.89	57.03	57.19
Jisamar Extract (1.5 %)	12.00	12.16	0.92	0.89	13.63	14.48	58.60	58.76
Jisamar Extract (2 %)	12.16	12.33	0.85	0.82	14.19	14.91	60.18	60.17
LSD at $_{0.05}$	0.72	0.66	0.09	0.13	1.21	1.64	3.16	2.95

These results are in agreement with those obtained by Hegab *et al.* (2005) working on Balady oranges and they reported that total soluble solids content increased with increasing rates of algae extract. As well as, Abd El-Motty *et al.* (2010), Mohamed *et al.* (2012), Mohamed El- Sehrawy (2013) spraying seaweed extract on different varieties of mango and they found that spraying trees with algae extract increased total soluble solids. Moreover, Saleem *et al.* (2008), Kassem *et al.* (2012) spraying putrescine on different varieties of orange and they found that total soluble solids (TSS) significantly improved with polyamines compared with control. Where, these results are on the contrary

with those obtained by Zaghloul *et al*. (2011) spraying activated jasmine oil on Navel orange trees and they found that untreated (control) fruits recorded the highest values of S.S.C compared to jasmine oil treated fruits in both seasons. So, it seems recommended to use activated jasmine oil on Washington Navel to improve fruit quality and delayed ripening.

5.2. Vitamin C (Ascorbic Acid):

With respect to the effect of various applied treatments on ascorbic acid content in juice of Washington Navel orange fruits, in both experimental seasons, the data demonstrated in Table (6) declared that as an average of all used treatments, the initial of Ascorbic acid significantly increased in both seasons compared with control. Moreover, the statistical analysis showed that putrescine at 6 mM, Spermine at 2 %, Jasmine Oil at 0.08 %, Thyme Oil at 0.08 % and Jisamar Extract at 2 % were more effective on increasing ascorbic acid (mg/100 juice) than that of other treatments. In accordance with these results, are those previously found by Hegab *et al.* (2005) working on Balady oranges and they reported that vitamin C content increased with increasing rates of algae extract. Moreover, Zaghloul *et al*. (2011) spraying activated jasmine at two rates (0.03 and 0.06)% on Navel orange trees and they reported that treated fruits had the highest V.C content than control at harvest time. In addition, Fatemi *et al.* (2011) working on *Citrus Sinensis* cv. Valencia and showed that the highest level of vitamin C (54.93 mg) was observed in thyme treatment (1000 ppm). Kassem *et al.* (2012) spraying putrescine on Washington Navel orange trees and found that all sprayed treatments increased vitamin C content.

5.3. Acidity:

Data concerning the effect of various treatments on fruit acidity content of Washington Navel orange in 2013 and 2014 seasons, are showed in Table (6). In both seasons results revealed that, generally, all treatments significantly decreased fruit juice acidity compared with control. In addition, the statistical analysis showed that putrescine at 6 mM, Spermine at 6 %, Garlic Extract at 2 %, Clove Extract at 2%, Algaefol Extract at 2 % and Jisamar Extract at 2 % were more effective on decreasing acidity percentages than other treatments. These results are in harmony with those obtained by Hegab *et al.* (2005) working on Balady oranges and they reported that fruit total acidity decreased with increasing rates of algae extract. Ali *et al.* (2010) working on Canino apricots cultivar and they reported that fruit acidity was lower than control at all polyamines treatments. As well as, Mohamed *et al.* (2012), Mohamed and El-Sehrawy (2013) spraying seaweed extract on different varieties of mango. They reported that treating the trees with seaweed extract (SWE) at 0.1 to 0.4 % twice, thrice or four times significantly improved chemical characteristics of the mango fruits in terms of decreasing total acidity percentages in relative to the check treatment. Where, these results are on the contrary with those obtained by Fatemi *et al.* (2011) working on *Citrus Sinensis* cv. Valencia and showed that total acidity content had shown significant difference in inoculated and non inoculated fruits affected by treatments. The highest total acid value was observed in non-inoculated fruits of thyme treatment with 100 ppm concentration (1.49 mg). Also, Zaghloul *et al*. (2011) spraying activated jasmine

at two rates (0.03 % and 0.06 %) on Navel orange trees and they reported that acidity values were not affected.

5.4. TSS/Acid ratio:

Data of studying the effect of some natural pre-harvest foliar applications on TSS/Acid ratio of Washington Navel orange at harvest are listed in Table (6). In the two seasons of study 2013 and 2014, results showed that all treatments caused a significantly increase in TSS/Acid ratio comparing with control, except for Jasmine Oil at 0.04% and Thyme Oil at 0.04% in 2013 season where the differences were not big enough to be significant. Moreover, in the two seasons of study, the statistically analysis showed that Putrescine at 6 mM, Spermine at 6 mM, Garlic Extract at (1.5 and 2)%, Clove Extract at (1.5 and 2)%, Algaefol Extract at (1.5 and 2)% and Jisamar Extract at (1.5 and 2)% were more effective on increasing TSS/Acid ratio than other treatments. This results are in agreement with those obtained by Ali *et al.* (2010) working on Canino apricots cultivar and they reported that SSC/Acidity ratio was higher in all Putrescine and Spermine treatments compared to control.

5.5. Reducing sugars:

Data concerning the effect of various treatments on fruit reducing sugars percentage of Washington Navel orange in 2013 and 2014 seasons are shown in Table (7). In both seasons, results revealed that, generally, all treatments significantly increased fruit reducing sugars percentage compared with control. Moreover, in the two seasons of study, the statistically analysis showed that Putrescine at 6 mM, Spermine at 6 mM, Jasmine Oil at 0.08 %, Thyme Oil at (0.06 and 0.08) %, Garlic Extract at (1.5 and 2)%, Clove Extract at (1.5 and 2)%, Algaefol Extract at (1.5 and 2)%, Jisamar Extract at (1.5 and 2)% are more effective in increasing fruit reducing sugars percentage compared with other treatments. The increase in reducing sugars may be attributed to accumulation of sugars as a result of the metabolism of polysaccharaides. These results are in harmony with those obtained by Hegab *et al.* (2005) working on Balady oranges and they reported that reducing sugars content increased with increasing rates of algae extract. Moreover, Saleem *et al.* (2008) working on 'Blood Red' sweet orange and they found that reducing sugars significantly improved with polyamines compared with control. Also, Kassem *et al.* (2012) spraying putrescine on Washington Navel orange trees and found that all sprayed treatments increased reducing sugars content. In addition, Mohamed *et al.* (2012), Mohamed and El-Sehrawy (2013) spraying different varieties of mango. They reported that treating the trees with seaweed extract (SWE) at 0.1 to 0.4 % twice, thrice or four times significantly improved chemical characteristics of the mango fruits in terms of increasing reducing sugars percentage.

5. 6. Non-reducing sugars:

Data of studying the effect of some natural pre-harvest foliar applications on fruit non-reducing sugars percentage of Washington Navel orange at harvest are listed in Table (7). Results, generally, showed that the non-reducing sugars did not show a constant or regular trend in both seasons. Even that, it showed a significant increase compared with control for all treatments, except for Putrescine at 2 mM, Jasmine Oil at (0.04 and 0.06)%, Thyme Oil at (0.04, 0.06

and 0.08)%, Garlic Extract at 2%, Clove Extract at (1.5 and 2)% and Algaefol Extract at 2% where the differences were not big enough to be significant in the first year of study.

Table (7): Effect of some natural pre-harvest foliar applications on reducing sugars, non-reducing sugars and total sugars percentage of Washington Navel orange fruits in 2013 and 2014 seasons

Treatments	Reducing Sugars (%)		Non-Reducing Sugars (%)		Total Sugars (%)	
	2013	2014	2013	2014	2013	2014
Control (Water Only)	3.62	3.58	3.40	3.54	7.02	7.13
Putrescine (2 mM)	3.79	3.82	3.52	3.47	7.31	7.29
Putrescine (4 mM)	3.87	3.88	3.57	3.57	7.44	7.45
Putrescine (6 mM)	3.91	3.94	3.66	3.65	7.58	7.60
Spermine (2 mM)	3.77	3.81	3.56	3.54	7.33	7.35
Spermine (4 mM)	3.86	3.90	3.62	3.59	7.48	7.50
Spermine (6 mM)	3.91	3.96	3.69	4. 67	7.60	7.64
Jasmine Oil (0.04 %)	3.79	3.79	3.54	3.56	7.33	7.35
Jasmine Oil (0.06 %)	3.90	3.88	3.47	3.53	7.37	7.42
Jasmine Oil (0.08 %)	3.93	3.91	3.65	3.66	7.58	7.58
Thyme Oil (0.04 %)	3.83	3.80	3.53	3.57	7.35	7.38
Thyme Oil (0.06 %)	3.93	3.91	3.53	3.56	7.46	7.48
Thyme Oil (0.08 %)	3.99	4.01	3.55	3.57	7.54	7.58
Garlic Extract (1 %)	3.84	3.82	3.58	3.61	7.42	7.44
Garlic Extract (1.5 %)	3.94	3.96	3.60	3.61	7.54	7.58
Garlic Extract (2 %)	4.05	4.02	3.45	3.63	7.50	7.66
Clove Extract (1 %)	3.84	3.81	3.60	3.65	7.44	7.46
Clove Extract (1.5 %)	3.96	3.94	3.52	3.65	7.48	7.60
Clove Extract (2 %)	4.07	4.03	3.55	3.60	7.62	7.64
Algaefol Extract (1 %)	3.84	3.84	3.62	3.61	7.46	7.46
Algaefol Extract (1.5%)	3.94	3.96	3.60	3.63	7.54	7.60
Algaefol Extract (2 %)	4.06	4.03	3.52	3.62	7.58	7.66
Jisamar Extract (1 %)	3.84	3.82	3.64	3.67	7.48	7.50
Jisamar Extract (1.5 %)	3.96	3.91	3.62	3.70	7.58	7.62
Jisamar Extract (2 %)	4.06	4.00	3.64	3.67	7.70	7.68
LSD at $_{0.05}$	0.15	0.17	0.16	0.13	0.09	0.10

In 2014 season, results showed a non-significant increase compared with control for all treatments, except for Jisamar Extract at (1, 1.5 and 2)% where the differences were big enough to be significant while, it showed a non-significant decrease for Putrescine at 2 mM and Jasmine Oil at 0.06 % in the same season. These results are in agreement with those obtained by Marzouk and Kassem (2010) worked on Washington Navel orange trees and they repotted that, preharvest foliar sprays with putrescine increased non-reducing sugars content compared with the control.

5. 7. Total sugars:

Results of the present investigation, presented in Table (7) showed the effect of some natural pre-harvest foliar applications on total sugars content of Washington Navel orange fruit at harvest in 2013 and 2014 seasons. Data showed that, in both seasons, all treatments caused a significant increase in total sugars content compared with control. Moreover, in the two seasons of study, the statistically analysis showed that Putrescine at 6 mM, Spermine at 6 mM, Jasmine Oil at 0.08 %. Thyme Oil at 0.08 %, Garlic Extract at (1.5 and 2)%, Clove Extract at (1.5 and 2)%, Algaefol Extract at (1.5 and 2)% and Jisamar Extract at (1.5 and 2)% were more effective on increasing total sugars than other treatments. These results are in agreement with those obtained by Hegab *et al.* (2005) working on Balady oranges and they reported that total sugars content increased with increasing rates of algae extract. Moreover, Saleem *et al.* (2008) working on 'Blood Red' sweet orange and they found that total sugars significantly improved with polyamines compared with control. Also, Kassem *et al.* (2012) spraying putrescine on Washington Navel orange trees and found that all sprayed treatments increased total sugars content. In addition, Mohamed *et al.* (2012), Mohamed and El-Sehrawy (2013) spraying seaweed extract on different varieties of mango. They reported that treating the trees with seaweed extract (SWE) at 0.1 to 0.4 % twice, thrice or four times significantly improved chemical characteristics of the mango fruits in terms of increasing total sugars percentage.

CONCLUSION

Foliar applications with Putrescine, Spermine, Jasmine Oil, Thyme Oil, Garlic Extract, Clove Extract, Algaefol Extract and Jisamar Extract on Washington Navel orange trees four times after full bloom, increased the yield, improved leaf mineral contents and fruit quality. In addition, Results declared that the higher concentrations of treatments were more effective than the low concentration on yield and fruit quality of Washington Navel orange fruits.

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الملخص العربي

تحسين ثمار البرتقال أبوسرة برش بعض المواد الطبيعية قبل الحصاد

أ- المحتوى المعدني والمحصول وجودة الثمار

ثناء مصطفى عز*، محمود أحمد على*، إقبال زكريا على أحمد، ريحاب عبدالهادى عوض*، محمود جمعه عبدالجواد****

*** قسم الإنتاج النباتي- كلية الزراعة (سابا باشا)- جامعة الأسكندرية**

**** محطة بحوث البساتين – الصبحية – الأسكندرية- مركز البحوث الزراعية**

أجريت هذه الدراسة خلال موسمين متتالين (٢٠١٣ /٢٠١٤) بهدف دراسة تأثير الرش ببعض المواد الطبيعية قبل الحصاد على المحتوى المعدني والمحصول وجودة ثمار البرتقال أبوسرة وذلك عن طريق الرش قبل الحصاد بكل من معاملة الكنترول (المقارنة)، البتروسين بتركيز (٢، ٤، ٦) ملليمول، الأسبيرمين بتركيز (٢، ٤، ٦) ملليمول، زيت الياسمين بتركيزات (٠,٠٤، ٠,٠٦، ٠,٠٨) ٪، زيت الزعتر بتركيزات (٠,٠٤، ٠,٠٦، ٠,٠٨) ٪، مستخلص الثوم بتركيزات (١، ١,٥، ٢) ٪، مستخلص القرنفل بتركيزات (١، ١,٥، ٢) ٪، مستخلص الجيفول بتركيزات (١، ١,٥، ٢) ٪، مستخلص الجيسامار بتركيزات (١، ١,٥، ٢) ٪ وقد تم رش أشجار كل معاملة ٤ رشات فكانت الرشة الأولى عند اكتمال مرحلة عقد الثمار لأشجار البرتقال أبو سرة، الرشة الثانية بعد شهر من الرشة الأولى ثم الرشة الثالثة بعد شهر من الرشة الثانية ثم الرشة الرابعة قبل موعد الحصاد بحوالي ٤٥ يوم.

ويمكن تلخيص النتائج كما يلي:

أوضحت النتائج أن جميع المعاملات قد أدت إلى زيادة محتوى الأوراق من النيتروجين، الفسفور، البوتاسيوم، الكالسيوم، الماغنسيوم، الحديد، النحاس، الزنك والمنجنيز عن معاملة المقارنة، كما كان التركيزان الأعلى (١,٥، ٢) ٪ من المعاملات مستخلص الثوم، مستخلص القرنفل، مستخلص الجيفول ومستخلص الجيسامار الأفضل في زيادة محتوى الأوراق من العناصر الكبرى والصغرى من باقي المعاملات.

أدت جميع المعاملات إلى تقليل النسبة المئوية لتساقط الثمار مقارنة بمعاملة الكنترول، كما أن التركيز الأعلى للبتروسين ٦ ملليمول، الأسبيرمين ٦ ملليمول، مستخلص الثوم ٢٪ ومستخلص القرنفل ٢٪ كان الأفضل في تقليل تساقط الثمار من باقي المعاملات.

أيضا أتضح أن جميع المعاملات قد أدت إلى زيادة المحصول ومتوسط وزن الثمار مقارنة بمعاملة الكنترول، كما أن التركيز الأعلى للبتروسين ٦ ملليمول، الأسبيرمين ٦ ملليمول، زيت الياسمين ٠,٠٨٪ وزيت الزعتر ٠,٠٨٪ كان أكثر تأثيرا في زيادة المحصول ومتوسط وزن الثمار مقارنة بباقي المعاملات.

أدت جميع المعاملات إلى زيادة المواد الصلبة الذائبة الكلية، فيتامين (ج)، المواد الصلبة الذائبة الكلية إلى الحموضة، السكريات المختزلة، السكريات الغير مختزلة، السكريات الكلية وتقليل حموضة الثمار عن معاملة الكنترول، هذا بالإضافة إلى أن التركيزات الأعلى من كل المعاملات المستخدمة كانت لها تأثير أفضل في تحسين جودة ثمار البرتقال أبو سرة عند مقارنتها بالتركيزات الأقل.

Alternative Control Measure for Reducing Citrinin and Alternariol in Broad Beans

N.H. Youssef [2] and A.S.A.Saad[1]

[1]Faculty of Agriculture Saba Basha, Department of Plant Protection and Pesticides. Alexandria University.
[1]Regional Central for Food and Feed. Alexandria, Agriculture Research Center, Egypt.

ABSTRACT : An environmental problem was recorded in broad bean crop cultivated in Noubareya region during season 2013. Harvested broad bean seeds were obtained by satisfactory evidence of weak economic value.

An attempt of seed treatment process was carried out in this study to inhibit fungal growth and mycotoxins produced by *Alternaria alternata* and *Penicillium citrinum* in field during cultivation process using sorbic and benzoic acids at 10 and 15 ppm,; ethyl sorbate and/or ethyl benzoate at 5 and10 ppm for each treatment as alternative to the fungicides metalaxyl DS and ridomil MZ72WP at recommended rate (x) and 1 ½ recommended rate applied for seed protection during cultivation process.

The germination test showed the failure of all the tested preservative treatments to germinate seeds. Therefore; all treatments were used as foliar seedlings spray applied 3 times every 15 days during the experiment (60 days) . The results of fungicidal activity indicated that the use of preservative up to 10 ppm totally inhibited fungal growth except ethyl benzoate and ethyl sorbate which completely inhibited fungi at 5ppm Moreover, 5 and 10 ppm concs realized the same inhibition rate exerted by metalaxyl and ridomil MZ at 1.5 x. Untreated plants showed higher death ratios, compared with treated ones. Ridomil MZ at conc. 1.5 x reduced dead plants 60% followed by benzoic acid 56% at conc.5 ppm. Furthermore, the ester form of both benzoic and sorbic acids were more effective in reducing AOH and CTN than the other tested fungicides. metalaxyl and ridomil MZ at 1.5 x. Ridomil MZ at conc. 1.5 x reduced dead plants 60% followed by benzoic acid 56% at conc.5ppm. Furthermore, the ester form of both benzoic and sorbic acids acids were more effective in reducing altrnariol (AOH) and citrinin (CTN) than the other tested fungicides. Accordingly they can act successfully as fungicides alternatives.

Benzoic acid has been actively playing a great role as antifungal and detoxifier agent. Meanwhile, it affected plant growth which badly in need for more studies to avoid these side effects.

Key Words: Alternariol and citrinin detoxification, broad beans, Alternatives to ridomil MZ and metalaxyl, benzoic and sorbic acids.

INTRODUCTION:

Faba bean (*Vicia fabae* L.) is one of the most important food legumes due to its high nutritive value in terms of energy and protein contents (24-30 %),58% carbohydrate and it is an excellent nitrogen fixer (El wakile *et al*., 2009). Egypt is the second largest producer of faba bean in the world, next to china (Torres *et al*., 2006a). The annual faba bean production in Egypt is ranging from 0.56 to 0.58 million metric ton during 2003-2005. However, this production is not enough to meet domestic demand (FLRP, 2004, ICARDA, 2005, Maalouf *et al*.,2009 and yehia *et al* .,2011). The first report concerning a new disease of faba bean crops which has been invaded by *Alternaria tennuisina* in Japan (Mohamed *et al*.,2002 and Barkai-Golan and Nachman,2008).

Alternaria alternata (Fr.) Keissler is a ubiquitous fungi and cause numerous plant diseases and many damages to crops in the field (Mašková *et al*.,2012). This facultative pathogen induces (spots and lesions) mainly on

leaves and fruit and less severely on stolons and finaly leads to complete death of the plant. (El Morsi *et al*., 2006 and Vûckovíc *et al*.,2012). This disease was found in several countries and several plant crops (Bodroža-Solarov *et al*.,2012 and Vûckovíc *et al*.,2013). In addition to economic losses in production and processing (Kosiak *et al*., 2004),the disease lead to significant reduction in grain quality (Bodroža-Solarov *et al*., 2012) , this fungus produce AAL toxins (which means *Alternaria alternata* toxins) with different toxicological properties. The presence of these compounds in the food chain is an increasing concern for human and animal health due to their possible harmful effects. (Fern´andez-Cruz *et al*., 2010 and Burkin and Kononenko 2011).

There is a wide range of alternaria toxins but only few of them are associated with health risk acute toxicity (EFSA, 2011). AOH (alternariol) and AME(alternariol monomethyl ether) are of the major concern since they were found to have mutagenic, genotoxic and carcinogenic effects on mammalian cells (Battilani *et al*., 2009 and Bhaat *et al*.,2010).

Alternariol was detected in many agricultural commodities and other foodstuffs (Asam *etal*.,2010 and 2011, Malachova *etal*.,2011,Suchowilska *et al*.,2010, Vučković *et al*.,2012, Eckhout *et al*.,2013).

Both of *Alternaria alternata* and *penicillium citrinum* are not usually broad bean seeds invaders pathogens (Dixit and Singh).According to the available literature, this may be the first registration of this phenomena in Egypt suggesting the possibility to be a new patho-types.

Citrinin is acutely nephrotoxic at relatively high dose in mice and rats, rabbits ,pigs and poultry causing swelling and eventual necrosis of the kidneys and affecting the liver function at a lesser extents (Abou-Zeid ,2012 and Friedman and Rasooly , 2013). There is no specific fungicides for controlling this crop disease case .However,many attempts *in vitro* are reported for inhibiting *Alternaria alternata* and *Penicillium citrinum* using metalaxyl and ridomil MZ (Javaid *et al*.,2006).

Metalaxyl: is used to control certain diseases caused by air-and soil-borne fungi. Foliar sprays with mixture of metalaxyl and protectant fungicides are recommended to control certain air-borne diseases.
Ridomil MZ 72 WP contains metalaxyl 8% and mancozeb 64%. Recently Shu-Yuan Cheng *et al*., 2014 demonstrated that mancozeb (MZ) induced cytotoxicity in rat pheochromocytoma (PC12) cells partially via nuclear factor kappa B (NF-κB) activation. This study demonstrated that MZ induced DNA damage as seen in comet assay.

Zeidan, (2006) reported that benzoic acid was applied on grapevine in Germanic green houses as MENNO-Florades (9% benzoic acid) to antagonize *Plasmopara viticola*. This application realized highly antagonistic frequency (91.40%), (two days before fungal infection).

Therefore, the aim of this study is to reduce the applied dose of fungicides by using preservatives and investigate their side effects on mycotoxins detoxification under field conditions.

MATERIALS AND METHODS

Fungicides:

Metalaxyl: (IUPAC) name: methyl N-(methoxyacetyl)-N-(2,6-xylyl)-D-alaninate.
Ridomil MZ: methyl N-(methoxyacetyl)-N-(2,6-xylyl)-D-alaninate+ Mancozeb: manganese ethylene bis (dithiocarbamate) (polymeric) complex with zinc salt.

Organic acid used as a food preservatives:

Benzoic: $C_7H_6O_2$ (or C_6H_5COOH).
Sorbic acid, or 2,4-. hexadienoic acid: $C_6H_8O_2$

Structures of mentioned Mycotoxins:

Alternariol is 3,7,9-Ttrihydroxy-1 methyl-6H-dibenzo[b,d] pyran-6-one.Its molecular formula $C_{14}H_{10}O_5$.
Citrinin [C_{13} H_{14} O_{51}] IUPAC: (3R, 4s)-4,6- dihydro-8nhydroxy-3,4,5-trimethyl-6-oxo-3H2- benzopyran-7-carboxylic acid.

The seed borne fungi associated with infected broad bean seeds collected from Noubaria region are previously isolated, purified and identified from surface sterilized seeds using seed health testing method and Frequency of the obtained fungi (*Alternaria alternata ,Penicillium citrinum and Aspergillus flavus*) was determined. Moreover, mycotoxin production ability was estimated and the occurred mycotoxins (alternariol and citrinin) were detected and registered as mentioned in previous study (Youssef *et al*., 2014).

Preparation of chemicals and organic acids serving in Agricultural Experiment:

Benzoic and sorbic acids used as chemical or synthetic preservatives (Class II) are brought from Sigma, Aldrich, Bureau of Cairo Egypt. The food standards regulations required that not more than one Class II preservative should be used in one particular food item (Anand and Sati, 2013). Metalaxyl and ridomil MZ are brought from Syngenta Agro Egypt manufacturing.

Agricultural experiment

Preliminary tests for agricultural experiment:

It was necessary to test the performance of the used tested treatments on seed germination process, and fungal growth. The percent germination process was considered as the determining factor of how tested treatments will be applied during agricultural experiment either seed treatment before seeds Sown process or spraying seedling with the tested treatment every two weeks during the experiment (first test). Furthermore, it was necessary to determine the effect of these treatments on the growth of the occurred fungi associated with infected seeds (second test).

First test: Effects of the tested treatments on seed germination process .

Untreated non infected seeds (Giza blanka) were brought from Research Seeds and Oily seeds Institute, Agricultural Researches Centre, Giza, Egypt. Germination viability test was carried out according to ISTA (1996), Singh and Garampalli, (2012) and Soughir *et al*., 2012 with certain modification. 100 g of seeds were taken from each healthy and/or infected seeds and divided into 5 replicates - 20g each. Two fungicides metalaxyl and ridomil MZ treatments are used at concentrations 0.5 x, x and 1.5 x (where x =500mg /250ml water). Benzoic and sorbic acids and their esters are used at concentrations 5, 10, 15 and 25 ppm. The effect of ethyl alcohol on germination process at concentration 0.25% was tested also. Seeds (20g) in each treatment were placed in sterilized cup 125 ml in volume, the tested concentration was added to sterilized distilled water 100 ml to each cup for each treatment. The negative control for both healthy and infected healthy seed replicates comprise distilled sterilized eater treatment. Each cup solution was decanted 5 hours later, and then weighed. Seeds from each treatment were placed in 120-mm-diameter Petri dishes between two layers of Watman filter paper and then moistened with 10 ml of distilled water for negative control, whereas, the other treatments were moistened with the same solution of the tested treatment . Seeds were kept at room temperature (25℃) under normal light. The number of germinated seeds was counted daily for 7 days after which no further seed germination was occurred. The appearance of 2 mm or more of radical was considered as germination. Parameters measured in this experiment were registered:
Total germination (TG) measured in the seventh day using the formula GT (%) = (total number of germinated seeds (B)/ total seed (A) x 100.(Scott *et al*.,1984 and Moradi *et al*., 2008). The obtained data were registered in Table (1).

Second test 2 :(Confirmation): Testing the treatments effect on growth of fungi occurred in seeds:

The aim of this test was to determine the suitable concentrations for each treatment which will be applied during agriculture experiment. 15 seeds per replicate were taken then soaked in different concentrations of the tested fungicides and preservatives for 10 minutes. Healthy seeds for control were initially surface sterilized using sodium hypochlorite solution 5.0 % for 3 min. and then they were rinsed 3 times with distilled water for 2 min. (Soughir *et al*., 2012). For non infected and naturally infected control, the seeds were soaked in distilled water. Seeds of all the treatments were placed on filter papers in 9 cm diameter petri plates, moistened with 3 ml of distilled water and/or tested treatment concentration each. Plates were incubated in a growth room at 25±2℃ for 8days under alternative light and dark 12 hours each. Each treatment was replicated thrice (Christensen, 1957; Javaid *et al*., 2006 and Sitara and Hasan, 2011 with certain modification).

After 8 days of incubation, fungal species grown on the surface of treated seeds were purified and identified and their percentage frequency (PF) was determined according to Samson *et al.* (1996) and Javaid *et al*. (2006). The number of colonies growing on each plate was counted for each identified

fungus and its frequency percentage was calculated according to the following formula (Pitt and Hocking, 1997):

PF = (No. of seeds on which fungus appeared / Total No. of seeds) × 100

The resulted data were registered as shown in Table (2). The ability of the main occurred fungi was previously tested and detected as mentioned in precedent study (Youssef *et al*., 2014).The resulted data were registered as shown in Table (2). The selected treatment concentrations for agricultural experiment were summarized in Table (3).

Agricultural experiment:

The clay soil was used in this study ,the electrical conductivity(EC), in decisiveness per meter was measured by Baxter, Digital conductivity meter in saturated soil paste extract as described in hand book 60 (U.S Salinity Laboratory Staff, 1954). Acidity (pH value) was also determined in the tested soil paste using pH meter.

Plastic pots containing 1.5 kg sterilized autoclaved clayey soil for 30 min. and kept covered until sowing seeds. Both of healthy and infected seeds were surface sterilized using sodium hypochlorite 5% for 2 min. Seeds were then rinsed three time in 100 ml sterilized water each to completely get rid of sodium hypochlorite. Weighed seeds for 1hour (10 seeds per pots) were carefully sown. Each treatment was replicated thrice. Pots were placed in complete sunny and fresh air weather to accomplish the field conditions. Seedlings of two weeks age are sprayed with tested treatments. The spraying process was applied and repeated fortnightly**.** At the end of the experiment, the number of dead plants was counted, measured as illustrated in Table (4), plants, 60 days age, were collected, washed then air dried. Plant fresh weight, root and shoot lengths and shoot black lesions lengths (for both dead and alive plants) were measured. Data were registered as illustrated in Table (5).

Estimation of the inhibitory effect of treatments on plant contents of alternariol (AOH) and citrinin (CTN):

The main target of this experiment was to achieve the best treatment which reduce or prevent the production of the two tested mycotoxins during agriculture experiment (*in vivo*) under field conditions. Moreover, this experiment was aimed too to study the following:-The transition of alternariol (AOH) and citrinin (CTN) during the agricultural process from sown seeds to plant; and the effectiveness of the applied spraying method in reducing the two tested mycotoxins.

Plants in each treatment were gently cut into small pieces, and then puted in sterilized cups 10 g each. Treatments were triplicated. Plant samples were prepared to be detected firstly by using TLC (Thin layer chromatography) plate

(Jouany, 2007 and Kütt *et al*., 2010).Two development systems were used for each toxin: Anis: 0.5% p-anisaldehyde in methanol/acetic acid/conc; and sulphuric acid (17:2:1v/v/v) for alternariol and benzene: glacial acetic acid: acetone (5:4:1) v/v/v (Frisvad *et al*. 2007 and Eckhout *et al*., 2013). Under UV light at 254 nm AOH was detected whereas, CTN was detected at 366 nm. After that the detection of alterniol (alternariol) and citrinin was confirmed by using quantitatively HPLC-UV technique according to Azcarat *et al.,* (2008), Asam *et al*. ,(2011) and Brzonkalik *et al*., (2011) at Central Lab, Faculty of Pharmacy, Alexandria University. The obtained citrinin and alternariol standards were brought from Sigma, Aldrich ,Cairo, Egypt. Results were registered in Table (4)**.**

Statistical analysis:

The experiment was laid out in completely randomized design with three replications. The data were subjected to statistical analysis using Costat computer package (CoHort Software, Berkeley, CA, USA). Least significant difference (LSD) using Duncan's Multiple Range test was applied to compare the treatment mean values according to McDonald, (2009).

RESULTS AND DISCUSSION

2. a. Determination of the Electric conductivity and pH in soil used in the experiment.

The applied soil was sterilized before planting and soil electrical conductivity (EC) and pH degree were determined. EC of the soil paste was 3.4 dS/m, whereas soil pH was 7.5.

2. b. Tested treatments effects on seed germination process .

The germination viability of seeds under treatments concentration was tested. Resulted data as illustrated in Table (1) indicated the following: The number of seeds in the same weight varied according to fungal infection. Furthermore, the degree of infection varied between seeds in the same yield. Germination process was affected by fungal infection, the average of germinated seeds attained the highest value at metalaxyl at recommended dose (x) and ridomil MZ at (1/2x).

Retardation in germination was observed during treatment with ethyl alcohol 25%, but it was completely inhibited and delayed in treatments, treated with the tested preservatives and their esters. Fungal infection reduced seed germination rate. These findings were totally in harmony with those reported by Embaby *et al*. (2013) and Perelló and larrán (2013). These results limited the mode of treatments application as seedling spraying method. Both of benzoic and sorbic acids and their esters failed to be applied as seed treatment. Our results are completely in agreement with those of Maouni *et al*. (2002), Sitara and Akhter (2007), Saleem *et al*. (2012) and Sarmamy and Khidir, (2013), who reported that ridomil MZ , ridomil MZ gold and metalaxyl increased seed germination percentages. Moreover, results obtained by benzoic acid and other alternatives were totally in agreement with Sunaina and Singh ,(2014) and indirectly coincided with those of Yadav and Singh (2013), who reported that

benzoic acid (BA) decreases the germination ratio of *Triticum aestivum* L. sown in pots containing concentrations (0.5,1and 1.5 mM) of BA in dose dependent manner. Maximum 37.5% reduction in germination was recorded at highest concentration of BA. In our study benzoic, sorbic acids and their esters completely failed in germination process. Differences may be attributed to differences in seeds cultivars, and s the applied method. In our experiment, faba bean seeds were completely emerged in aqueous solution in treatment left for 5 h. before decanting water then placed between two filter papers imbibed with the tested treatment concentration. Thus, the treatment was entirely available for seeds, whereas in Yadav and Singh experiment (2013), seeds were sown in soil containing high concentration of benzoic acid each but undoubtly, the bioavailability of treatment in aqueous media is different than soil because soils can absorb this acid, consequently reduce the treatment bioavailability to seeds. Our findings were also in compatible with those reported by Deepavali and Nilima ,(2012), who reported that aflatoxin decreases germination rate.

Second test*:* Inhibitory Effect of the treatments on fungal growth of seed flora:

The effects of the tested treatments on growth of fungal seed flora were confirmed. Treatments have inhibitory effects against *Alternaria alternata, Penicillium citrinum ,Aspergillus flavus, Penicillium sp* and *Aspergillus niger.* Results were registered as elucidated in Table (2).

Metalaxyl had moderate inhibition against *A. alternata*, but increased the *Penicillium citrinum* growth. Our findings were highly in accordance with those of Cohen, (1981), who found that metalaxyl enhanced the penicillium growth in citrus fruits. Our results were also harmoniously compatible with those of Matheron and Porchas (2000) and Saleem *et al*. (2012), who reported that metalaxyl 15% + copper oxychloride and ridomil MZ (metalalaxyl+mancozeb) exhibited a satisfied inhibitive effect against *A.alternata* and *P.expansum*. According to results obtained in the present investigation and those reported by others, chemicals added to metalaxyl such as copper oxychloride or mancozeb ameliorate augmented the inhibitory effect of these mixture against *Penicillium* than metalaxyl alone.

Agricultural experiment:

2.1. Determination of death rate:

The aim of this test is to determine the effect of fungal infection on plant death and investigate the effects of the tested treatments on reducing death rate. Data in Table (4) illustrated that ridomil MZ at conc. 1.5 x realized the best results in maintained plant life under fungal infection conditions, followed by benzoic acid at 10 ppm. Sorbic acid at conc.10 ppm and its ester form revealed approximately the same action. These findings were partially in harmony with Hawthorne *et al*. (2014), who reported that mancozeb (750-800g/kg) significantly suppressed *Alternaria spp* growth, compared with the other tested fungicides. Similarly, the findings of the same authers may also explain our second finding concerning the worth treatment in maintained plant life enhanced

by metalaxyl and ridomil MZ at their recommended dose. This notice may also indicated that these recommended doses were applied only for healthy seed and plant protections but not for actually occurred infection treatment. Death rate in untreated infected plant was extremely high. Our findings are harmoniously agreed with those of Perelló and larrán (2013), who reported that *Alternaria* not only reduces germination and vigor of wheat seed but it also causes seedling blight disease in Argentina (Rajput *et al*., 2005 and Perelló, 2010 a and b) its transmission from seed to seedling of wheat seeds has been done in Argentina. Moreover, every year this seed-borne fungi cause heavy yield loss of the crop.

Table (1): Comparing between the influence of certain fungicides, organic acids and esters on germination process of broad bean seeds

Treatment		T.S.N/W For 5replicate (A)	Tested conc.	Average of Germinated seed number (B)	Day at G start	Total germination T.G. (B/A)x100
Control	Healthy control	98i	0.0	56f	3cd	57.143
	Infected control	138b	0.0	68d	4bc	49.275
	Healthy +alcohol	97i	0.25*	55f	6a	56.701
Inf. seeds	+Metalaxyl	135c	X	120a	3cd	88.89
Infected seeds +Fungicides	+Metalaxyl	130g	½ X	110c	4bc	81.48
	+ Metalaxyl	125h	1½ X	65e	5ab	52.00
	+Ridomil MZ	130g	X	115b	2d	88.46
	+Ridomil MZ	145ef	½ X	120a	3cd	82.76
	+Ridomil MZ	130g	1½ X	115b	2e	88.46
Infected seeds +organic acids +Sorbic acid	+Benzoic acid	132cd	5ppm	0.0g	0ef	0.0
	+Benzoic acid	134de	10ppm	0.0g	0ef	0.0
	+Benzoic acid	130g	15ppm	0.0g	0ef	0.0
	+Benzoic acid	135c	25ppm	0.0g	0ef	0.0
	+Sorbic acid	135c	5ppm	0.0g	0ef	0.0
	+Sorbic acid	130g	10ppm	0.0g	0ef	0.0
	+Sorbic acid	132cd	15ppm	0.0g	0ef	0.0
	+Sorbic acid	132cd	25ppm	0.0g	0ef	0.0
Infected seeds + Esters	+Ethyl benzoate	130g	5ppm	0.0g	0ef	0.0
	+Ethyl benzoate	125h	10ppm	0.0g	0ef	0.0
	+Ethyl benzoate	132cd	15ppm	0.0g	0ef	0.0
	+Ethyl benzoate	145ef	25ppm	0.0g	0ef	0.0
	+Ethyl sorbate	134de	5ppm	0.0g	0ef	0.0
	+Ethyl sorbate	133cd	10ppm	0.0g	0ef	0.0
	+Ethyl sorbate	135c	15ppm	0.0g	0ef	0.0
	+Ethyl sorbate	131fg	25ppm	0.0g	0ef	0.0
	L.S.D.$_{0.50}$	1.4297		1.8842	1.2272	

Where:

-T.S.N /W/5replicate= Total seed number in 20g seeds per 1 replicate.

*= ethyl alcohol concentration-

- used = 1: 4 sterilized de-ionized water.

**= The germination process started later than the other treatments.

X=recommended dose for application

(R.D) = 0.5g/250ml water**).**

G start = day in which seed start to germinate.

H. seeds = non infected seeds.

Inf.seeds=infected seeds.

Table (2): Effect of the tested treatments on fungal inhibition

Treatment	Conc.	Number of colonies formed per 15 seeds for each replicate						Tot.Fr.	Inhib. ER %
		A. alternata		*P.citrinum*		*Other fungi*			
			Freq%		*Freq%*		*Freq%*		
Healthy seeds	0.0	0.0	0.0	0.0	0.0	6+2*	10.67*	10.67	
Infected seeds(I.S)	0.0	58	77.34.	12	16.0	5	6.67**	100.01	0.0
I.S.+Ethyl alcohol	0.25ml	56	74.667	12	16	7	9.334**	99.651	0.448
+metalaxyl	1/2Xg/ml	32	71.12	16	21.33	2.0**	2.667*	95.116	4.979
+ metalaxyl	X gm/ml	8	10.667	10	13.33	2.0**	2.667*	26.664	73.363
+metalaxyl	1½Xgm/ml	5	6.667	4	5.333	0.0	0.0	12.334	87.678
+ridomil MZl	1/2Xgm/ml	7	9.333	10	13.33	0.0	0.0	22.663	77.736
+ridomil MZ	Xgm/ml	5	6.667	7	9.333	0.0	0.0	16.0	84.402
+ridomil MZ	1½ Xgm/ ml	1	1.33	3	4.000	0.0	0.0	5.33	94.675
+benzoic acid	5ppm	0.0	0.0	11	14.66	2**+2*	5.33	19.99	80.029
+benzoic acid	10ppm	0.0	0.0	10	13.33	2**	2.667	15.996	84.019
+benzoic acid	15ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+benzoic acid	25ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+sorbic acid	5ppm	0.0	0.0	5.0	6.667	0.0	0.0	6.667	93.34
+sorbic acid	10ppm	0.0	0.0	2.0	2.667	0.0	0.0	2.667	97.34
+sorbic acid	15ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+sorbic acid	25ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+ Ethyl benzoate	5ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+Ethyl benzoate	10ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+ Ethyl benzoate	15ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+ Ethyl benzoate	25ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+ Ethyl sorbate	5ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+ Ethyl sorbate	10ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+Ethyl sorbate	15ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
+Ethyl sorbate	25ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0

Where: 8*= 6 colonies of *Penicillium* sp and 2 colonies of *Aspergillus niger* & PF = Frequency percentage of each fungal sp.& 2*+2**= 2**Penicillium* sp colonies+ 2***A.flavus* colonies & ** = *A.flavus* colonies

Our selected treatments are summarized as shown in Table (3)

Table(3): Treatment concentrations applied in the Agricultural experiment.

Treatment	Used Tested concentration	Efficacy ratio %
Metalaxyl	X gm/ml	73.363(R.D)
Metalaxyl	1½Xgm/ml	87.678
Ridomil MZ	Xgm/ml	84.402 (R.D)
Ridomil MZ	1½ Xgm/ ml	94.675
Benzoic acid	10ppm	84.019
Benzoic acid	15ppm	100.0
Sorbic acid	10ppm	97.336
Sorbic acid	15ppm	100.0

Table (4): effect of the tested treatments on reducing plant death:

Treatments	Death rate %	AV.of Number of dead Seedlings(per 18seeds) for each replicate	Reduction ratio in death rate%
Healthy control	11.12	2g	-
Infected control	94.45	17a	-
Metalaxyl (x)	88.89	16a	5.56
Metalaxyl (1.5 x)	88.89	16a	5.56
Ridomil MZ (x)	88.89	16a	5.56
Ridomil MZ (1.5x)	33.34	6f	61.11
Ethyl benzoate (5ppm)	66.67	12bc	27.78
Ethyl benzoate (10ppm)	72.22	13b	22.23
Ethyl Sorbate (5ppm)	50.56	10cd	43.89
Ethyl Sorbate (10ppm)	50.0	9de	44.45
Benzoic acid 10ppm	38.89	7ef	56.0
Benzoic acid 15ppm	50.0	9de	44.45
Sorbic acid 10ppm	50.56	10cd	43.89
Sorbic acid 15 ppm	61.12	11bcd	33.33
$L.S.D_{0.05}$		2.6944	

2.2. Effects of the tested treatments on certain plant growth parameters:

Seedling shoot and root lengths, plant fresh weight, black color lesion (BCL) on faba bean seedling shoots were determined. BCL ratio was calculated for each treatment to assess the effects of the tested treatments on curing infected seedlings. Data in Table (4) illustrated that fungal infection significantly reduced all plant growth parameters and realized the highest BCL values, which indicated the relation between BCL produced by these pathogens and their virulence in field. These findings were in harmony with Yamaji *et al*. (2001); Khan *et al*. (2008) and Hawthorne *et al*. (2014).

Our results concerning the effect on shoot length revealed that Ridomil MZ realized the two highest shoot lengths, followed by ethyl benzoate at conc.5 ppm then ethyl sorbate. Metalaxyl and benzoic acid decreased shoot length These findings were in agreement with Wandrey *et al.* (2004), who mentioned that metalaxyl affected plant growth and plant height only when was applied as spraying. Moreover, these results coincided with those reported by Maffei *et al*. (1999); Yadav and Singh (2013) and Sunaina and Singh (2014), who reported that benzoic acid (BA) significantly decreased plant growth and seed germination proportionally with the increase in concentration.

Concerning root length, ethyl benzoate, ethyl sorbate at 5 ppm and sorbic acid at 10 ppm realized the best same action as ridomil MZ at 1.5X on root length. In contrast to that, metalaxyl, benzoic acid and sorbic acid at 10 ppm achieved the worth results. These results are partially in agreement with Magarey *et al*. (1995 and 1997) and Matheron and Porchas (2000), who mentioned that mancozeb ameliorate root and shoot growth than metalaxyl and were in harmony with those of Fujita and Syono (1996), who reported that the extent of inhibition of root growth by benzoic acid at 10 ⁄ µM in pir2-l and pir2-l auxl-7 seedlings was 44% and 19%, respectively as compared with control in absence of benzoic acid (BA) without any inhibition of polar auxin transport (Hertel *et al*., 1969 and 1983). On the other hand, Kim and Roh (2014) reported that BA appeared to promote the growth of tobacco plants. The best growth was obtained on day 50, but the activity of the antioxidative enzyme (glutathione reductase) was inhibited, which suggested that faba bean plant is less resistant to BA than tobacco plants.

Seedling fresh weight determinations :both of ethyl benzoate (5ppm) and sorbic acid (10ppm) realized similar effects as ridomil MZ (1.5x) on seedling fresh weight. Our findings were in agreement with those of Magarey and Bull (1994) and Saleem, (2010), who reported that mancozeb augmented shoot and root dry weight of sugarcane. Furthermore, Magarey and Croft (1995) reported that metalaxyl reduced shoot and root dry weight. Moreover, Magarey and Bull (2003) found that mancozeb caused yield decline in affected soil.

Black color lesions (BCL) attained the highest values in case of infected untreated seedlings and was absent in uninfected seedlings. These results indicated that the existence of this phenomenon was completely correlated to phytopathogenicity and plant diseases. According to many literatures, the seedling infection with *Alternaria alternata* or *Penicillium citrinum* do not produce these large black color lesions but the last one appeared when the double infection with both fungus occurred. Thus, it is suggested the presence of a synergistic effect between the two last mentioned fungi which appeared strongly on BCL production is a sort of virulent phytopathogenisty. Our findings are coincided with those of Perelló *et al*. (2005, 2008 and 2012 and Benssassi *et al*. (2009).

Treatment's effectiveness rank was as the following: ethyl benzoate at 5ppm > benzoic acid at 10pm > ridomil MZ at 1.5 x > sorbic acid at 10ppm then

ethyl sorbate at 5ppm. Both of benzoic and sorbic acids at 15 ppm had approximately the same efficiency of metalaxyl x.

2.3.Effect of the tested fungicides and their alternative preservatives on alternariol (AOH) and citrinin (CTN) inhibition in obtained plants after agriculture process.

This experiment was carried out on plants collected and prepared for mycotoxins estimation as mentioned above and data were registered and illustrated as shown in Table (5).

Concerning transition of AOH and CTN during the agriculture process from sown seeds to plant, according to Youssef *et al*. (2014), the average of seeds mycotoxins contents in non-treated seeds were 231.00 µg/gm for AOH and 337.00 µg/g for CTN (Table 6). It was remarked that during agriculture process both of the tested mycotoxins were transmitted from infected seeds to infected plants containing 219.739 and 250.950 µg/g in AOH and CTN, respectively. These findings are coincided with those of Muller and Amend (1997) and Perelló and larrán (2013), who suggested that the decline in mycotoxins degradation in plant was resulted from the exhaustion of nutrients lowering the mycotoxin production rate. Furthermore, our results are compatible with those of Miller *et al*., 1983 and Bhatnagar *et al*. (1991), who hypothesized that the biological degradation of mycotoxins in plant is an enzymatic degradation which considered the plant as source of these enzymes. Lugauskas, (2005) mentioned that AOH and CTN need a sort of fermentation to be degraded.

The efficiency of the tested treatment in inhibiting or reducing AOH and CTN during agriculture process: Ethyl benzoate at conc.10 ppm was the best treatment, where complete inhibition of AOH and CTN production, followed by the concentration 5 ppm then ethyl sorbate at 10 ppm and benzoic acid at 10 and15 ppm, followed by sorbic acid at 15 ppm. Metalaxyl at its recommended dose has a strong inhibitory effects on CTN only but ridomil MZ has a quite effects on both toxins. The inhibition rate was reversely proportional to concentration in ridomil MZ. These findings were reasonably compatible with those of Abd-El Ghany and Tayel (2009), who reported that fungal growth inhibition was sometimes inversely proportional to mycotoxin inhibition .In contrast to that, sorbic acid at 10 ppm has an effective inhibitory effects on CTN and moderately effect on AOH.

The effectiveness of the applied spraying method in reducing the two tested mycotoxins: According to our obtained results, the applied spraying method during this experiment was very satisfactory effective in reducing the two tested mycotoxins. This explained its success in making the pre-harvest crop's yield safety for both human and animal consumption and the plant commodities too.

According to Table (5) and (6) we can notice that in case of BCL, AOH and CTN inhibitions, ethyl benzoate had the inhibitoriest effect. It can be suggested

that both mycotoxins are involved in BCL appearance and phytotoxity. Such explanation was in agreement with those of Wang (1948); Nickell and Finlay (1954); White and Truelove (1972); Damodaran *et al*. (1975) and Yamaji *et al*. (2001), who concluded that citrinin at 125 ppm caused collapse of the root structure and tissue browning, and the growth of seedlings was inhibited markedly .

CONCLUSION:

According to the obtained results, benzoic , sorbic acids and their ester forms especially ethyl benzoate are very effective in reducing the production of AOH and CTN by *Alternaria alternate* and *Penicillium citrinum*. The use of ethyl benzoate as alternative to the tested fungicides may realize a big challenge in reducing fungicides used for treatment of infected seedlings as spray. Besides, it reduces the phytotoxic effect of these mycotoxins which lead to diminish the virulence of these pathogens in field.

On the other hand, it was obvious that in order to avoid the failure of benzoic and sorbic acids and ethyl sorbate to realize best growth to the infected seedlings, further studies are needed on treatment of the infected seeds with metalaxyl (x) or ridomil MZ(x) before sowing seeds and reduction of the number of spraying time of seedlings with benzoic or sorbic acids or ethyl sorbate by spraying seedlings each 21 days instead of 15 days.

Table (5): Effect of the tested treatments on certain plant growth parameters:

Tested treatments	A	B	C	D	E	F
Healthy control	10ml St.w	16.95a	8.049a	0.0f	0.000e	-
Infected control	10ml St.w	5.43cd	2.282d	15.4a	0.697a	-
Metalaxyl	X	3.40de	3.177cd	12.90ab	0.462b	33.715
Metalaxyl	1.5X	2.35e	2.767cd	5.01cd	0.289c	58.536
Ridomil	X	7.40c	4.71bc	10.860b	0.203cd	70.875
Ridomil	1.5X	11.9b	6.085ab	4.660cd	0.0840de	87.948
Ethyl benzoate	5ppm	13.6b	6.460ab	3.00de	0.0598e	91.42
Ethyl benzoate	10ppm	6.1cd	4.383bcd	4.700cd	0.118de	83.070
Ethyl Sorbate	5ppm	11.4b	3.770cd	4.800cd	0.105de	84.935
Ethyl Sorbate	10ppm	5.75cd	4.660bc	5.100cd	0.268c	61.549
Benzoic acid	10ppm	6.26cd	3.803cd	1.500ef	0.074de	89.383
Benzoic acid	15ppm	4.6de	3.310cd	5.00cd	0.495b	28.98
Sorbic acid	10ppm	11.05b	6.380ab	4.300cde	0.100de	85.653
Sorbic acid	15ppm	3.94de	2.583cd	6.200c	0.477b	31.563
L.S.D $_{0.05}$		2.4209	1.89645	2.68199	0.11852	

Where:
A=Concentration of tested treatments.
B= Average of one seedling shoot length in cm .
C= Average of Fresh weight ofone seedling
D= Black color lesions(BCL) On shoot in cm .
E= BCL ratio on shoot =black lesions length= Av of lengths of black lesions on treated seedlings/Av of total seedlings lengths
X=R.D= 500mg/250ml water.
1.5 X= R.D + 0.5 R.D=750mg/250ml & Seedling = complete growing plant but before flowering then fruiting stages.

Table (6): Assessment of alternariol (AOH) and citrinin (CTN) in obtained plants after agriculture process and efficacy ratios (E.R %) of treatments:

Treatment	Tested conc.	AOH µg/g	E.R.%	CTN% µg/g	E.R.%
Healthy cont.	0.0	0.00000[l]	-	0.0000[g]	-
Infected cont.	0.0	219.739[a]	-	250.95[a]	-
Metalaxyl	X	142.150[c]	35.309	62.283[d]	85.859
Metalaxyl	1[1]/2X	199.013[b]	9.4320	68.138[c]	72.848
Ridomil MZ	X	86.777[d]	60.509	81.676[b]	67.453
Ridomil MZ	1[1]/2X	45.489[g]	79.299	60.972[d]	75.703
Sorbic acid	10ppm	80.9697[e]	63.152	2.1816[fg]	99.131
Sorbic acid	15ppm	36.708[h]	83.294	5.3810[e]	97.856
Benzoic acid	10ppm	60.6515[f]	72.398	4.4048[ef]	98.245
Benzoic acid	15ppm	35.242[h]	83.962	3.9308[ef]	98.434
Ethyl sorbate	5ppm	39.195[h]	82.163	4.0367[ef]	98.391
Ethyl sorbate	10ppm	24.0079[i]	89.074	4.1931[ef]	98.329
Ethyl benzoate	5ppm	13.0401[J]	94.065	1.5724 [fg]	99.373
Ethyl benzoate	10ppm	6.6337[k]	96.981	1.4413[fg]	99.426
L.S.D $_{0.05}$		3.99945		2.64552	

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الملخص العربى

حل بديل للتحكم فى انتاج كل من السترينين والالترناريول على محصول الفول البلدي

نسرين حسن يوسف [٢] وعبد الفتاح سيد عبد الكريم سعد [١]

[١]كلية الزراعة سابا باشا–جامعة الاسكندرية.[٢] المركز الاقليمى للأغذية والاعلاف ، مركز البحوث الزراعية– الاسكندرية.

استهدفت الدراسة عدة نقاط :

اولا : دراسة تطوركل من المرض الفطرى (والحادث لاول مرة فى منطقة النوبارية) وانتاج السمين الفطريين تحت الظروف الحقلية ومدى تأثير هذين السمين الفطريين الالترناريول والسترينين على النبات كمنتج نهائى يصل للسلسلة الغذائية للانسان.

ثانيا: دراسة تأثير المبيدات الميتالاكسيل والريدوميل والتى كانت تستخدم لوقاية البذور والنباتات السليمة من الاصابة الفطرية أثناء الزراعة فى معاملة بذور ونباتات مصابة وتسجيل مدى كفاءة هذه المبيدات فى الحد من الاصابة وتقليل انتاج التوكسينات.

ثالثا: دراسة تأثير كل من حمضى السوربيك والبينزويك والاستر الخاص بكل منهما على كل من النبات والتوكسينات المنتجة أثناء الزراعة ودراسة مدى كفاءة هذه المواد كبدائل امنة لتقليل الجرعات المستخدمة من المبيد الفطرى وكذلك دراسة مدى امكانية الاحلال الكامل لهذه البدائل محل المبيدات المستخدمة .

ولقد توصل البحث إلى النتائج التالية : – تم تطبيق طريقة المعاملة بالرش للبادرات كل ١٥ يوم لفشل الاحماض واستراتها فى عملية انبات البذور. اثبتت الدراسة وجود علاقة طردية بين السمين الفطريين الالترناريول والسترينين و مدى شراسة وتطور المرض الفطرى بما يوضح ان هذين السمين من السموم السامة للنبات (phytotoxic) بالا ضافة لكونهاسموم عصبية (nephrotoxic) وسموم خلوية (cytotoxic) ومسرطنة ايضا(carcinogenic) للانسان والحيوان على حد سواء .كما اثبتت الدراسة وجود نوع من التعاضد بين الفطرين ومايتجانه من سموم فى التأثير على حجم المناطق السوداء التى تظهر على النباتات المصابة فقط وتقل بعد المعاملات محل الدراسة وتنعدم فى النباتات السليمة والتى بمقارنتها فى المراجع المختلفة لم تكن بهذه المساحة الكبيرة فى حالة وجود نوع واحد من السموم المختبرة وتنعدم فى حالة الاصابة بسلالة فطرية غير قادرة على انتاج اى من السمين.

أظهرت الدراسة تأثيركل من المبيدات المستخدمة و الاحماض العضوية والاسترالخاص بكل منها على كل من النمو الفطرى وانتاج التوكسين ودلت النتائج على التالى:– انه بالنسبة للمبيدات: بلغت نسبة التثبيط للنمو الفطري الكلى٩٤,٦٧٥% للريدوميل (١,٥x حيثx = مرة) و٨٤,٤٢٢% للميتالاكسيل عند نفس التركيز مما يدل على تفوق الريدوميل على الميتالاكسيل عند تركيز (١,٥ مرة قدر النسبة المقررة لرش البادرات فى حالة الوقاية) كما قلل الريدوميل(عند نفس التركيز المذكور) نسبة الموت للبادرات بنسبة ٦١,١١% . بالنسبة لحمضي البنزويك والسوربيك والاستر الخاص بكل منهما : أحدث كل من حمض البنزويك والسوربيك تثبيطا للنمو الفطرى بلغت بسبته ١٠٠%و ٩٧,٣٦% على التوالى وذلك عند تركيز١٥ جزء فى المليون بينما حقق كل من ايثايل بنزويت وايثايل سوربيت ١٠٠% تثبيطا للنمو الفطرى عند تركيز٥ جزء فى المليون كما بلغت نسبة الخفض فى المناطق السوداء على الساق% ٩١,٤٢ فى حالة ايثايل بنزويت ٥ جزء فى المليون تلاها حمض البنزويك ١٠ جزء فى المليون ٨٩,٣٨٣ % ثم الريدوميل١.٥مرة ٩٤٨ ,٨٧% ثم حمض السوربيك ١٠ جزء فى المليون ٨٥,٦٥٣%. أظهرت الدراسة أن الأحماض المستخدمة واستراتها كانت أكثر كفاءة فى القدرة على تثبيط وخفض انتاج التوكسين فى النبات النامى تحت الظروف الحقلية حيث بلغت نسبة خفض الستربنين ٩٩,٤٢٦ % ٩٩,٣٧٣% بواسطة ايثايل البنزويت على التركيزين ٥ و١٠ جزء فى المليون على التوالى تلاه حمض السوربيك على تركيز ١٠ جزء فى المليون بنسبة ٩٩,١٣١% أما الميتالاكسيل عند النسبة القررة فبلغت ٨٥,٨٥٩% تلاهاالريدوميل ١.٥مرة للنسبة المقررة ٧٥,٧٠٣% . فى حالة السم الفطرى الالترناريول كا ن المركب ايثايل بنزويت هو الاكثر كفاءة فى خفض التوكسين على كلا التركيزين المختبرين بواقع ٩٤,٠٦٥% و٩٦,٩٨١% على التركيزين ٥ و١٠ جزء فى المليون على التوالى تلاه الايثايل سوربيت ١٠جزء فى المليون بواقع٨٩,٠٧٤ ثم كل من حمضى البنزويك و السوربيك ١٥جزء فى المليون بفاعلية تثبط ٨٣,٩٦٢% و٨٣,٢٩٤% على التوالى. كانت نتائج المبيدات أقل فاعلية من البدائل محل الاختبار فى قدرتها على تثبيط انتاج الالترناريول حيث بلغ اقصى تثبيط للريدوميل ٧٩,٢٩٢% على تركيز ١.٥ مرة قدر النسبة المقررة بينما الميتالاكسيل بلغ ٣٥,٣٠٩ % عند تركيز النسبة المقررة (x) مما يدل على عدم حساسية الالترناريول للميتالاكسيل .

التوصيات: نوصى باستخدام الميثايل بنزويت كبديل للمبيدات الفطرية فى حالة الرش وذلك بعد اجراء مزيد من الدراسات من قبل المختصين بفسيولوجيا النبات لدراسة مقارنة بين هذه المادة والمبيدات من حيث تأثيرها على الخواص الفسيولوجية و الانتاجية للنبات.

Efficacy of *Trichoderma harzianum* as A Bio-control Agent Compared with Traditional Chemical Fungicide for Controlling the Soil Borne Pathogen (*Fusarium oxysporum* f. sp. *Lycopersici*) Infesting Tomato Plants

Zen-El-Dein, Manal M.[1]; R.A. Hendi[2] and A.S. Abo-Shanab[1]
[1]Central Agricultural Pesticides Laboratory, [2]Plant Protection Research Institute, Agricultural Research Center, Egypt
Corresponding author : Zen-El-Dein, Manal, e-mail: manzen67@gmail.com

ABSTRACT : Laboratory and greenhouse experiments were conducted to investigate the efficacy of a biological control agent (*Trichoderma harzianum*) against the soil-borne plant pathogen (*Fusarium oxysporum* f. sp. *lycopersici*) as compared with a traditional fungicide (Vitavax®-200). Results indicated that *T. harzianum* was more effective than Vitavax®-200 for radial growth inhibition. Through seedling dip and soil application, Vitavax®-200 was more effective than *T. harzianum* where it recorded the least wilt incidence comparing to untreated control, but it gave a shorter height of tomato plant than *T. Harzianum* with significant differences between them. Also, application of *T. harzianum* as antagonistic agent significantly increased the plant height and increased fruit yield/plant without significant differences with Vitavax® when compared with untreated control.

Keywords: *Trichoderma harzianum*, Disease severity, soil-borne plant pathogen, *Fusarium oxysporum*.

INTRODUCTION

Tomato *(Lycopersicon esculenturn* Mill) is one of the most important Solanaceous economic vegetable crops in Egypt for local consumption and exportation. Its popularity is due to its high nutritive value, diversified use, and nutritional significance as a source of vitamins A and C. It is affected by several diseases, reflecting negatively on plant growth and the produced yield (Anonymous, 2007). Fungal pathogens are considered as damaging agents causing a considerable reduction of its production.

The wilt disease caused by the soil-borne fungi [*Fusariurn oxysporum* f. sp. *Lycopersici* (Sace.)] has serious effects on tomato plants either in nurseries or in the fields (Besri, 1982). It remains to be a challenging task in terms of management, because of nature, application of fungicides to control this disease is not practical. Besides, chemicals pose serious health hazards to the applicator as well as to the consumer.(Agrios, 2005;Srinon*et al*., 2006 and Cal *et al*., 2004).In addition to target organism, pesticides also kill various beneficial organisms. Their toxic forms persist in soil and contaminate the whole environment (Hayes and Laws, 1991).

Trichoderma species that are common inhabitants of the rhizosphere are useful as they can be used as biological control organisms against a wide range of soil borne pathogens and also have been known to provide plant growth promotion. Successful reductions of *Fusarium* wilt in many crops with application of different species of *Trichoderma* have been found (Bell *et al*., 1982; Elad and Kapat, 1999 and Ramezani 2009). However, it is also reported that all the isolates of *Trichoderma* spp. are not equally effective in control of pathogen *in vitro* (Biswas and Das, 1999 and Ramezani, 2008) and *in vivo*

conditions to control diseases. Therefore, *T. harzianum* gave a successful control of a particular pathogen. *T. harzianum* Rifai have been known to show antagonism to various root pathogens such as *Pythium* spp., *Rhizoctonia* spp. and *Fusarium* spp. (Baker, 1989 and Chet *et al*., 1987) and has been described as a most promising biocontrol agent, (Morsy *et al*., 2009 and Sabalpara *et al*., 2009). Some strains of *T. harzianum* establish robust and long lasting colonization of root surfaces penetrating into the epidermis (Harman, 2000). This colonization by *T. harzianum* frequently enhances root growth development, crop productivity and resistance to abiotic stresses through enhancement of mineral absorption.

Therefore, the objectives of the present study were to assess the ability of *T. harzianum* as a bio-control agent in suppressing the populations of *Fusariurn oxysporum* f. sp. *Lycopersici* (Sace.) in tomato under *in vitro* and *in vivo* conditions, comparing with standard chemical traditional fungicide [Vitavax®-200 75% WP] which has been recommended by the Egyptian Ministry of Agriculture.

MATERIALS AND METHODS

Tested fungi were : *Fusariurn oxysporum* f. sp. *Lycopersici* (Sace.) and *T. harzianum* obtained from the Plant Pathology Institute laboratory, Agricultural Research Center, Egypt.

Tested chemical : [Vitavax®-200(37.5% Carboxin + 37.5% thiram)] was also obtained from Central Agricultural Pesticide Laboratory, Agricultural Research Center, Egypt.

In vitro comparing effect of *T. harzianum* antagonist and a traditional fungicide (Vitavax®-200) against *F. oxysporum* f. sp. *lycopersici* pathogen

The tested fungi were placed and cultured on potato dextrose agar (PDA) medium separately, and incubated at the laboratory conditions at 25°Cfor 4 days for *T. harzianum* and 7 days for *F. oxysporum* f. sp. *lycopersici*. Nine millimeters discs of fifteen days old *F. oxysporum* fungal culture were placed on PDA medium one cm away from the edge of the plate, separately and anther (9 mm) disc of *T. harzianum* or traditional fungicide (Vitavax®-200) were placed at the opposite side of the petri plate. Four replicated plates for each treatment was maintained and incubated at 25°C. Inhibition percentage over control was calculated (Vincent, 1927) as the following formulae :

$$IP = \frac{C-T}{C} X\ 100$$

Where :IP = Inhibition percentage over control, C = Growth of tested pathogen with absence of antagonist (mm) and T = Growth of the tested pathogen with antagonist (mm)

Greenhouse experiment: A field experiment was conducted to test the efficacy of *T. harzianum* and Vitavax®-200against *F. oxysporum* f. sp. *lycopersici*. Soil Mixture (clay: sand1:1 w/w) was prepared and autoclaved for 1hr for two consecutive days and was put in plastic pots of 5 kg capacity. Tomato (supper strain B) seeds were sown in autoclaved soil mixture in the plastic pots. After 25 days, the seedlings were pulled out from the pots and washed in tap water then

immersed in the *T. harzianum* conidial suspension (10^7/ml) or dipped in the Vitavax®-200 solution (0.15%), ensuring that the roots alone were immersed in the solutions and then transplanted in pots at the rate of four seedlings per pot (5 kg capacity which were infested with the wilt pathogen *F. oxysporum* f. sp. *lycopersici* at a concentration of 10^7 conidia/ml allowed to establish in the soil for a period of 6 days.). Soil drenched with treatments after 15and 30 days of transplantation.

Disease severity (DS) assessment was done 21 days after transplanting when symptoms of infection were observed. Such symptoms included clearing of the veins and drooping of petioles followed by yellowing of lower leaves (Agrios, 1988). Four plants were selected at random, marked with pieces of string and were used to evaluate disease severity after every 3 weeks. Disease severity was determined using a modification of a scale proposed and designed by Waudo *et al*., (1995). This was based on the wilt severity rated as follows; (% of shoot wilted, using a scale of 0–5 where, 0=No symptoms, 1=One leaf wilted (1%-25%), 2= 2 or 3 leaves wilted (26%-49%), 3=half plant wilted (50%-74%), 4= all leaves wilted (75%-100%) and 5=Plant dead). Four seedlings from treatments had their roots were stained by the method of Kormaik and McGraw (1982).

The observation on the disease incidence percentage was recorded at the harvest time. Each treatment was replicated six times in Completely Randomized Block Design (CRBD).Table 1 shows the treatments details.

Table (1) : The treatments of the biological control agent and the fungicide Vitavax®-200

Treatments	Treatment details
Trichoderma harzianum	Seedling dip at 0.2 % + Soil application at 15 and 30 DAT*at 0.2 %
Vitavax®-200 (0.15%)	Seedling dip at 0.15 % + Soil drenching at 15 and 30 DAT at 0.15 %
Inoculated control	(with pathogen)
Healthy control	(without pathogen)

*DAT : day after treatment

Severity of infection and treatment efficacy percentages were recorded as loss of weight according to the equation suggested by Spalding and Reeder (1974) :

DI (Disease Index %) = (No. of leaves wilted / Total No. of leaves) x 100

Statistical analysis : The data were statistically analyzed and the treatment means were compared by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The efficiency of the tested treatments (*In vitro*) on the radial mycelial growth of *F. oxysporum* f. sp. *lycopersici*

T. harzianum and Vitavax®-200weretested for their *in vitro* effect against *F. oxysporum* f. sp. *Lycopersici* by traditional dual cultural technique.

The obtained data in Fig. (1) indicated that *T. harzianum* inhibited the mycelial growth of *F. oxysporum* f. sp. *lycopersici* to an extent of 79.0% over control followed by traditional fungicide Vitavax®-200 by 64.0% radial growth inhibition. There for, the bio-control agent (*T. harzianum*) was more effective than the traditional fungicide in inhibiting the radial growth of *F. oxysporum*.

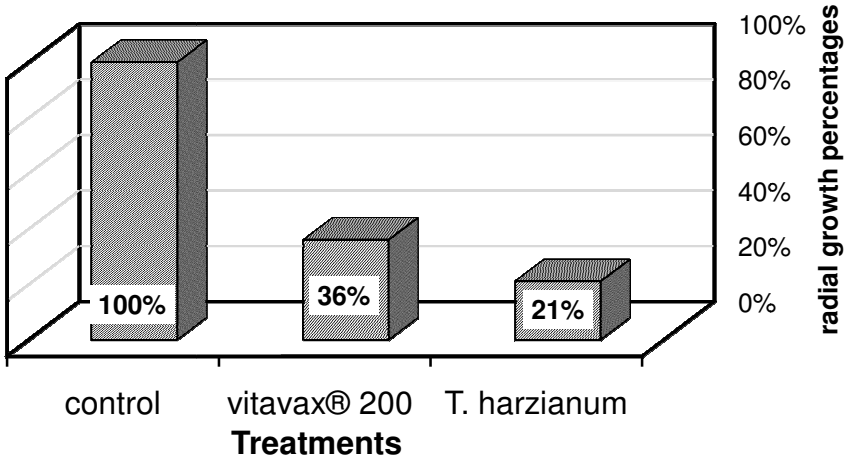

Fig. (1) : Soil-borne fungus *F. oxysporum* f. sp. *Lycopersici* radial growth percentages affected by tested bio-control agent and traditional fungicides Vitavax®-200.

Effectiveness of *T. harzianum* antagonist on wilt incidence and yield parameters under glasshouse conditions

Obtained data in Table (2) showed that application of *T. harzianum* antagonist through seedling dip and soil application was effective in suppressing wilt incidence giving a disease incidence percentage of16.9%.It was clear that Vitavax®-200 (0.15%) was found to be more effective than *T. harzianum,* where it recorded the least wilt incidence of 11.3% compared to untreated control, but it gave a shorter height of tomato plant than *T. Harzianum* (62.4 cm) with significant differences between them. Also, the results of this experiment revealed that the application of *T. harzianum* antagonistic agent significantly increased the plant height (by 15.1 cm) and increased fruit yield/plant without significant differences with Vitavax®-200when compared to untreated control. *T. harzianum* recorded the highest fruit yield (235 g/plant) followed by Vitavax®-200 (228.5 g/plant) with no significant differences. The use of the bio-control agent would be useful and recommended to reduce environmental pollution that resulted from chemical fungicides.

Table. (2): Efficacy of tested treatments in the management of *Fusarium* wilts of tomato under greenhouse conditions.

Treatments	Plant height (cm)	Disease incidence Percentage	Fruit yield g/plant
T. harzianum	69.6[a]	16.9[b]	235.0[a]
Vitavax®-200 (0.15%)	62.4[b]	11.3[a]	228.5[a]
Inoculated control (with pathogen)	48.3[d]	59.6[d]	123.5[c]
Healthy control (without pathogen)	54.5[c]	21.4[c]	183.5[b]

- Mean of six replications
- In a column, means followed by the same letters are not significantly different at the 5% level by DMRT.

The potential of *Trichoderma* species as bio-control agents against various plant diseases has been reported by several workers (Wells *et al*., 1972 and Sharon *et al*., 2001). In the present investigation, fungal antagonist *T. harzianum* caused highly significant reduction in tomato wilt incidence under *in vitro* and *in vivo* conditions. The inhibitory effect of these bio-agents against tested pathogen was probably due to competition and/or antibiosis.

In vitro effectiveness of *T. harzianum* against species of *Fusarium* have been reported (Padmadaya and Reddy 1996). The antagonist *Trichoderma harzianum*, *T. coningi* and *T. viride* were reported to be equally antagonistic to *F. udum in vitro* (Bahatnagar, 1986).Sivan and Chet, (1987) reported that *Trichoderma* spp. successfully controlled *Fusarium* spp. on cotton, wheat and muskmelon. Sesame seeds treated with three isolates of *T. viride* reduced the pre- and post-emergence damping off caused by *R. solani* and *F. oxysporum* f. sp. *sesame* under pot culture and field conditions.

In the present investigation, the plant height and fruit yield were also increased in *T. harzianum* treated plants. Similar results on increased plant growth due to application of *Trichoderma gamsii* in cereals and legume crops were reported (Rinu *et al*., 2013). The increase in plant growth might be associated with secretion of auxins, gibberellins and cytokinins.

The increase in biomatter production may be due to the production of plant growth promoters or through indirect stimulation of nutrient uptake and by producing siderophore or antibiotics to protect plants from deleterious rhizosphere organisms. Therefore, the antagonist *T. harzianum* is chosen to be the most promising bio-control agent for *F. oxysporum* f. sp. *lycopersici*. On the base of present study the bio-agents of fungi, might be exploited for sustainable disease management programs to save environmental risk (Margaret *et al*., 2011 and Sundaramoorthy and Balabaskar, 2013).

Finally, the present evaluation thus gave clear indication that *T. harzianum* is effective and virulent antagonist, which can be effectively used in the management of tomato wilt. Combination of seedling dip and soil application appears to be most effective.

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الملخص العربى

فعالية التراكوديرما هارزيانم كعنصر مكافحة حيوية مقارنة مع مبيد فطرى كيميائى تقليدى لمكافحة ممرض التربة فيوزاريم اكسيسبوريم الذى يصيب نباتات الطماطم

منال محمد زين الدين[١] ورضا عبد السميع هندى[٢] واحمد صالح ابو شنب[١]

[١]المعمل المركزى للمبيدات، [٢]معهد بحوث وقاية النباتات – مركز البحوث الزراعية

تم تنفيذ التجارب المعملية وفى الصوب للتحقق ومقارنة كفاءة عنصر مكافحة حيوية لممرضات التربة (التراكوديرما هارزيانم) مع مبيد فطرى تقليدى فيتافاكس–٢٠٠. وقد أوضحت النتائج أن التراكوديرما كانت أكثر كفاءة من مبيد الفيتافاكس فى تثبيط النمو الفطرى بالتجربة المعملية. وخلال تجربة نقع الجذور ومعاملة التربة فى الحقل تحت ظروف الصوبة تبين أن المبيد الفطرى فيتافاكس–٢٠٠ كان أكثر كفاءة من التراكوديرما المختبرة حيث سجل أقل نسبة إصابة بالذبول لنباتات الطماطم مقارنة بالكنترول الغير معامل، وبالقياسات النباتية كانت نباتات الطماطم الناتجة من المعاملات أطول معنوياً من الناتجة من الكنترول الغير معامل حيث كانت النباتات الناتجة من معاملة الفيتافاكس أقصر طولاً من النباتات الناتجة من معاملة التراكوديرما بفارق معنوى، بينما لم تظهر أى فروق معنوية فى إنتاجية محصول الطماطم الناتج من المعاملتان (العامل الحيوى والمبيد الفطرى) رغم تضاعف انتاجهما تقريباً عن الكنترول (غير المعامل).

Influence of Temperature and Host Plants on The Development of The Two-spotted Spider Mite, *Tetranychus urticae* Koch (Acari: Tetranychidae)

M. Z. Embarak, A. A. A. Salem and Aiman K. Abou El-Saad
Plant Protection Res. Institute, Agricultural Research Center, Giza, Egypt

ABSTRACT : Duration of immature stages of the two-spotted spider mite, *Tetranychus urticae* Koch, reared on eggplant leaves at constant temperatures of 21, 25 and 29℃ was determined. Developmental threshold of the immature stages was 10.4℃. The mean number of degree- days required by *T. urticae* to complete its development was 133.5 DD. The total mortality from egg to adult emergence was 32.14, 26.8 and 30.36% at 21, 25 and 29℃, respectively. Moreover, the greatest mortality occurred during the egg stage. Regarding host plant involved, *T. urticae* developed faster on peanut, *Arachis hypogae* L. (8.08 days), followed by cucumber, *Cucumis sativus* L. (9.31 days) and eggplant, *Solanum melongena* L. (9.37 days). These results indicated that the temperature and host plant affected the development time of *T. urticae*.
Key words: *Tetranychus urticae*; temperature; host plant; development.

INTRODUCTION

The two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) is one of the most serious pests on vegetables and crops in agriecosystem. Temperature is usually the environment factor with the greatest effect on development rate of mite stages. To quantify the effect of temperature on mite development, life stage of a species may be held at constant temperatures and the resultant development times can be used to estimate development rate curves **(Southwood, 1978)**. From these development rate curves, models can be formulated to predict development time as a function of temperature. The models are useful in making pest management decisions, or to be used as components of more comprehensive models for the investigation of population dynamics.

Host plants of spider mites differ in the degree of food quality, which either depend on the level of primary plant metabolites, or on the quantity and nature of secondary metabolites **(Rosenthal and Berenbaum, 1991)**. Many secondary metabolites found in plants have a responsibility in defense against herbivores, pests and pathogens. These compounds can perform as toxins, deterrents, digestibility reducers or act as precursors to physical defense systems **(Bennett and Wallsgrove, 1994; Balkema-Boomstra *et al.,* 2003)**.

Several studies have investigated the effects of temperature on development and reproduction of tetranychid mites on different host plants, such as *T. urticae* on cotton **(Carey and Bradley, 1982)**, *Tetranychus piercei* McGregor on banana **(Yueguan *et al.,* 2002)**, *Eutetranychus banksi* (McGregor) on sweet orange **(Badii *et al.,* 2003)**, *T. urticae* on beans **(Praslicka and Huszar, 2004)**, *T. urticae* on apple **(Kasap, 2004)**, *Tetranychus turkestani* Ugarov and Nikolski on eggplant **(Nemati *et al.,* 2005)**, *T. urticae* on eggplant **(Ju *et al.,* 2008)**, *Eutetranychus orientalis* (Klein) on Siris **(Imani *et al.,* 2009)**, *T. turkestani* on cucumber **(Karami Jamour, 2011)**, *T. urticae* on Pear **(Abd El-Wahed and El-Halawany, 2012)** and *T. urticae* on persimmon trees **(El-Halawany and Abd El-Wahed,2013)**.

However, few attempts have been made to determine the developmental threshold and the thermal units needed for development of *T. urticae* on some host plants, particularly in Egypt. Hence, the goal of this study was to evaluate the developmental threshold and the thermal requirements of *T. urticae* as a key pest on eggplant and the suitability of the three economically important host plants (i.e. eggplant, cucumber and peanut) to this mite species.

MATERIALS AND METHODS

This study was conducted in the laboratory of plant protection research at Assiut Governorate during the year of 2014. Three host plants [eggplant, *Solanum melongena* L. (Solanaceae); cucumber, *Cucumis sativus* L. (Cucurbitaceae) and peanut, *Arachis hypogae* L. (Fabaceae)] were used to investigate the development time and some life table parameters. Adults of *T. urticae* were collected from leaves of each host plant using a fine camel hair brush, the stock population of the mite was established in the laboratory by placing the adult stages on discs of related plants in Petri dishes (80 mm in diameter) with wetted cotton wool fixed on a disc of plastic foam (Mannaa, 1988). Newly deposited eggs (less than 24 hrs) were transferred singly to the disc of fresh eggplant leaves (20mm in diameter) placed on a water-saturated cotton in a Petri dish. Fifty six of mite eggs (egg on each disc) were incubated at each tested temperature of (21, 25 and 29℃) with a photoperiod of 16:8 (L:D) and 60±10 R H and observed daily until hatching. The newly-hatched larvae (< 12 hours-old) were reared in each experimental temperature and provided with clean eggplant leaves as a source of food until emergence of the adults.

The same above-mentioned procedures were conducted with the three host plants (eggplant, cucumber and peanut) at 25℃ to assess development times of these eggs and other immature stages until reaching adulthood for each host plant.

Data obtained were statistically analyzed using analysis of variance and means were compared according to Duncan's Multiple Range test (Duncan, 1955). Obtained results of each immature stage of *T. urticae* were used to calculate the development threshold (t_0) according to linear regression model: $Y= a + bx$, whereas, (Y) is the rate of development (100/duration) at temperature (X) ℃, a is the intercept on the Y axis, b is the regression coefficient and the lower development threshold (t_0) = -a/b. On the other hand, thermal units (TU) required for the development of each mite stage were calculated according to Mangat (1977); thermal units (DD's)= T ($t-t_0$) where, T- development time, t- temperature in degree centigrade and t_0- lower development threshold.

Also, the obtained data were used to form a concise statement for every interval of age, the number of deaths (d_X), the number of survivors at the beginning of the age class X (l_X), the rate of mortality (q_X), the numbers living between the ages X and X+1, which is the age structure (L_X) and survival rate within stage (S_x).

RESULTS AND DISCUSSION

1. Development time of the immature stages:

The results in Table (1) show that the incubation period of *T. urticae* decreased as temperature increased. It averaged 5.59±0.74; 3.94±0.34 and 2.59±0.25 days at 21, 25 and 29°C, respectively. The duration of larval, protonymph and deutonymph stages decreased gradually as temperature increased from 21 to 29°C. The larval stage durated 2.37±0.1; 1.85±0.05 and 1.18±0.12 days at 21, 25 and 29°C, successively. The periods of protonymph and deutonymph stages lasted for 2.40±0.18 and 2.24±0.09; 1.67±0.18 and 1.91±0.21; 1.75±0.03 and 1.68±0.04 days at the same degrees of temperature, respectively.

Statistical analysis of data showed significant variation between the development periods of each immature stage of two-spotted spider mite at all tested temperatures. In addition, when the total development time (from egg to adult emergence) is compared among all tested temperatures, the variation is significant.

Table (1): development periods (in days) of the immature stages of *T. urticae*, reared at different constant temperatures

Temp.(°C)	Development periods (in days)±SD				
	Egg	Larva	Protonymph	Deutoymph	Total (from egg to adult emergence)
21	5.59±0.74a	2.37±0.1a	2.40±0.18a	2.24±0.09a	12.60±0.72a
25	3.94±0.34b	1.85±0.05b	1.67±0.18b	1.91±0.21ab	9.37±0.1b
29	2.59±0.25c	1.18±0.12c	1.75±0.03b	1.68±0.04b	7.20±0.19c

*Mean in each column, followed by the same letter are not significantly different at 0.05 probability level

Data in Table (1) gave the possibility of calculating the developmental threshold (t_0) and the thermal units (TUs) required for the development of the immature stages of the mite according to **Mangat (1977)**. Hypothetical temperature threshold which was used in the estimation of (t_0) and (TUs) were chosen below the rearing temperatures of 21 and 29°C, Table (2). Data revealed that the threshold temperature for development of the immature stages of the mite on eggplant, as shown in Figure (1), was 10.4°C and the thermal units necessary to complete its development were about 133.5 day-degrees.

Table (2): Day-degrees (DD) necessary for the development of immature stages to adult stage of *T. urticae* using hypothetical temperature thresholds below rearing temperatures of 21 and 29℃

Temp. threshold (t_0)	Thermal units (DD's) = T (t – t_0)	
	21℃(T = 12.6)	29℃(T = 7.20)
7	176.4	158.4
8	163.8	151.2
9	151.2	144.0
10	138.6	136.8
11	126.0	129.6
12	113.4	122.4
13	100.8	115.2
14	88.2	108.0
15	75.6	100.8
16	63.0	93.6
17	50.4	86.4
18	37.8	79.2
19	25.2	72.0
20	12.6	64.8

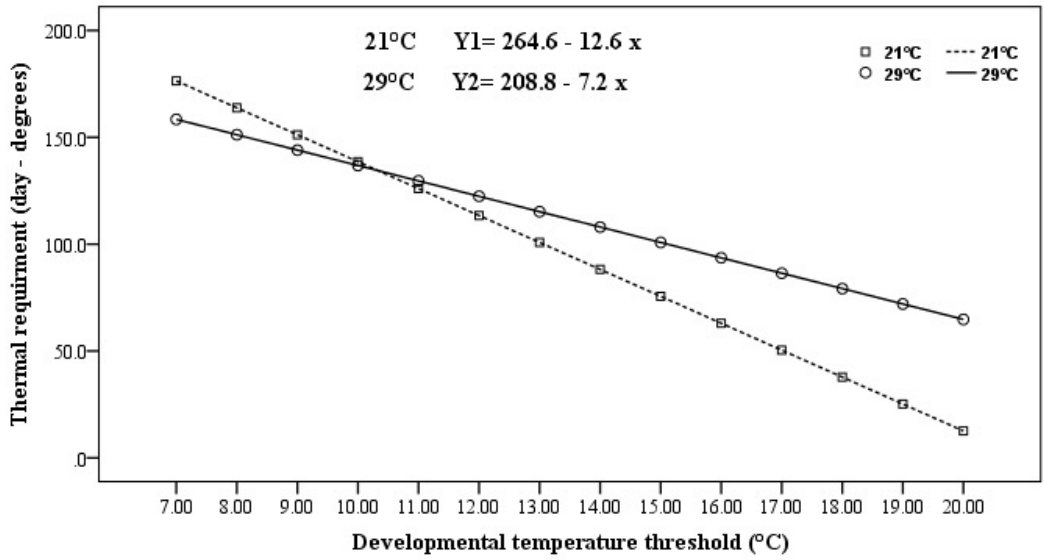

Fig. (1): Thermal units needed for the development of the immature stages of *T. urticae*.

2. Age-specific survival life table:

Data in Table (3) referred to the combined life table describing one pathway for age specific mortality of *T. urticae* immature stages reared at the three constant temperatures. Results indicated that the highest percentage (73.2%) of 56 two-spotted spider mite eggs successfully emerged as adults occurred at 25℃ followed by (69.64%) at 29℃, while the lowest percentage

(67.86%) of adults emerged from the mite eggs was recorded at 21℃. Moreover, the life table of *T. urticae* indicated high mortality occurring during the early life stages against a distinct lower percentage of mortality as they reached adulthood.

Table (3): Life table of two spotted spider mite, *T. urticae* reared on eggplant leaves at different constant temperatures

Temp. (℃)	X	lx	Lx	dx	100qx	Sx
21	Eggs	56	48	15	26.79	73.21
	Larva	41	40	2	4.88	95.12
	Protoymph	39	38	1	2.56	97.44
	Deutonymph	38	38	0	0.0	100.0
	Adult	38	19	-	-	-
25	Eggs	56	52	7	12.50	87.50
	Larva	49	47	4	8.16	91.84
	Protoymph	45	43	3	6.67	93.33
	Deutonymph	42	41	1	2.38	97.62
	Adult	41	20	-	-	-
29	Eggs	56	50	12	21.43	78.57
	Larva	44	43	2	4.55	95.45
	Protoymph	42	41	2	4.76	95.24
	Deutonymph	40	39	1	2.5	97.5
	Adult	39	19	-	-	-

X = development stage
lx = number entering stage
Lx = number alive between stage X and X+1
dx = number that died in stage X
100qx = percent apparent mortality
Sx = survival rate within stage

3. Influence of host plant on the development time of *T. urticae*:

Obtained results in Table (4) elucidated insignificant variation between the two host plants, eggplant and cucumber in case of the total development period of *T. urticae*, whereas significant variation between peanut and each of eggplant and cucumber for the total development period (F=18.28; df=2; p=0.00001). The development period of different stages of *T. urticae* indicated that larval stage development occupied the first rank (1.51±0.41 days) followed by (1.72±0.11, 1.82±0.13 and 3.87±0.46 days) for protonymph, deutonymph and egg stages, subsequently with significant differences (F=1272.03; df=4; p=0.00001).

Table (4): Length of the development period of *T. urticae* as influenced by host plant (in days) at constant temperature of 25℃

Hosts	Developmental periods (in days)				Average
	Egg	Larva	Nymph	Total (from egg to adult emergence)	
Eggplant	3.94Ab*	1.85Ad	3.58Ac	9.37Aa	4.69A
Cucumber	4.31Ab	1.52Ad	3.48Ac	9.31Aa	4.65A
Peanut	3.35Bc	1.17Ad	3.56Ab	8.08Ba	4.04B
Average	3.87b	1.51d	3.54c	8.92a	

*detectable differences are indicated by capital letters in host plants within each column and lower case in stages within each row.

Voluminous of studies are available on the biology of *T. urticae* on different host plants. However, it would be uphill to compare the present results with others, as rearing conditions (temperature as well as host plant) were different. As a discussion, the results of the present study clearly showed the effect of temperature and host plants on development time and mortality of immature stages were in agreement with previous results have been reported by many authors. Immature development times of *T. urticae* were 12.60, 9.37 and 7.20 days at 21, 25 and 29℃, respectively. **Praslicka and Huszar (2004)** found that the length of development times of *T. urticae* on *Capsicum annuum* L. were 12.9, 10.10 and 7.0 days at 20, 25 and 30℃. While, **Nemati *et al.* (2005)** observed the developmental times of *T. turkestani* on eggplant were 30.32, 17.41, 9.98 and 5.71 days at 15, 20, 25 and 30℃, respectively. **Whereas, Ju *et al.* (2008)** reported (25.8 days at 17℃) for *T. urticae* on eggplant. **Romeih *et al.* (2013)** also, reported that the total development time of *T. urticae* males was significantly influenced by the rose cultivars and ranged between 12.01 and 7.88 at 20°C; 6.84 and 3.44 at 25°C; and 5.35 and 2.57 days at 30℃. Moreover, our findings at 25℃ are close to those recorded on different host plants by **(Skirvin and Williams, 1999)** 11.7 days; **(Kasap, 2004)** 10.0 and 9.3 days; **(Rajakumar *et al.*, 2005)** 12.36 and 10.7 days for female and male, respectively, and **(Razmjou *et al.*, 2009)** 9.38 days.

The lower temperature threshold of 10.4℃ for *T. urticae*, computed by linear regression, is similar to the 10.57℃ reported by **Ali (2002)** on cotton, but this value was lower than those reported by **Ju *et al.* (2008)** for *T. urticae* (12.8 and 12.5℃) for male and female on eggplant and by **Nemati *et al.* (2005)** for female *T. turkestani* (13.4℃) on eggplant, as well as **Riahi *et al.* (2013)** for *T. urticae* (12.1 and 13.8℃) for male and female on peach. While, the value of temperature threshold is higher than the 8.4℃ reported by **Kasap (2004)** on apple.

The mean number of degree-days required by *T. urticae* to complete its development was 133.5DD, which was closer to 140.33 and 131.88DD for female and male, respectively, required by *T. turkestani* to complete its development **(Jamour and Shishehbor, 2012)** and was higher than those of **Ju *et al.* (2008)**

on eggplant (80.5 and 74.7DD) for female and male, respectively; and **Nemati *et al.* (2005)** for female *T. turkestani* (102.0DD) on eggplant. While, these was lower than those of (160.2 and 174DD) for females and males of *T. urticae* **(Riahi *et al.,* 2013)**; (172.4DD) reported for female **(Najafabadi and Zamani, 2013)**. on apple by **Kasap (2004)** and (155DD) estimated by **Ali (2002)** on cotton. The total mortality from egg to adult emergence was 32.14, 26.8 and 30.36% at 21, 25 and 29℃, respectively. Similar results have been stated by **(Riahi *et al*., 2011)** 27.45 to 68.5% of eggs developed to maturity on peach, whereas **Saeidi (2011)** mentioned that 74-88% of eggs completed its maturity. Immature stages mortality rate ranged also from 11.65 to 18.75% on different bean cultivars **(Najafabadi and Zamani, 2013)**. In addition, among immature stages, the greatest mortality occurred during the egg stage was in accordance with the results of **(Najafabadi and Zamani, 2013)**.

The difference among the three host plants; eggplant, cucumber and peanut was further confirmed by the statistical analysis. Therefore, obtained results from these experiments showed a better performance of *T. urticae* on peanut leaf discs than cucumber and eggplant. This was shown in the development times of *T. urticae* (8.08, 9.31 and 9.37days) for peanut, cucumber and eggplant, in respect. Similar results have been also observed on various host plants **(Praslicka and Huszar, 2004** and **Razmjou *et al.*, 2009)**. The difference in the development of the mite on different hosts may have been caused by quality, accessibility or actual ratio of nutrients, as indicated by **Wermelinger *et al.* (1985)**. In addition, variations among the other aspects and parameters included in this article might be due to the differences to either the mite species or to the adopted techniques.

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الملخص العربى

تأثير الحرارة والعوائل النباتية على تطور أكاروس العنكبوت ذو البقعتين

ماجد زاهي إمبارك ، علاء الدين عبد القادر أحمد ، أيمن كامل أبو السعد

معهد بحوث وقاية النباتات– مركز البحوث الزراعية– الجيزة– جمهورية مصر العربية

أجريت هذه الدراسة بهدف معرفة تأثير درجات الحرارة الثابتة على تطور آكاروس العنكبوت ذو البقعتين *Tetranychus urticae* عند تربيته على أوراق الباذنجان كواحد من محاصيل الخضر التي تصاب بشدة بهذا الآكاروس، وكذلك دراسة تأثير العوائل النباتية المختلفة مثل الخيار والفول السوداني على تطور هذا الآكاروس.

وقد أوضحت النتائج انه عند تربية الآكاروس على أوراق الباذنجان واستخدام درجات حرارة ٢١ ، ٢٥ ، ٢٩°م فأن فترة تطور الآكاروس تقل مع زيادة درجة الحرارة (١٢.٦٠، ٩.٣٧، ٧.٢٠ يوم على التوالي). دلت النتائج أيضا أن عتبة النمو للأطوار الغير كاملة كانت ١٠.٤ درجة مئوية ، كما أن آكاروس العنكبوت ذو البقعتين يحتاج ١٣٣.٥ وحدة حرارية يوميا حتى يكمل تطوره.

تم دراسة نسبة الوفيات عند كل درجة حرارة وقد وجد أن أعلى نسبة وفيات تحدث عند درجة حرارة ٢١°م (٣٢.١٤%) يليها عند درجة حرارة ٢٩°م (٣٠.٣٦%) وأخيرا عند درجة حرارة ٢٥°م (٢٦.٨%) ، وان أعلى نسبة وفيات تحدث في طور البيضة عند درجات الحرارة المختلفة.

عند دراسة تأثير اختلاف العوائل النباتية على تطور آكاروس العنكبوت ذو البقعتين عند تربيته على درجة حرارة ٢٥°م ، وجد أن الفول السوداني هو أفضل عائل لتطور آكاروس العنكبوت ذو البقعتين يليه الخيار وأخيرا الباذنجان، ويتضح ذلك من خلال طول فترة التطور حيث سجلت أقل فترة تطور على الفول السوداني ثم الخيار وأخيرا الباذنجان (٨.٠٨، ٩.٣١، ٩.٣٧ يوم ، على التوالي).

Seasonal incidence and Chemical Control of Land Snails in Pear Orchards at Alexandria Governorate

Eshra, E.H[1]., Y. Abobakr[1] and M. S. El-Shahaat[2]
(1) Plant Protection Research Institute, Agricultural Research Center, Egypt.
(2) Central Agricultural Pesticide Laboratory, Agricultural Research Center, Egypt.
Corresponding author: eheshra@yahoo.com

ABSTRACT: The seasonal abundance of three injurious land snail species, *Theba pisana* (Müller), *Helicella vestalis* (Pfeifer) and *Monacha obstructa* (Férussac) (Pulmonata: Helicida) on pear trees was monitored during two successive years from December 2012 up to or till November 2014 in AL-Amriah region at Alexandria Governorate. The results showed that the more or less higher means numbers of *T. pisana* were recorded during the elapsed period of March-Aug. in the first year and Feb.-July in the second one. More ever, the higher means numbers of *H. vestalis* and *M. obstructa* were recorded during the lasted periods of March-June and March-May respectively, in both following years. These data revealed that *T. pisana* was the most abundant snail in the inspected orchards during the experimental period. In concern to the performed chemical control, the obtained results exhibited the comparative higher and faster molluscicidal activity of methomyl and/or methomyl/boric acid and mixture against *T. pisana* than boric acid alone.
Key words: Land snails, Seasonal abundance, Chemical control, Pear orchard

INTRODUCTION

Land snails became one of the serious injurious animal- pests of a wide range of agricultural and horticultural crops in world wide which capable of extensively damaging plants including flowers, vegetables and some spherules and trees (Godan, 1983 and Speiser and Kistler, 2002). In Egypt, land snails have been dispersing in different localities especially in the northern governorates. These pests attack numerous orchard fruit trees, field and vegetable crops as well as ornamental plants and cause great damage to all plants in the northern costal belt (Kassab and Daoud, 1964; Bishara *et al*., 1968; EL-Okda, 1979; Hashem *et al*., 1992; El-Deeb *et al*., 1996; Abobakr, 1997; Eshra, 1997and 2004).

The terrestrial snails *Eobania vermiculata*, *Theba pisana*, *Helicella vestalis* and *Monacha obstructa* were recorded in many Egyptian Governorates attacking various plantations (EL-Okda, 1984; El-Wakill *et al*., 2000; Eshra, 2013). There are different methods for controlling these pests. In general, chemical control is one of the most effective methods against land snails, particularly over large areas (Moran *et al*., 2004; EL-Shahaat *et al*., 2005).The aim of the present study is devoted to monitor three occurring land snail populations and their chemical control in the pear orchards at Alexandria Governorate during two successive years.

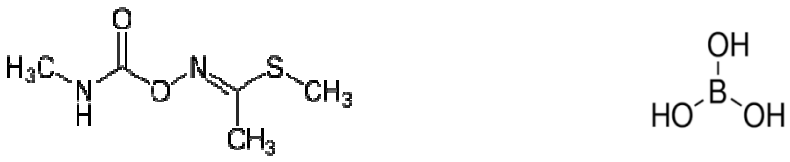
MATERIALS AND METHODS

Seasonal abundance of detected land snails in pear orchards: Survey and monitoring of existing land snails were conducted in a severely infested pear (*Pyrus communis*) orchard at AL-Amriah region, Alexandria Governorate during two successive years, from December 2012 till November 2014.

The established land snails in pear orchards were recorded. The land snail species were identified according to the terminology given by Godan (1983) and El-Okda (1984). The seasonal abundance of the three, more or less, dominant snail species was estimated by counting the collected snail individuals on 15 randomly marked pear trees (3 replicates, 5trees/each) as permanent sampling sites. Every month, land snail species were handly collected in the early morning from all parts of the tree and the area of surrounding soil. The prevailing monthly average temperatures and relative humidity percentages were obtained from the Egyptian Meteorological Authority (General Directorate for Scientific Research).

Chemical control : The initiated or achieved chemical control was performed against the white garden snail, *T. pisana* in a pear orchard at AL-Amriah region.

The evaluated treatments were applied as prepared baits using each of methomyl (s-methyl carbamoyl oxy thioacetamidate) as Lannate 90% SP and boric acid 99% (trihydroxid boron, H_3BO_3) as shown in Table (1) and Fig1.



(a) (b)

Figure(1): Chemical structure of methomyl (a) and boric acid (b).

Table (1): Local bait compositions (% w/w) for laboratory and field evaluation.

Bait	Laboratory Experiment				Field Experiment			
	Wheat bran	Sugar cane honey	Methomyl	Boric acid	Wheat bran	Sugar cane honey	Methomyl	Boric acid
Control	98	2	-	-	98	2	-	-
Methomyl	97	2	1	-	96	2	2	-
Boric acid	97	2	-	1	96	2	-	2
Methomyl-boric acid mixture	97	2	0.5	0.5	96	2	1	1

Adult snails of T .*pisana* were collected from AL-Amriah region and allowed to be acclimatized under laboratory condition for 2 weeks and fed only on bran bait. Healthy and active snails were chosen for the evaluation of tested baits. To evaluate each of the prepared baits, ten adult animals were placed in 1-letter glass jar, covered with cloth netting and secured with rubber band. Three replicates for each treatment were involved and dead animals were recorded daily up to 5 days. The check control treatment was performed pesticide-free wheat bran bait. The mortality percentage values were calculated according to Abbott (1925)

$$\text{Mortality\%} = (1 - \frac{\text{count of snails after treatment}}{\text{count of snails in check treatment}})\text{X}100$$

The results as LT_{50} values were statistically analyzed according to Finney (1971).

Field evaluation: For each bait treatment a quarter feddan cultivated with infested pear trees by *T. pisana* was exposed to bait application. For each bait treatment, four replicates of three pear trees were randomly chosen. In addition, untreated twelve trees were left as a check control. The treatments were distributed according to a complete randomized block design.

Baits were applied in heaps (100 g) on blue plastic sheets (25 × 25cm) in early morning on the damply soil (after four days from irrigation). The evaluated baits were renewed every 10 days. Numbers of snails on the trees and around them were estimated before treatment and after 1, 3, 7, 14 and 21 days of bait application according to Henderson and Tilitton (1955).The obtained results were statistically analyzed according to the method of Snedecor and Cochran (1967) and the differences between treatments were compared by $L.S.D_{0.05}$ measure.

RESULTS AND DISCUSSION

1-Sesonal abundance of land snails in pear orchards in AL-Amriah region.

Our obtained results revealed that three common land snail species, i.e., the White Garden Snail (WGS), *T. pisana (*Müller), the Small Sand Snail (SSS), *H. vestals* (Pfeifer) and the Clover Snail (CS), *M. obstructa* (Férussac) were found prevailing investigated pear orchard at AL-Amriah region, Alexandria Governorate. The fluctuating abundance of each species, on the examined pear fruit trees during both the successive years was investigated.

Data presented in Tables (2&3) indicated that the monthly estimated numerical densities of *T. pisana* (Müller), *H. vestalis* (Pfeifer) and *M. obstructa* (Férussac) on the trees of inspected pear orchard during the two subsequent years of 2012/2013&2013/2014 greatly varied according to the studied snail species, temperature, and relative humidity; and showed remarkable high or low fluctuating seasonal patterns. ***T****. pisana* snail was the dominant land snail species in pear orchards during the two following years, whereas its calculated general mean number comprised 120.6 snail/tree in the first year and 128.6 snail/tree in the second one. The results also indicated that *T. pisana* snail was the most abundant snail species. The highest counts of the snail (195 snails/tree) and (243.3 snails/tree) were recorded during May 2013 & 2014 in the first and second year, in respect, while its lowest counts were recorded in December 2012 in the first year (81.7 snails/tree) and in November 2014 in the second one (21.6 snails/tree) (Tables 2 and 3). *T. pisana* is distributed throughout the Mediterranean, as well as Atlantic Islands, Western Europe, southern Africa and Australia (Anonymous, 1982). It is considered a greatly damaging pest to a wide variety of fruits, vegetables, and ornamental plants in most of the areas of its distribution (Harpez and Oseri, 1961). In Australia, *T. pisana* is a significant pest of cereals (Baker, 1986). The snail was reported as a pest of seed alfalfa in France (Cairaschi and Lecomte, 1973). Furthermore, it is an intermediate host of significant parasites of cattle and sheep like the lung worm, *Muellerius capillaries* (Mueller), and many other nematodes (Baker, 1986).

The second abundant snail was *H. vestalis* was less abundant than T*. pisana* snail. Data in Tables (2 and 3) illustrate the numerical densities of *H. vestalis* on the inspected pear trees at Alexandria Governorate during the two consequent years. It was cleared that the determined infestation rate of pear trees by *H. vestalis* was high in the two subsequent years during spring months (March to June).The lowest mean number was recorded on pear trees during winter months (January and February) in the first year and September and November in the second one.

M. obstructa snail was, comparatively, the least abundant species on the pear trees where mean total number of the snails was 66.0 and 70.9 snails/tree in 2012/2013 and 2013/2014 respectively (Tables 2 &3). The highest counts of the snail were recorded in the spring months (March to May) in both years. Unlike the previous two species, the peak count was recorded in April in both years. Generally, *T. pisana* snail was the most abundant snail in the orchard of pear trees at AL-Amriah region during the two years of study followed by *H. vestalis* and *M. obstructa*.

The obtained results are in agreement with that reported by Bishra *et al.*(1968).They recorded *H. vestalis, T. pisana, Cochlicella acuta* and *Eobania vermiculata* in the northern delta (Alexandria and EL-Behera Governorates).The same species were recorded also by EL-Okda *et al.*(1980 and 1984) at Alexandria Governorate. Nakhla *et al.* (1993) reported that *E. vermiculata, H. vestalis, C. acuta*, and *T. pisana* were the prevailing land snails in banana orchards at EL-Behera Governorate. Eshra (2013) recorded five land snail species at Abees region in Alexandria Governorate on grape orchards including *E. vermiculata, T. pisana, H. vestalis, M.obstructa* and *Oxychillus alliarius* and three land snails, *T. pisana*, *H. vestalis* and *M. obstructa* on navel orange and apple trees in Kafr EL-Dwar center at EL-Behera Governorate.

Table(2): Monthly counted individuals of the detected common land snails species in pear orchard in AL-Amriah region at Alexandria Governorate during 2012-2013.

Month	Means Numbers of Snails Land Snails Species				Climate		
	T. pisana	*H. vestalis*	*M. obstructa*	Mean	Temperature		Humidity
					Max	Min.	
Dec. 2012	81.7^{d}	58.3^{de}	48.3^{def}	62.8^{ef}	22.1	7.1	74
Jan. 2013	96.7^{cd}	43.3^{e}	41.7^{f}	60.6^{f}	21.7	6.9	75
Feb.	101.7^{cd}	38.3^{e}	63.3^{cdef}	67.8^{def}	24.8	7.1	72
Mar.	130^{bcd}	80^{cd}	83.3^{bc}	97.8^{b}	30.5	9.3	70
April	161.7^{ab}	103.3^{b}	113.3^{a}	126.1^{a}	30.9	11.0	64
May	195^{a}	128.3^{a}	96.7^{ab}	140^{a}	32.1	16.1	70
June	128.3^{bcd}	85^{bc}	75^{bcd}	96.1^{bc}	32.4	21.4	73
July	136.7^{bc}	66.7^{cd}	51.7^{def}	85^{bcd}	31.2	21.8	69
Aug.	116.7^{bcd}	76.7^{cd}	45^{ef}	79.4^{cde}	32.6	20.3	72
Sep.	106.7^{cd}	60^{de}	41.7^{f}	69.4^{def}	33.6	18.4	68
Oct.	105^{cd}	80^{cd}	70^{cde}	85^{bcd}	30.3	14.6	66
Nov.	86.7^{d}	71.7^{cd}	61.7^{cdef}	73.3^{def}	27.5	12.3	76
Mean	120.6^{a}	74.3^{b}	66^{c}				

Values with similar superscript (s) are not significantly different at (P< .05)

Table (3): Monthly counted individuals of the inspected common land snails species in pear orchard in AL-Amriah locality at Alexandria Governorate during season of 2013-2014.

Month	Mean Numbers of Snails Land Snails Species				Climate		
	T. pisana	*H. vestalis*	*M. obstructa*	Mean	Temperature		Humidity
					Max.	Min.	
Dec. 2013	105^{fg}	73.3^{def}	61.7^{de}	80.0^{d}	24.6	6.8	73
Jan. 2014	84.3^{g}	77.7^{de}	73.3^{cd}	80.6^{d}	21.2	6.4	80
Feb.	123.3^{ef}	85.0^{cd}	90.0^{c}	99.4^{c}	24.1	8.0	75
Mar.	163.3^{cd}	108.3^{bc}	111.7^{b}	127.8^{b}	29.0	9.5	70
April.	206.7^{b}	131.7^{ab}	138.3^{a}	158.9^{a}	33.4	11.9	67
May.	243.3^{a}	156.7^{a}	110.0^{b}	170.0^{a}	34.2	12.8	70
June	198.3^{bc}	130.0^{ab}	81.7^{c}	136.7^{b}	34.8	21.3	71
July	143.3^{de}	123.3^{b}	60.0^{def}	108.9^{c}	32.3	20.5	73
Aug.	96.7^{fg}	71.7^{def}	45.0^{efg}	71.1^{de}	33.7	18.5	69
Sep.	70.0^{g}	45.0^{f}	30.0^{g}	48.3^{f}	32.6	17.6	72
Oct.	78.3^{g}	55.0^{ef}	43.3^{fg}	58.9^{ef}	28.7	12.3	70
Nov.	21.7^{h}	10.0^{g}	6.7^{h}	12.8^{g}	27.0	17.0	73
Mean	128.61^{a}	88.75^{b}	70.97^{c}				

Values with similar superscripts are not significantly different.

2- Chemical control

`The problems caused by terrestrial snails, particularly the white garden snail (WGS), *T. pisana*, have remarkedly increased, as illustrated by the 70-fold increase of molluscicide usage over the last 30 years. These gastropods are a serious pest of worldwide economic importance (South, 1992) as they have adapted well to the various environments to which they have been introduced around the world.

Tables (4 and 5) and Figure (2) show the results of made laboratory and field evaluations of the molluscicidal activity of methomyl, boric acid, and their mixture against the (WGS) *T. pisana*. It was indicated that methomyl and / or methomyl/boric acid mixture were more toxic than boric acid, whereas the deduced mortality percentages for methomyl and for its mixture with boric acid were higher than that assigned for boric acid alone at all intervals of experimental period. In the laboratory evaluation, the calculated median lethal time (LT_{50}) values of (2.1days) for methomyl and (1.7 days) for methomyl/boric acid mixture indicated that both of them were significantly more rapid in killing snails than in baits of boric acid alone (9.2 days).

The molluscidal efficacy of the laboratory tested baits was also evaluated in pear orchard as shown in Table (5). The reduction percentage values of the mature specimens of (WGS) snail amounted to 31.2, 53.8, 68.3 and 79.3 after 3,7,14, and 21 days with methomyl bait, respectively. While, these % values of infestation reduction comprised 15.9, 23.0, 34.2 and 46.7 with boric acid bait treatment. Referring to tested bait of methomyl-boric acid, the recorded % values of infestation reduction were 41.1, 72.05, 80.2 and 88.7 after 3,7,14 and 21days, respectively. The highest toxic molluscidal effect expressed as general mean of the all evaluated baits was detected after 14 days (60.02%) and 21 days (71.18%). Moreover, the highest determined toxic effect according to the calculated general mean values of infestation reduction

showed that the highest toxic influence was 57.12% with the mixed chemicals of 3rd bait, while the lowest effect is related to boric acid bait (25.41%) (Table, 5).

Edible toxic baits are the most important way of delivery of molluscicides in terrestrial gastropod control programmes (Bailey, 2002). Miller *et al*. (1988) performed laboratory and field cage tests to evaluate the toxicities of some molluscicides against *T. pisana*. of 19 commercial bait formulations tested, Deadline Bullets, 4% metaldehyde bait and Slug-Geta, 2% methiocarb bait were the most effective.

Table (4): Efficiency of laboratory evaluated methomyl and boric acid baits against *Theba pisana*.

Treatment	Mortality (%) at different intervals (Days)					Probit analysis			
	1	2	3	4	5	LT_{50} (Day)	95% Fiducial Limits (Days)		Slope ± SE
							Lower	Upper	
Methomyl	15.0±0.0	41.7±4.7	68.3±2.3	88.3±4.7	98.3±2.3	2.1[b*]	1.6	2.5	3.97±0.3
Boric acid	1.0±0.0	4.3±0.33	7.7±6.7	14.3±0.83	27.7±1.3	9.2[a]	7.0	16.5	2.65± 0.5
Methomyl +Boric cid	23.3±1.7	55±0.0	78.3±1.7	88.3±1.7	99±1.0	1.7b	1.6	1.9	3.4±0.27

*Values with similar superscripts are not significantly different.

Table (5):Toxic efficiency of field evaluated of prepared baits against *Theba pisana* snails in pear orchard in El-Amryah at Alexandria Governorate

Treatments		% Reduction					General Mean
		1 days	3days	7days	14 days	21 days	
Lannate	X±SD	13.5±2.1 e*	31.2±3.7 d	53.8±5.07 c	68.3±5.09 b	79.3±1.8 a	49.21 b
	$L.S.D_{0.05}$			5.79			
Boric acid	X±SD	7.2±4.4 e	15.9±4.6 d	23.0±5.8 c	34.2±2.2 b	46.7±2.9 a	25.41 c
	$L.S.D_{0.05}$			5.59			
Lannate+ Boric acid	X±SD	17.3±2.9 d	41.1±1.5 c	72.05±5.5 b	80.2±3.7 ab	88.7±3.00 a	57.12 a
	$L.S.D_{0.05}$			5.96			
General Mean		12.6 e	26.9 d	48.7 c	60.02 b	71.18 a	
$L.S.D_{0.05}$				3.57			2.63

*Values with similar superscripts are not significantly different.

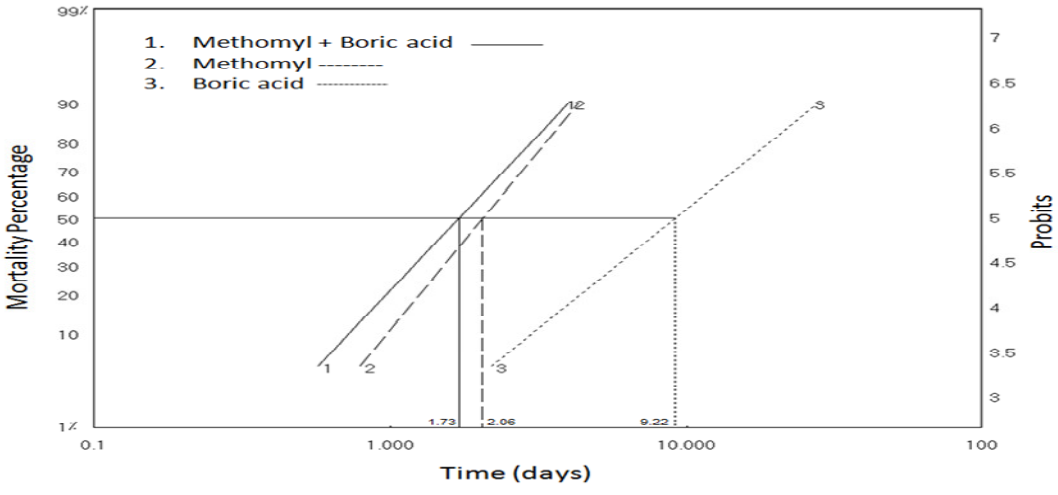


Figure (2) :Toxicity lines and median lethal times (LT_{50}) of methomyl, boric acid, and their mixture against *Theba pisana* under laboratory condition.

The high molluscicidal activity of methomyl bait was confirmed by many investigators (Radwan *et al*., 1992; EL-Shahaat *et al*., 2005; Eshra, 2013). Moreover, referring to that reported before, boric acid and sodium borate are pesticides since 1948 for controlling of many insects by acting as a stomach poison affecting the insects' metabolism, besides its dry powder is abrasive to the insect exoskeleton (Wong *et al*., 1964; Weir and Fisher, 1972; Reigart and Roberts, 1999). The present study proved that boric acid could not be used alone as molluscicide to control the terrestrial snail *T. pisana*. However, it could be mixed with methomyl to increase its efficacy and shorten the time of its molluscicidal action.

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الملخص العربى

معدل التواجد الموسمى والمكافحة الكيميائية للقواقع الارضية في حدائق الكمثرى في محافظة الاسكندرية

السيد حسن عشره[١]، ياسر أبو بكر[١]، محمد سعيد الشحات[٢]

(١) معهد بحوث وقاية النباتات – مركز البحوث الزراعية– مصر.

(٢) المعمل المركزي للمبيدات– مركز البحوث الزراعية– مصر.

تم دراسة التعداد الموسمي لثلاثة انواع من القواقع الأرضية هي قوقع الحدائق الابيض *Theba pisana* (Müller) ، وقوقع الرمال الصغير *Helicella vestalis* (Pfeifer) وقوقع البرسيم *Monacha obstructa* (Férussac) والتى تتبع رتبة Pulmonata وعائلة Helicidae والتى تصيب أشجار الكمثرى على موسمين متتالين خلال الفتره من ديسمبر ٢٠١٢ حتى نوفمبر ٢٠١٤ فى منطقة العامرية بمحافظة الأسكندرية. أوضحت النتائج أن أعلى تعداد للنوع *T. Pisana* سجل خلال الفتره من مارس–أغسطس فى العام الاول وخلال فترة فبراير– يوليو فى العام الثانى من الدراسة. وكان أعلى تعداد للنوعين *H.vestalis* و *M.obstructa* خلال فتره مارس– يونيووخلال فتره مارس– مايو على الترتيب خلال عامى الدراسة. وقد أوضحت النتائج أن *T. pisana* كان القوقع الاغلب وجودا خلال فترة الدراسة .كذلك أوضحت النتائج ان كلا من الطعوم المجهزة من مبيد ميثوميل أو مخلوط الميثوميل مع حمض البوريك قد أظهر أعلى وأسرع كفاءة إبادية ضد قوقع *T. pisana* مقارنه باستخدام الطعم المجهز من حمض البوريك بمفرده .

GIS-Forecasted Surface Hydrology for Reducing Risks of Food Production (Northern West Coast, Egypt)

Abd El-Hady A.M.[1], Aggag A.M.[2], Abdelaty E.F.[3] , Bahnassy M.H.[4]
1, 2, 3:Prof. , Assoc.Prof. and Lecturer, Dept. Natu. Res. & Agric. Eng., Fac. Agric., Damanhour Univ. 4:Prof. Soil&Water, Fac.Agric.Alex.univ. (Egypt)
(www.damanhour.edu.eg)
Corresponding author: A.M. Abd El-Hady, hadyhady200@damanhour.edu.eg

ABSTRACT: The North Western Coastal Region (NWCR) of Egypt is one of the most promising areas for agricultural development. It extends from Alexandria in the east to Sallum in the west with about 500 km width and 40 km depth. It located between longitude of (29º 50' 00'' E and 25º 10' 00''E) and latitude (30º 50' 00'' N and 31º 10' 00''N). The study area (El-Dabaa) covers an area of approximately 60490 hectare. It extends from 606259 E to 651072 E and from 3437982 N to 3416473 N. The area is bounded on the north by the Alex-Matrouh road and on the south by Elgesh road.Four 1:50000 scaled-topographic maps covering the study area were digitized. The watersheds of El-Dabaa studied area that were derived from the digital elevation model (DEM) consist of fourteen basins having area ranged between 8.6 km^2 to 136.8 km^2. Stream networks showed twenty eight net outlets that localized the recommended twenty eight reservoirs of rain water. Flow accumulation map indicated that the studied region has large seven-flow accumulation that have the direction from south to north. The posted accumulated flow data were used to calculate the twenty eight reservoirs water capacity by being integrated with (a) slope gradient, (b) forecasted mean precipitation rate of the future climate period (2011-2030), and (c) surface runoff coefficient. The results referred the averaged harvested water may have a maximal (278828 m^3/year) and minimal values (18992 m^3/year). In addition, results indicated that the construction of these twenty eight water reservoirs may supply the population by 2604325 m^3/year for each year of the future period (2011-2030).Results of forecasted crops net irrigation water requirements of the future period (2011-2030), showed clearly that alfalfa needs largest one (1275 mm/year), while barley requires the smallest water requirements (247 mm/season). Furthermore, sorghum and wheat net irrigation water requirements may be 330 and 250 (mm /season), respectively.The compiling of forecasted net irrigation water requirements with that of harvested water reservoirs was conducted to calculate the total optional planting areas of the dominated crops. Alfalfa may be yearly planted over an area 6397.55 feddans. Other, optional planting areas may be 1535.93, 2027.42, and 2052.08 (feddans/season) for sorghum, wheat and barley, respectively.The number of cattle and sheep that can be grazed on irrigated harvested water-barley was calculated to assess land potential grazing capacity. Grazing capacity of the twenty eight locations has ranged between 75 to 1099 and 299 to 4396, for cattle and sheep, respectively. Grazing capacity has its min. and max.,surrounding reservoir no.26 and no.7, respectively. Finally, the yearly optional grazing capacity, through the future period (2011-2030), was expressed by two values;10264 cattle and 41058 sheep.

Keywords: Northern West Coast, Egypt - El-Dabaa - watersheds - net outlets - flow accumulation forecasted crops - irrigation water requirements - land potential grazing capacity

INTRODUCTION

Climate is a vital natural resource to our well-being, health and prosperity. The information gathered, managed and analyzed helps decision-makers and users to plan and adapt their activities and projects for the expected conditions. In

this way, decisions may be taken in planning which reduce risks and optimize socio-economic benefits (Fildes and Kourentzes, 2015). They designed the scientific approach of forecasting the climate changes. International Research Institute for Climate and Society (2015) has output numerous models to forecast climate parameters, such as seasonal precipitation, seasonal temperature and temperature anomaly.

Rain Water Harvesting.org (2015) defined water harvest as capturing rain where it falls or capturing the run off in your own village or town. In addition, taking measures to keep that water clean by disallow polluting activities to take place in the catchment. It can serve to provide drinking and irrigation water, increase groundwater recharge, and to reduce storm water and urban floods.

Hamid *et al*. (2009) designed RS and GIS for decision support system to determine preference sites for water harvest at Eastern Nile locality - Sudan. This model had the objective to conserve water and avoid the floods. This idea of integrated RS and GIS was applied by numerous researches. Weerasinghe *et al*. (2011) used the assessment of several water related environmental challenges such as soil erosion, degradation of land by water logging, ground and surface water contamination, and ecosystem. They provided evidence for successful catchment management including reservoir system management, irrigation scheduling and risk management.

Ministry of Water Resources and Irrigation (2013) proposed the strategy of improving water harvesting. They reported that a big chance for storing increasing amounts of the rain falling by developing and improving traditional methods and introducing modern storing methods. Improve water-harvesting systems by Introducing geographic system for surveying the areas good for applying different water harvesting methods according to the nature of every area. Improving the storing rain water in sand lands like the Northeastern Coast and west of the Northwestern Coast (Brani-Al-Sallum) by selecting soil treatment materials to increase surface flow rate. They also informed that the analysis of meteorological data and the land's topographic study and the soil composition to set the appropriate models for rain water harvesting.

The main objective of this research is to present technological breakthroughs to reduce risks of food production relating to climate changes. So, a decision making supporting agro-system was built basing on the following parameters:

a- determination the location and capacity of water harvest reservoirs,
b- forecasting of crop evapotranspiration (ET_c),
c- determination of plantation area by rain water harvest and
d- determination of land potential grazing capacity.

MATERIALS AND METHODS

The North Western Coastal Region (NWCR) of Egypt is one of the most promising areas for agricultural development. It extends from Alexandria in the east to Sallum in the west with about 500 km width and 40 km depth. It is located between longitude of (29º 50' 00'' E and 25º 10' 00''E) and latitude of (30º 50' 00'' N and 31º 10' 00''N). The study area (El-Dabaa) covers an area of approximately 60490 hectares. It extends from 606259 E to 651072 E and from 3437982 N to 3416473 N (Fig., 1). The area is bounded to the north by the Alex-Matrouh road and on the south by Elgesh road.

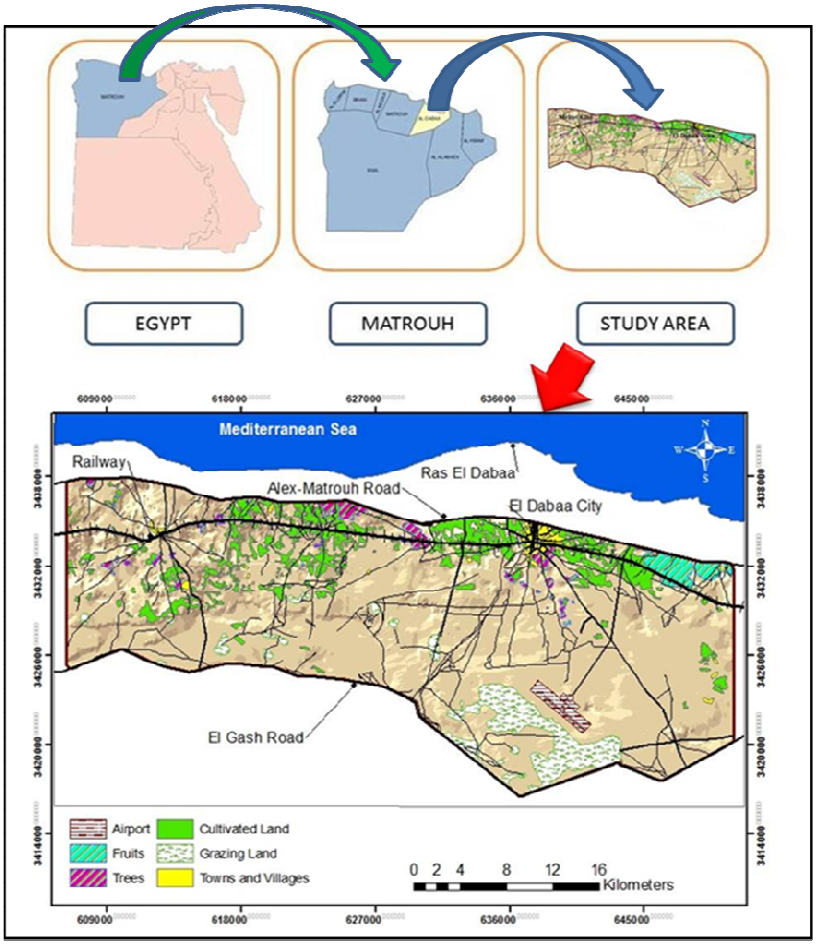

Fig. (1). Studied area (El-Dabaa) (606259 E to 651072 E and 3437982 N to 3416473 N)

The current study was elaborated through four interrelated and independent phases as follows:

(1) Digitizing of the topographic maps: Four 1:50,000 scaled-topographic maps covering the studied area were digitized and clipping to create the mosaic of the studied region. The coordinate was converted from the geographic coordinates (Lat.–Long.) system to Universal Transverse Mercator (UTM) coordinates system ArcMap 10.0 (2010) .Then the maps were registered by ENVI 4.5 (2008) and IAO (2010).

(2) GIS- geomorphological mapping: Digital Elevation Model (DEM) was derived from contour lines and spot heights were utilized by contour gridder extension under Arc View to create DEM with15x15 m spatial resolution. This DEM was conduct to a preliminary understanding of the geomorphology, and derivation of the drainage network. Slope gradient and slope aspects were derived from (DEM) to be classified as illustrated in Table (1), and Figure (2).

Table (1): Classes of gradient slope.

No.	Slope Class	Slope %	No.	Slope Class	Slope%
1	Flat	0.0 - 0.5	5	Moderately sloping	10 – 15
2	Nearly level	0.5 -1	6	Strongly sloping	15 – 30
3	Gently slope	1-5	7	Steep	30 – 60
4	Sloping	5 – 10	8	Very steep	> 60

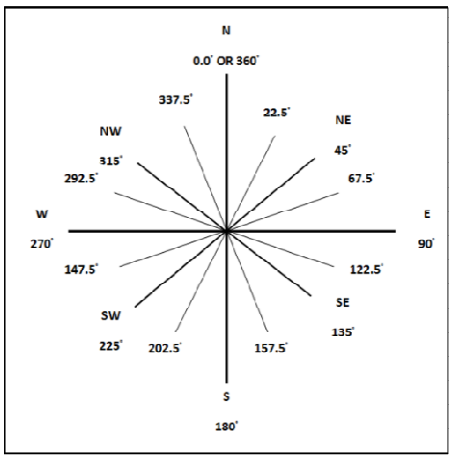

Fig. (2): Slope aspects classes and their Azimuth ranges.

(3) GIS - mapping of the surface hydrology: The surface hydrological outputs were obtained by running of (ArcGIS 10.0, 2010); watersheds (drainage basins and streams, and flow accumulation).

(4) Design supporting system of agricultural decision making: The system was built by integration of the following parameters (a) GIS-forecasted agroclimatic data of future period (2011-2030), (b) determination of location and capacity of

basins reservoirs harvested water, (c) calculation of harvested water product, (d) calculation the optional planting areas of the dominated crops and (e) determination of potential grazing capacity.

(a) Forecasting Agroclimatic Data of future period (2011-2030): Agroclimatic data of future period (2011-2030) were forecasted (AbdEl-Hady *et al*, 2014) by applying time series statistical analysis (Fathony *et al*, 2009; ABS, 2011; Coghlan, 2015 a and b) on agroclimatic data of the baseline period (1973-2010) Mersa Matruh, Egypt weather station. The potential evapotranspiration (ET_0) were determined by using CropWat 8.0 application (FAO, 2009). Crop water requirements for the dominate growing crops was calculated using crop factor (K_c) for each crop (Allen *et al*., 1998; Al-Najar, 2011).

(b) Determination of location and capacity of basins reservoirs harvested Water: Determination the location and capacity of basins reservoirs conducted to calculate harvested water reservoirs capacity at outlet grid cells as:

$$HWRC = P_{max} \times R \times N \times S$$

where:

HWRC = Harvested water reservoirs capacity (m^3/year)

P_{max} = maximum annual precipitation (m/year) of the future agroclimatic data (2011-2030),

R = factor of runoff adjusted,

S = surface area of outlet grid cell (m^2) and

N = number of accumulative cells of outlet.

Where N= (number of accumulative cells at the well) – (sum number of accumulative cells at the wells before it on the same stream line)

(c) Calculation of harvested water product:

$$HWP = P_{mean} \times R \times N \times S$$

where:

HWP = product of harvested water (m^3/year)

P_{mean} = mean annual precipitation (m/ year) of the future agroclimatic data (2011-2030); R , N and S are as noted above.

(d) Calculation the optional planting areas of the dominated crops: The compiling of forecasted net water requirements and harvested water reservoirs were used to calculate the total optional planting areas of the dominated crops; alfalfa, sorghum, wheat and barley.

(e) Determination of potential grazing Capacity: A common rule for estimating a properties potential carrying capacity or potential stocking rate. Potential stocking rate (head/ha) = [(Annual rainfall mm – 250) x 1.3] / 25 (Attwood, 2007). It was difficult to apply this equation, hence the annual precipitation of the studied area generally less than 250 mm/year. Thus, grazing capacity was expressed by the number of cattle and sheep.

RESULTS

(1) GIS- geomorphological characterization of the studied region:

The GIS-geomorphological characterization of the studied region was elaborated through the steps of:

a- Digitizing and Clipping; Four 1:50000 scaled-topographic maps of covering the study area were digitized using on the screen. Then, the area studied was clipped according its coordinates 606259 E to 651072 E and 3437982 N to 3416473 N (Fig., 2). The figure showed that the studied area that extends from Alexandria-Matrouh desert road at the north to Elgesh road has the following themes; cultivated land, fruits, trees and grazing land.

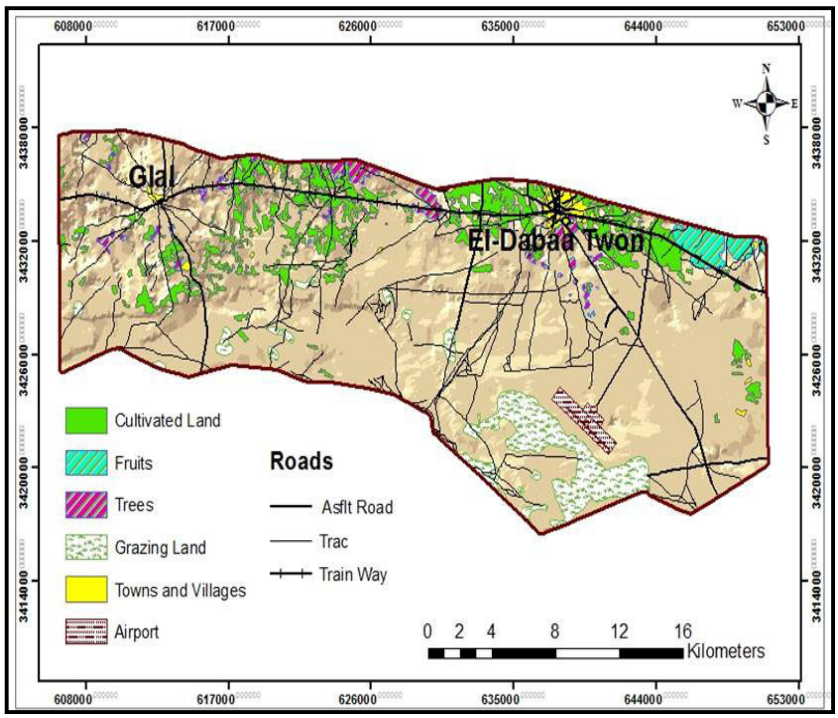

Fig. (2). Clipping of El-Dabaa area, Western North Coast, region, Egypt Coordinates: 606259 E to 651072 E and 3437982 N to 3416473 N.

b- Digital Elevation Model (DEM): The digital elevation model (DEM) was displayed in Fig. (3). The figure showed that the elevation ranges from 10 m to 80 m Above Sea Level (A.S.L). The dominant elevation class that has a percent of 22.1% of the studied area ranges from 30 to 40 m A.S.L. About 2.3% the region has an elevation ranges from 10 m to 20 m A.S.L. (Table 2) to present the elevation class of the smallest area.

c- Slope gradients: Slope gradients were derived from the digital elevation model (DEM) as shown in Figure (3) and Table (2). The table illustrated that the studied area were practically divided into three slope gradient classes (FAO, 1990) that ranges from flat slope class (0.0 - 0.5%) to gently slope class (1 - 5%) with an area of 83.3% and 6.1%, respectively. This indicated clearly that the majority of the studied area suited in the sloping class of flat that representing 83.3% of the area. The figure guided to determine the location of the interceptor drains. These drains are located across the direction of water flow at or near the interface where sloping land meets the flats (Fig., 3) as effective means of water harvest.

Table (2): DEM classes and area percentage of the studied area.

No.	Elevation (m)	%	No.	Elevation (m)	%
1	10-20	2.3	5	50-60	19.2
2	20-30	10.6	6	60-70	15.4
3	30-40	22.1	7	70-80	11.7
4	40-50	18.7			

d- Slope aspect: Aspect was interpolated from DEM to illustrate the main slope directions (Fig. 3). The attributed aspect direction data (Table 3) indicated that the dominant aspect classes are of northeast, north and east. They represented an area of 64.5% of the studied region.

Table (3): Slope gradient classes.

No.	Slope Gradient (%)	Slope Gradient Classes	Area (%)	No.	Slope Gradient %	lope Gradient Classes	Area (%)
1	0.0 - 0.5	Flat	83.3	4	5 – 10	Sloping	0.1
2	0.5 – 1.0	Nearly level	10.5	5	10 – 15	Moderately sloping	0.0005
3	1 – 5	Gently slope	6.1	6	15-30	Strongly sloping	

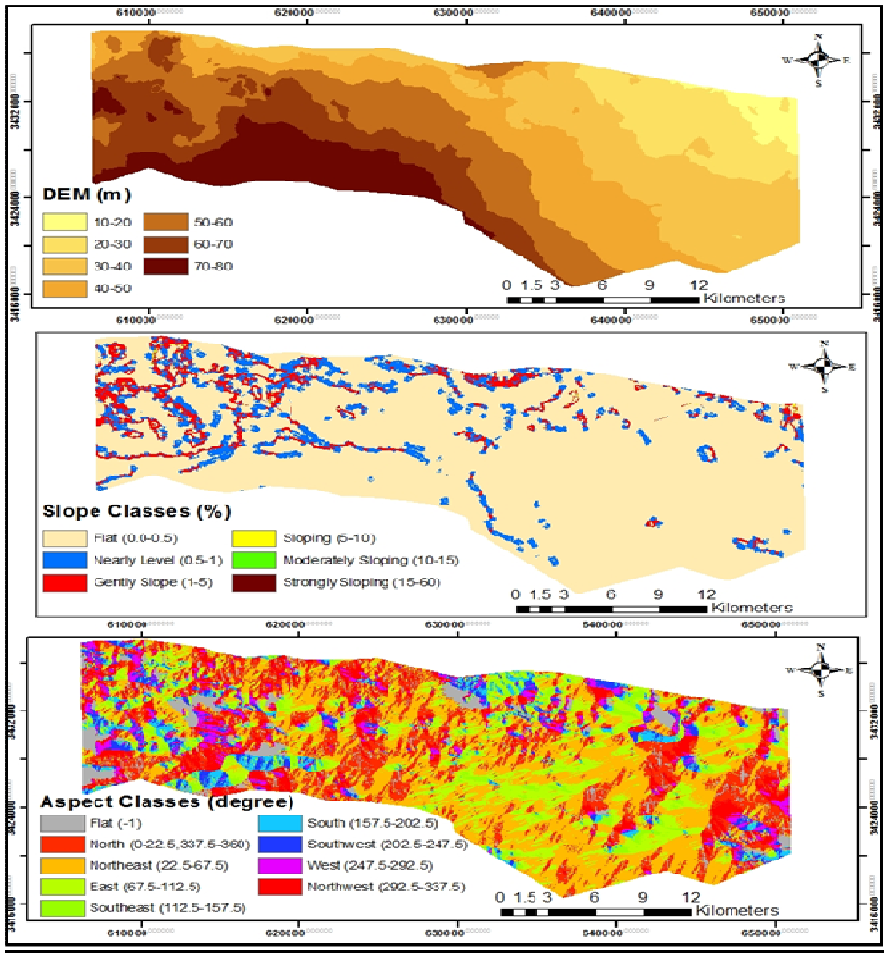

Fig. (3). Geomorphological features, digital elevation model (DEM), gradient and aspects maps

GIS- study of the surface hydrology:

a- Watersheds were derived from the digital elevation model (DEM), Fig (4). The figure illustrated that the watersheds of El-Dabaa studied area are distributed through fourteen basins that have an area ranged between 8.6 km^2 (basin, 11) to 136.8 km^2 (basin, 4), Table (4).

Table (4): Attributed data of aspect directions.

No.	Direction	%	No.	Direction	%
1	Flat	6.5	6	South	4.4
2	North	18.4	7	Southwest	4.2
3	Northeast	32	8	West	4.9
4	East	14.1	9	Northwest	9.6
5	Southeast	5.9			

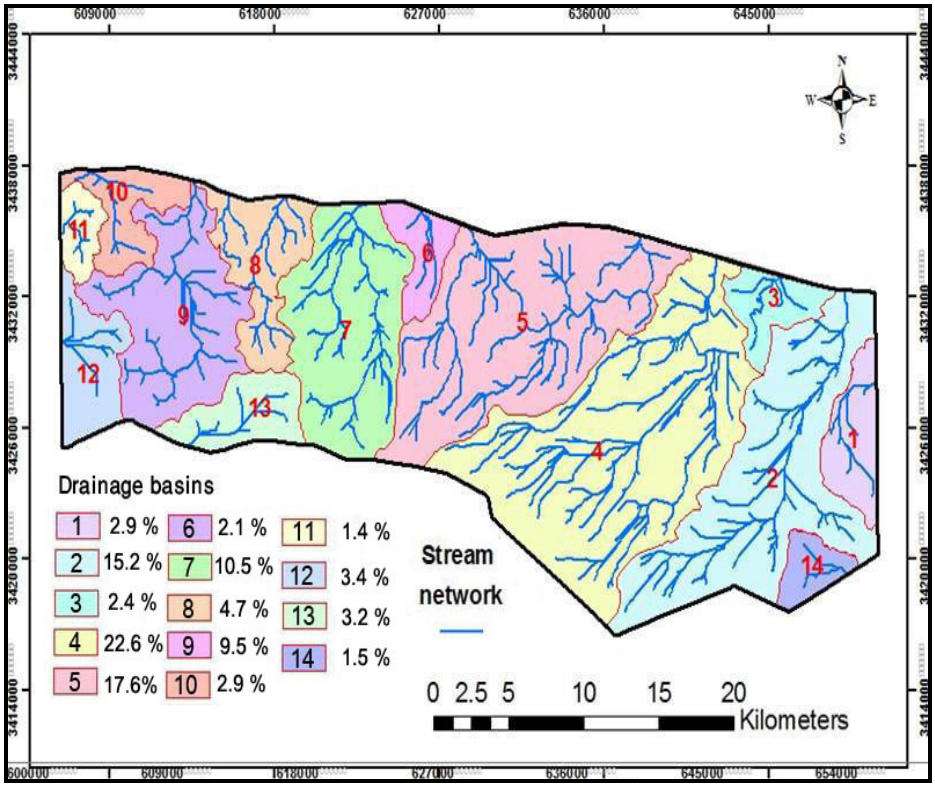

Fig. (4). Watersheds of the studied area; drainage basins and streams.

Table (5): Area of watershed basins.

Basin No.	Km^2	Area %	Basin No.	Km^2	Area %
1	17.4	2.9	8	28.7	4.7
2	92.0	15.2	9	57.7	9.5
3	14.6	2.4	10	17.6	2.9
4	136.8	22.6	11	8.6	1.4
5	106.2	17.6	12	20.8	3.4
6	12.5	2.1	13	19.3	3.2
7	63.4	10.5	14	9.3	1.5

b- Flow Accumulation: The figure of flow accumulation (Fig. 5) indicated that the studied region has large seven flow accumulation that have the direction from south to north. This map provided accumulated flow data that were latter used to determine the location and water capacity of the reservoir basins.

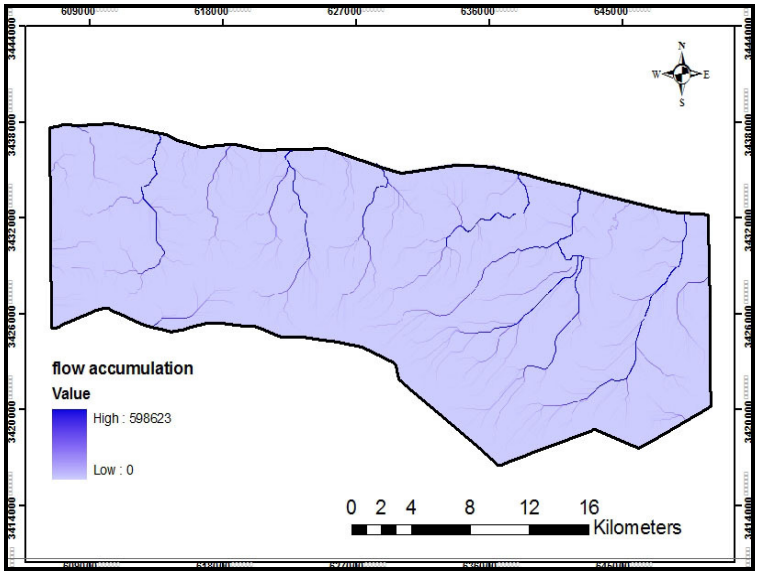

Fig (5). Flow accumulation of El-Dabaa studied area

(3) Design supporting system of agricultural decision making:

a- GIS-forecasted agroclimatic data of future period (2011-2030):

The agroclimatic data; average temperature, monthly precipitation rate and potential evapotranspiration (ET_0) were forecasted (Abd El-Hady *et al*, 2014) to calculate the net irrigation of water of the dominate crops. The area will be climatically characterized, in the future period of (2011-2030) by 20.66 ºC, 13.46 mm and 87.7 mm for temperature, monthly precipitation and potential evapotranspiration (ET_0), respectively.

b- Location and capacity of harvested rainwater reservoir:

Location and capacity of harvested rainwater reservoir determined according to output data of stream network (Fig. 6). The figure showed that the area has twenty eight locations that were suitable to build harvested water reservoirs that were defined by their number and coordinates (Table 6). The figure also indicated that drainage basins had a different area and number of harvested water reservoirs. Drainage basin no.4 had the largest area (136.8 Km^2) to contain five suitable water reservoirs locations (no. 6, 7, 8, 9 and 10). Four water reservoirs locations (no.11, 12, 13 and 14) were located in the drainage basin (no. 5). Three water reservoirs location were localized in the each basins of no. 7 and 9. These reservoirs have the numbers (16, 17and 18) and (21, 22 and 23), respectively. Two reservoirs can be built in the basin (no.8). Finally each of the remaining basins contains only a location of harvested water reservoir.

Table (6): GIS- recommended harvested water reservoirs locations

Basin No.	Recommended Harvested Water Reservoirs			Basin No.	Recommended Harvested Water Reservoirs		
	No.	Coordinates E	N		No.	Coordinates E	N
1	1	650549	3427969	6	15	626142	3435731
	2	649243	3432279		16	622966	3436262
2	3	647726	3427727	7	17	623578	3430889
	4	645357	3421879		18	621071	3432334
3	5	645673	3432995	8	19	618611	3436606
	6	642161	3433827		20	617276	3432045
	7	640677	3430403		21	613453	3437341
4	8	639932	3422567	9	22	612549	3433276
	9	638067	3425475		23	613452	3430442
	10	632069	3426033	10	24	607828	3437808
	11	638007	3434731	11	25	606493	3435005
5	12	632965	3430656	12	26	606395	3429977
	13	628406	3435273	13	27	613258	3425165
	14	627432	3431043	14	28	648912	3419589

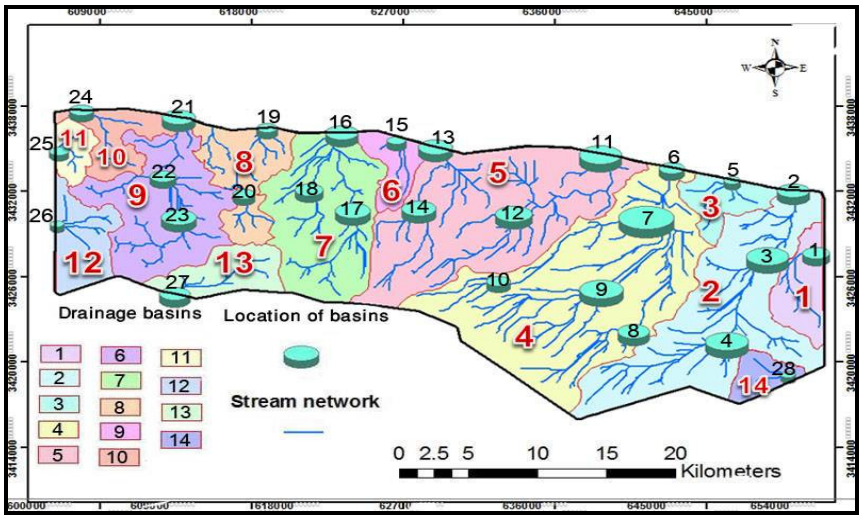

Fig. (6): Basins (red number) and location of water reservoirs (black number).

The capacity of the twenty eight water reservoirs was determined by based on (a) number of accumulative cells, (b) slope gradient, (c) maximum precipitation rate of the future climate period and (d) run coefficient (Table 6 and Fig. 7). The table referred to the construction of water reservoir at the location 7 (large one) may harvest 278828 m^3/year. The descriptive statics indicated that the construction of these twenty eight water reservoirs may supply the population by 2604325 m^3/year (more than two millions m^3 of water).

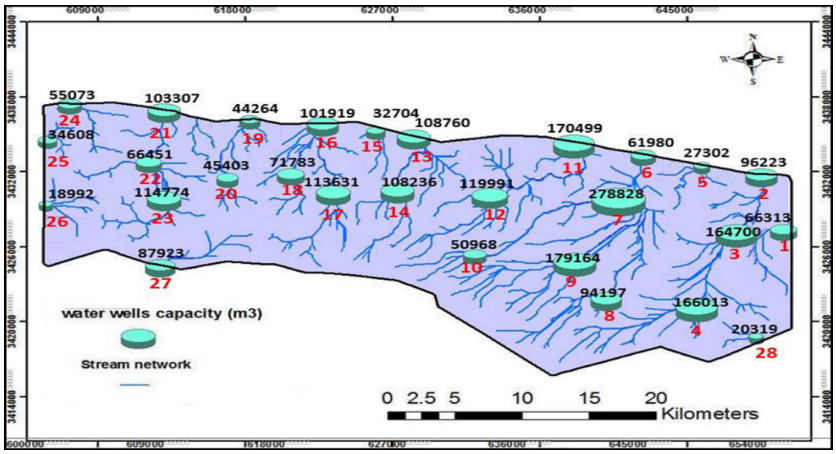

Fig. (7). Water reservoirs capacity (m^3/year) for the future climate period (2011 -2030).

c- Calculation of harvested water product:

The integration of the averaged mean annual precipitation, output data of water streams and slope gradient map, led to calculate the harvested water product of each reservoir (Table 7). The table illustrated that maximal (227917 m^3/year) and minimal (15524 m^3/year) will be collected in reservoir no.7 (basin no. 4) and reservoir no.26 (basin no. 14), respectively. The global annual harvest water product, for each year of the future period (2011-3030), may be 2604325 m^3 (more than two millions m^3 of water).

Table (7): Water reservoirs capacity (m^3/year) and harvested water product of the future climate period (2011 -2030)

Basin No.	water reservoirs No.	Water Reservoirs Capacity (m^3/year)	Harvested Water Product (m^3/year)	Basin No.	water reservoirs No.	Water Reservoirs Capacity (m^3/year)	Harvested Water Product (m^3/year)
1	1	66313	54205	6	15	32704	26733
	2	96223	78654		16	101919	83310
2	3	164700	134628	7	17	113631	92884
	4	166013	135701		18	71783	58677
3	5	27302	22317	8	19	44264	36182
	6	61980	50663		20	45403	37113
	7	278828	227917		21	103307	84444
4	8	94197	76998	9	22	66451	54318
	9	179164	146451		23	114774	93818
	10	50968	41662	10	24	55073	45018
	11	170499	139368	11	25	34608	28289
5	12	119991	98082	12	26	18992	15524
	13	108760	88902	13	27	87923	71870
	14	108236	88473	14	28	20319	16609

(d) Calculation of the optional planting areas of the dominate crops:

Results of forecasting crops water requirements showed clearly that alfalfa needs largest one (1275 mm/year), meanwhile the barley crop was had smallest water requirements (247 mm/season). Wheat and sorghum requires less irrigation water; 250 and 330 mm/season, respectively (Table 8).

Table (8): Forecasted crop water requirements (CWR), mm/season.

Crop	Alfalfa	Sorghum	Wheat	Barley	Maize
CWR	1275	330	250	247	360

The determination of the optional area of the crops was based on (a) crops water requirements and (b) capacity of water reservoir which calculated by mean precipitation rate of the future climate period (Table 9). The results generally indicated that larger area could be planted by wheat and barley than alfalfa and sorghum. It is recommended rejecting the option of alfalfa plantation because they needs large water requirements. The data concluded that the optional planting areas may be 1535.9, 2027.4, and 2052.1 (feddans/season) for sorghum, wheat and barley, respectively (Fig. 8).

Table (9): The optional planting areas of the dominant crops on the recommended rainwater reservoirs.*

Water Reservoirs No.	Crop Area (fed.)				Water Reservoirs No.	Crop Area (fed.)			
	Alfalfa	Sorghum	Wheat	Barley		Alfalfa	Sorghum	Wheat	Barley
1	10.12	39.11	51.62	52.25	15	4.99	19.29	25.46	25.77
2	14.69	56.75	74.91	75.82	16	15.56	60.11	79.34	80.31
3	25.14	97.13	128.22	129.77	17	17.35	67.02	88.46	89.54
4	25.34	97.91	129.24	130.81	18	10.96	42.34	55.88	56.56
5	4.17	16.1	21.25	21.51	19	6.76	26.11	34.46	34.88
6	9.46	36.55	48.25	48.84	20	6.93	26.78	35.35	35.78
7	42.56	164.44	217.06	219.7	21	15.77	60.93	80.42	81.4
8	14.38	55.55	73.33	74.22	22	10.14	39.19	51.73	52.36
9	27.35	105.66	139.48	141.17	23	17.52	67.69	89.35	90.44
10	7.78	30.06	39.68	40.16	24	8.41	32.48	42.87	43.4
11	26.03	100.55	132.73	134.34	25	5.28	20.41	26.94	27.27
12	18.32	70.77	93.41	94.55	26	2.9	11.2	14.78	14.96
13	16.6	64.14	84.67	85.7	27	13.42	51.85	68.45	69.28
14	16.52	63.83	84.26	85.28	28	3.1	11.98	15.82	16.01
		Total				397.6	1535.9	2027.4	2052.1

*Leaching fraction and efficiencies were not considered, Feddan = 4200 m^2

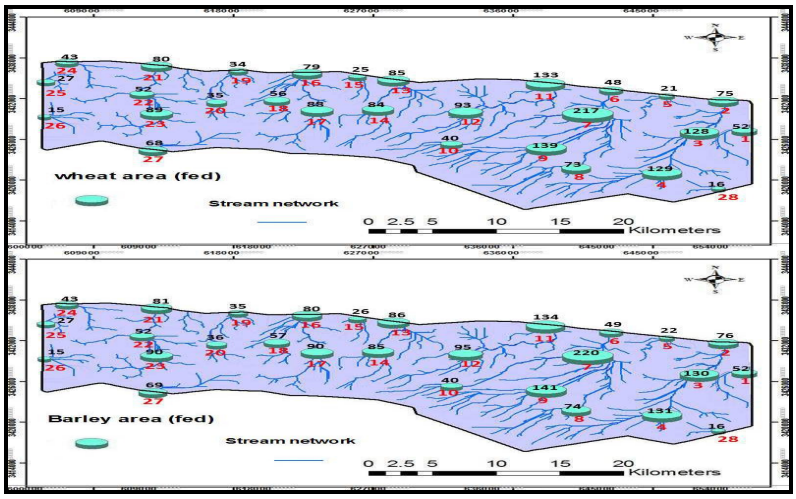

Fig. (8-a). Wheat and barley plantation area (2011-2030) using forecasted rainwater harvest.

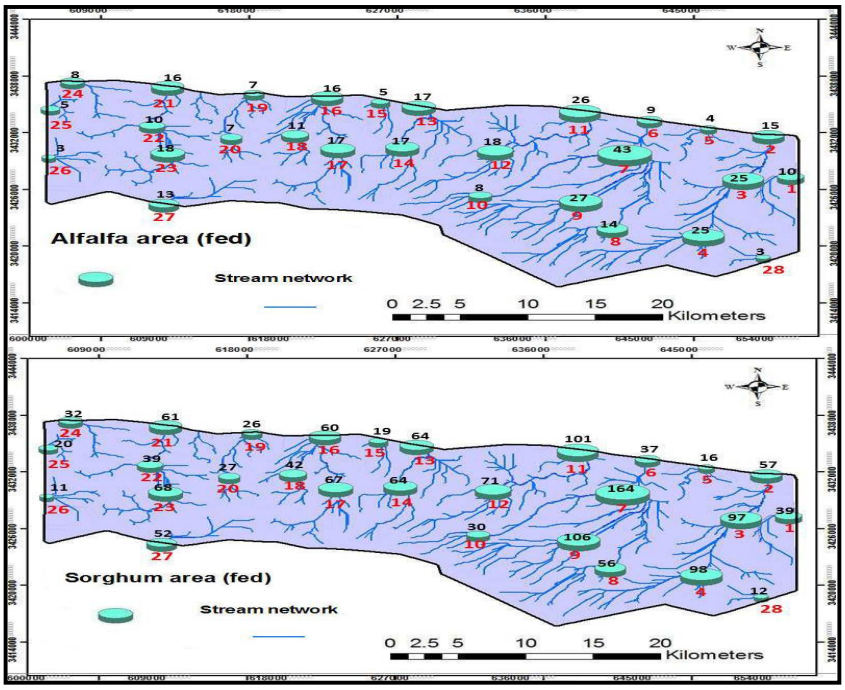

Fig (8-b). Alfalfa and sorghum plantation area (2011-2030) using forecasted rainwater harvest.

(e) determination optional grazing capacity:

Hence barely needs least water requirements for grazing capacity, surrounding each water reservoir, was calculated and expressed by number of cattle and sheep (Table 10, and Fig. 9). This calculation proposes that barley grazing capacity is five and twenty heads/feddan for cattle and sheep, respectively. The data showed that barley grazing capacity may have the ranges of 75 - 1099 cattle and 299 - 4396 sheep surrounding reservoir no. 7 and 26, respectively (Table 10). Finally, the yearly optional grazing capacity, through the future period (2011-2030), was expressed by two values; 10264 cattle and 41058 sheep.

Table (10): Potential grazing capacity under barley plantation.

Well No.	Cattle No.	Sheep No.	Well No.	Cattle No.	Sheep No.
1	261	1045	15	129	516
2	379	1517	16	402	1607
3	649	2596	17	448	1791
4	654	2617	18	283	1132
5	108	430	19	174	698
6	244	977	20	179	716
7	1099	4396	21	407	1629
8	371	1485	22	262	1048
9	706	2825	23	452	1809
10	201	804	24	217	868
11	672	2688	25	136	546
12	473	1892	26	75	299
13	429	1715	27	347	1386
14	427	1706	28	80	320
total				10264	41058

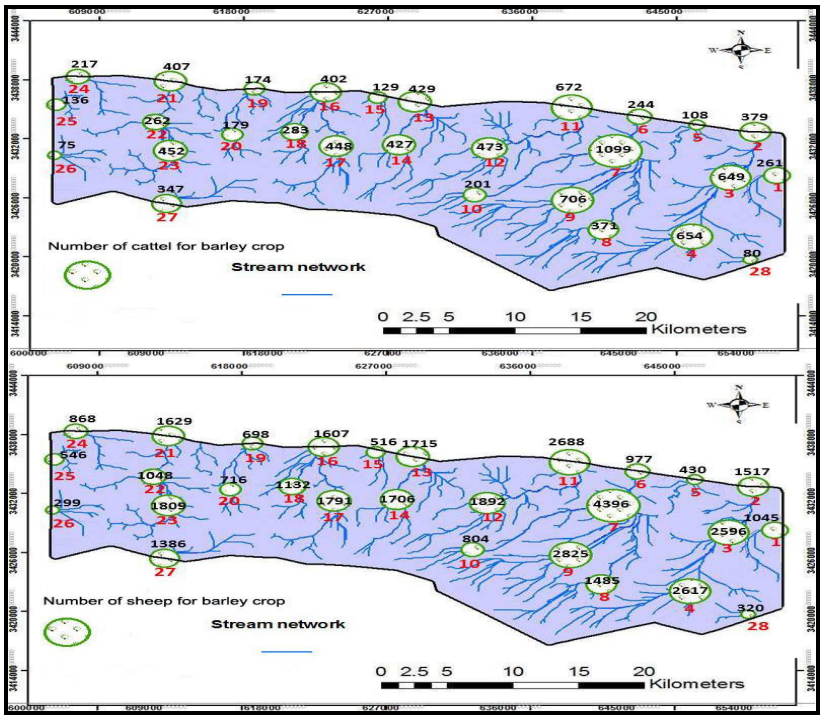

Fig. (9). Cattle and sheep grazing on barley irrigated by forecasted harvested water for each year of the future period (2011-2030).

DISCUSSION

The forecasted of precipitation rate showed that December month still the highest month in precipitation rate with maximum value (78.70 mm/month) during the future climate period that has general mean was (13.46 mm/month). According to output data of stream network, the area has twenty eight locations that were suitable to build harvested water reservoirs. Therefore, decision makers can start to construct water reservoir at the location 7 to harvest about 278828 m^3/year and continue to complete construction of the twenty eight water reservoirs to harvest about 2604325 m^3/year. Concerning to the rain water harvest, the larger area can be planted by wheat and barley than alfalfa and sorghum. It is recommend to reject the option of alfalfa plantation because of it large water requirements. Based on the barley crop that can be planted by water harvested in each well. The number of cattle that can be grazed ranged from 75 head to 1099 head while the number of sheep ranged from 299 head to 4396 head.

CONCLUSION

The integration of GIS- surface hydrology and forecasted agroclimate data was conducted to locate the sites of the harvested rainwater. Agroclimate data can be accurately determined by elaboration time series analyses that require reliable

series decomposition. Large amount of rainwater can be harvested, as example more two millions m^3 of water can be collected into fourteen reservoirs at El-Dabaa studied area. Finally, this research may present technological breakthroughs, to reduce risks of food production relating to climate changes, by building a decision making supporting agro-system.

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الملخص العربى

التنبؤ بالهيدرولوجيا السطحية باستخدام نظم المعلومات الجغرافية للحد من مخاطر إنتاج الغذاء (الساحل الشمالى الغربي – مصر)

عبدرب النبى محمد عبد الهادى[١] و أحمد محمد عجاج[١] و عماد فوزى عبد العاطى[١]
ومحمد حسن بهنسى[٢]

[(١)] أستاذ وأستاذ مساعد ومدرس الموارد الطبيعية والهندسة الزراعية كلية الزراعة – جامعة دمنهور

[(٢)] أستاذ الأراضى والمياه كلية الزراع بالشاطبى – جامعة الإسكندرية

منطقة الساحل الشمالى الغربى بمصر واحدة من أكثر المناطق الواعدة للتنمية الزراعية. فهي تمتد من الإسكندرية شرقاً إلى السلوم غرباً بحوالي ٥٠٠ كم عرض و٤٠ كم عمق، فهى تقع بين خطى طول (E "00' 50 º29 و '10 º25 E "00) وخطى عرض (N "00' 50 º30 و N "00 '10 º31). منطقة الدراسة (الضبعة) تغطي مساحة حوالي ٦٠٤٩٠ هكتار فهي تمتد من ٦٠٦٢٥٩ E إلى ٦٥١٠٧٢ E ومن ٣٤٣٧٩٨٢ N إلى ٣٤١٦٤٧٣ N ويحدها من الشمال طريق الإسكندرية مطروح ومن الجنوب طريق الجيش. استخدمت أربعة خرائط طبوغرافية بمقياس رسم ١:٥٠٠٠٠ تغطى منطقة الدراسة بعد تحويلها الى صورة رقمية وتم تحديد مناطق تجميع المياه بمنطقة الضبعة والمشتقة من نموذج الارتفاع الرقمي (DEM) ووجد انها تتكون من أربعة عشر حوضاً بمساحات تتراوح بين ٨.٦ إلى ١٣٦.٨ كم^{٢}. كما أظهرت شبكة ممرات المياه ثمانية وعشرون مخرجاً للشبكة والتي تعتبر ثمانية وعشرون مكاناً لخزانات مياه الامطار.

تشير خرائط تجميع التدفق ان منطقة الدراسة احتوت على سبعة مناطق لتجميع التدفقات وذات اتجاه من الجنوب الى الشمال. استخدمت بيانات التدفق التراكمى لحساب السعة المائية للثمانية وعشرين خزان وذلك بالتكامل مع (أ) التدرج في الميل (ب) التنبؤ بمتوسط معدل هطول الامطار للمناخ المتوقع في الفترة من (٢٠١١ – ٢٠٣٠) و (ج) معامل الجريان السطحى.

أظهرت النتائج ان متوسط حصاد الماء سيكون حده الأقصى (٢٧٨٨٢٨ م^{٣}/سنه) وحده الأدنى (١٨٩٩٢ م^{٣}/سنه). بالإضافة إلى ذلك، أشارت النتائج إلى أن بناء هذه الثمانية والعشرين خزانا للمياه ستزود السكان بحوالي ٢٦٠٤٣٢٥ م^{٣}/ سنة (أكثر من مليوني م^{٣} من الماء) عن كل سنة من الفترة المستقبلية (٢٠١١-٢٠٣٠). أظهرت النتائج المتوقعة للاحتياجات المائية للمحاصيل في الفترة المستقبلية (٢٠١١ – ٢٠٣٠) أن البرسيم الحجازى يحتاج لأكبر كمية من المياه (١٢٧٥ مم/سنه) بينما يحتاج الشعير الى أقل كمية من المياه (٢٤٧ مم/موسم) بالإضافة ان الاحتياج المائى للذرة السكرية والقمح ربما يكون ٣٣٠ و ٢٥٠ مم/ موسم بالترتيب.

الدمج بين الاحتياجات المائية المطلوبة مع كمية مياه الحصاد بالخزانات المجمعة استخدم لحساب المساحات الكلية التي يمكن زراعتها بالمحاصيل السائدة بالمنطقة فالبرسيم الحجازى يمكن زراعة مساحة منه تفوق ٦٣٩٧.٥٠ فدان. والاختيار الآخر للمساحات التي يمكن زراعتها ربما تكون ١٥٣٥.٩٣ و ٢٠٢٧.٤٢ و ٢٠٥٢.٠٨ فدان/ موسم لكل من الذرة السكرية والقمح و الشعير بالترتيب. لتقييم قدرة الرعى المحتملة للأرض تم حساب عدد الماشية والاغنام التي يمكن ان ترعى على الشعير المروى من المياه المحصودة ، قدرة الرعى للمواقع الثمانية والعشرين تراوحت بين ٧٥ الى ١٠٩٩ و ٢٩٩ الى ٤٣٩٦ للماشية والاغنام بالترتيب. قدرة الرعى كانت أقل ما يمكن عند الخزان رقم ٢٦ وأعلى ما يمكن عند الخزان رقم ٧.وأخيراً يمكن اعتبار أفضل اختيار للقدرة الرعوية للفترة المستقبلية (٢٠١١ – ٢٠٣٠) هي ١٠٢٦٤ للماشية و ٤١٠٥٨ للأغنام.

Estimating Agricultural Malmquist Total Factor Productivity for Some Arab Countries' Employing Data Envelope Analysis A Non Parametric Approach

Ahmed El-Kholei
Department of Agricultural Economics, Faculty of Agriculture, Menofia University, Egypt

ABSTRACT : The present paper aims is to provide up to date information on agricultural growth over the past three decades (1980-2012) for nine of the largest agricultural producers in the Arab world. Namely are Algeria, Egypt, Iraq, Jordan, Morocco, Sudan, Syria, Tunisia and Yemen. The analysis employs nonparametric, output-based Malmquist technique Data Envelopment Analysis (DEA) to estimate TFP index numbers. It uses data drawn from FAO. In general, results throughout the period 1980-2012 show that the average annual growth rate of agricultural productivity reached 1.2%. Efficiency changes contributed by a mere 0.2% while the rest 1% was provided by technical change. The country with the highest TFP growth is Jordan, with an impressive 3.7% average annual growth in TFP. However, for Yemen and Algeria it reached about 3% each, Egypt (2%), Sudan (0.8%), Tunisia and Iraq (0.4%).

Keywords: Data Envelope Analysis (DEA), Total Factor Productivity (TFP) , Egypt

1.INTRODUCTION

Agriculture has been and will continue to play vital role for humanity, because human welfare depends on the amount and stability of agricultural production, as determined by crop yield and cultivated area (Garibaldi *et al*., 2011).

Onjala (2002) argued that, the economic growth could be viewed as a process involving the entire economy's output performance; it mainly depends on the productivity of the country. Productivity, on the other hand, is essentially a microeconomic matter, focusing on how production units hire and use capital, labor, and other resource inputs in their output of goods and services. The direct link between productivity and economic growth is apparent in many ways. The sources of productivity growth over time have nowadays emerged as a central of growth and development.

As an objective of development policy, productivity growth has been difficult to achieve in many countries. For this reason, studies on sources of growth are a field of great importance to policy makers. The issue of productivity growth has drawn considerable attention over the last few decades, as it is considered, the major source of development for the agricultural sector, at a rate able to meet the demands for food and raw materials arising out of steady population growth. A country that falls short of achieving agricultural productivity growth may suffer deterioration, either of the foreign exchange balance, or of the internal terms of trade against industry, thereby also hindering industrial production (Hayami and Ruttan, 1970; Coelli and Rao, 2003). In contrast, a country that best utilizes its given resources within its agricultural sector may enjoy a significant comparative advantage in exporting markets.

Several studies have focused on this matter, using either Partial Factor Productivity (PFP) measures, most commonly labour productivity (e.g. Gutierrez , 2000; McErlean and Wu, 2003) or Total Factor Productivity (TFP) measures. The

latter are typically analysed using either i) a production function approach (e.g. Hayami and Ruttan, 1970; Wiebe *et al*. 2000), ii) an index number approach, usually Tornqvist index (e.g. Mukherjee and Kuroda 2003), or iii) a Data Envelopment Analysis (DEA) approach, the DEA- based Malmquist index (e.g. Coelli and Rao, 2003; Ludena *et al*., 2005).

Nin and Yu (2008) argued that the least-squares econometric production function models and total factor productivity indices are normally used with times series data and assume that all production units are technically efficient. Whereas, DEA approach can be applied to across-section of firms, farms, regions or countries to compare their relative productivity. If panel data are available, production functions, DEA and stochastic frontiers can be used to measure both technical change and efficiency improvement.

The Malmquist index, pioneered by Caves *et al*. (1982) used on distance functions, has become extensively used in the measure and analysis of productivity after Färe *et al*. (1994) showed that the index can be estimated using a non-parametric approach (Data Envelope Analysis). The nonparametric Malmquist index (discussed later in detail) has been especially popular since it does not entail assumptions about economic behavior (profit maximization or cost minimization) and therefore does not require prices for its estimation. Also important is its ability to decompose productivity growth into two mutually exclusive and exhaustive components: changes in technical efficiency over time (catching-up) and shifts in technology over time (technical change).

The study will examine changes in agricultural productivity in the Arab countries, in which their geographical locations are presented in Figure 1.

Figure (1): The Arab World Map

Source: Google maps

Figure 2 shows the share of agricultural Gross Domestic Production (GDP) in Arab countries economies during the period 2008-2012 (on average). It depicts that the agricultural sector plays an important role in Sudan that contributes about 32% to its gross GDP, followed by Syria (21%). Next come, Morocco, Egypt and Yemen (about 14% each on average). Whereas, Algeria and Tunisia accounted about 8% (each on average), Lebanon and Iraq nearly 5% (each on average), Jordan, Libya and Saudi Arabia 2.5% on average. Finally, Emirates and Oman (0.9% each), Bahrain and Kuwait (0.3% each) and Qatar (0.1%).

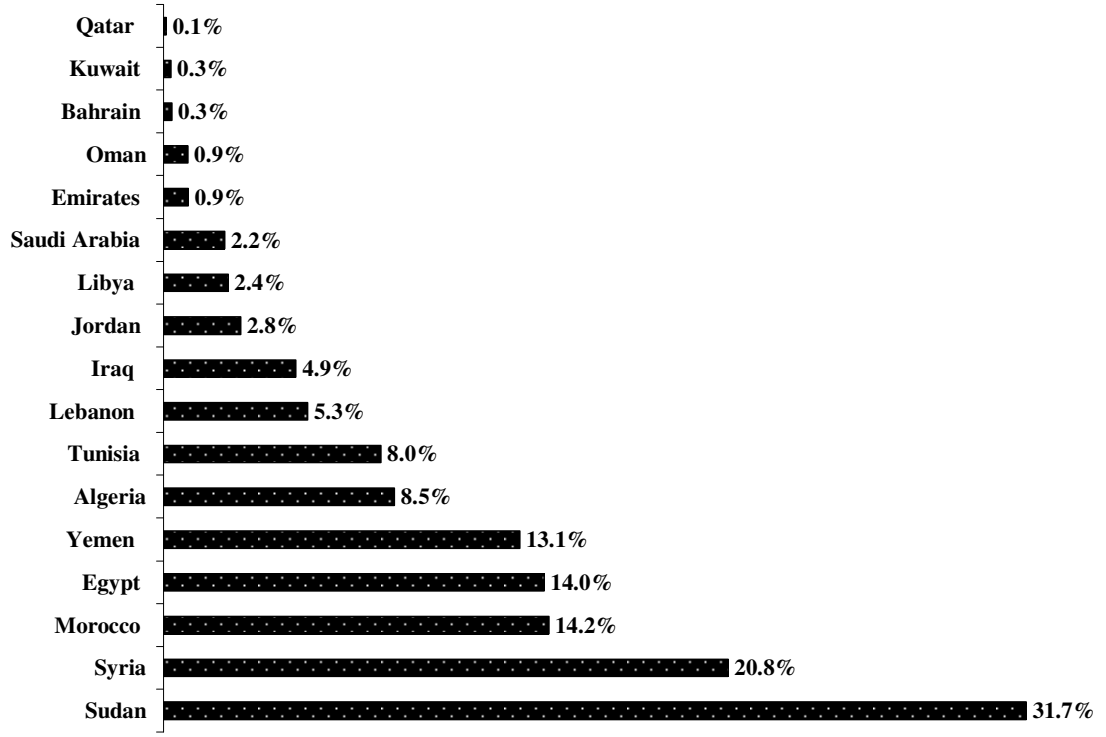

Figure (2): The Share of Agricultural GDP in Country's GDP during the period 2008-2012 (on average)

Source: Compiled and calculated from Arab Agricultural Statistics Yearbook (several issues)

The analysis dropped from the sample either the very small countries with negligible agriculture (such as Bahrain, Qatar, Kuwait, Oman and United Arab Emirates), or countries with missing data (such as Mauritania, Libya, Djibouti, Somalia, Comoros, Palestine, Lebanon and Saudi Arabia), in particular the study covers a relatively long period. Indeed almost the majority of sampled countries of this region continue to be extremely vulnerable to weather and commodity price shocks due to their limited economic resource base. They are prone to high volatility in economic activity, and therefore it is crucial to identify their sources of growth. (Belloumi and Matoussi, 2009). Thus, countries considered in this study are Algeria, Egypt, Iraq, Jordan, Morocco, Sudan, Syria, Tunisia and Yemen. The selected sample is considered the largest producers and importers of food and

feed grains in the Arab world and a major global market for agricultural and food products, for example, Egypt is the largest wheat importer in the world.

The paper is structured as follows. The next section briefly discusses the aim of the paper. Data collection is the subject of part three. The forth section is devoted to give a background on DEA and Malmquist TFP index methodology. The paper's estimation process is the main topic for section five.The sixth section discusses the estimated results. The seventh and last section is devoted to conclusion.

2. AIM OF THE PAPER

The principle aim of this paper is to estimate and provide up to date information on agricultural total factor productivity (TFP) growth over the past three decades (1980-2012) for nine of the largest agricultural producers in the Arab world. Using the Malmquist index methods described in Fare *et al.* (1994) and Coelli *et al.* (1998, Ch. 10).

3. DATA

All data for the study period (2003-2012) are obtained from the World Bank, FAO Statistics Division and Arab Organization for Agricultural Development (AOAD)

4. DEA MODEL AND MALMQUIST TFP METHODOLOGY

In this section, the article provides a brief background and literature of DEA method, in addition to, Malmquist TFP before going on to describe the Malmquist TFP calculations.

4.1. Background

Technical efficiency (TE) is a component of economic efficiency (Farrell, 1957). It is defined as the ability of a firm to transform a given set of inputs into maximum achievable output given the available technology (Bravo-Ureta *et al*., 2007). When one considers productivity comparisons over time, an additional source of possible productivity improvements is technical change. It measures the extent to which the production frontier, representing the state of the technology in a particular time period, shifts upwards over time. Such shifts represent technological progress.

As cited from Rao *et al*. (2004), these two concepts are illustrated in Figure 3, where F_0 and F_1 represent the production frontiers for two periods 0 and 1 (in the case of a simple one-input, one-output technology). Focusing on F_0, for a given input level, the distance OB shows the level of output that could technically be produced under period 0 technology. If the actual production is below the technologically feasible level and it is given by level OA, then a measure of technical efficiency of the country (or farm) is given by the ratio OA/OB, which takes a value between zero and one, with one indicating technical efficiency. This is an output-orientated technical efficiency measure.

An input-orientated technical efficiency measure is given by OC/OA showing the reduction input that is feasible, while maintaining the same output level. Technical change is measured by the shift in the frontiers represented by F_0 and F_1. The measure of technical change varies according to the input (or output) level at which it measured. For example, in Figure 3 an output-orientated technical change measure is calculated as $0B_1/OB$, where a value greater than one indicates technical progress, Rao *et al*. (2004).

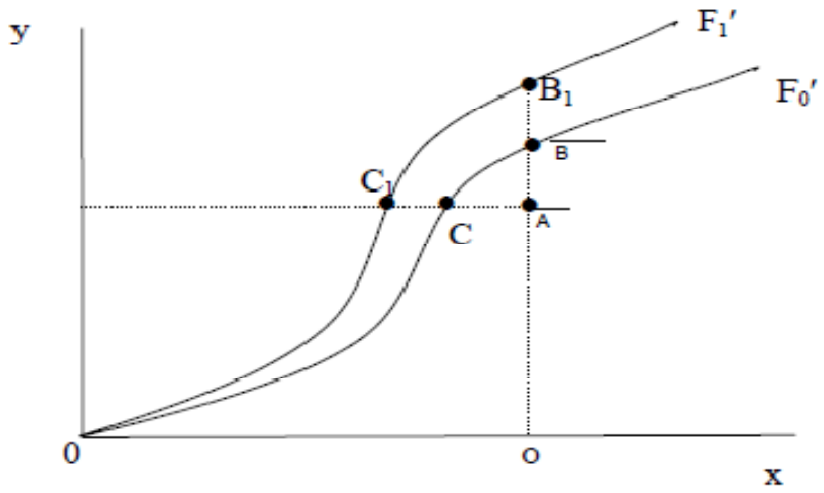

Figure (3): Technical change and technical efficiency change
Source: Rao *et al.* (2004)

Different types of frontier models based on the early work of Farrell (1957) have been developed for the measurement of technical efficiency. These models could be classified into parametric and non-parametric frontiers. Parametric frontier is further separated into two methods because they rely on a specific functional form (Aigner *et al*, 1977). These two groups are deterministic model which attributes any deviation to the inefficiency and the stochastic model which on the other hand tolerates statistical noise (Amara, *et al.,* 1999). Non-parametric models are usually based on mathematical programming and also known as data envelopment analysis (DEA) (Banker et al, 1984), (Thiam *et al,* 2001). However, DEA only offers relative efficiencies relative to the data considered. It does not, and cannot, offer absolute efficiencies.

As cited by (Galanopoulos, 2006), the DEA models are linear programming (LP) methods that calculate the frontier production function of the decision- making units (firms or countries). Those that operate on the frontier are technically efficient, whereas the degree of technical inefficiency of the rest is calculated on the basis of the Euclidian distance of their input /output ratio from the frontier (Coelli, 1998). Applying DEA methodology, Färe *et al.,* (1992) extended the work of Caves *et al*. (1982) and developed Malmquist productivity measures, which can be used in order to measure the productivity changes over time. Since then, the Malmquist TFP index has been applied in various studies, both in the industrial as well as the

agricultural sector. For instance, Grifell and Sintas (1995) measured TFP change in the European textile industry, Färe et al (2001) calculated productivity growth in Taiwan's manufacturing industry, and Chen and Ali (2004) analyze the productivity in the computer industry. In the agricultural sector, the Malmquist TFP indices have become extensively used in the measure and analysis of productivity by Bureau *et al.* (1995), Lusigi and Thirtle (1997), Fulginity and Perrin (1997, 1998 and 1999), Rao and Coelli (1998), Arnade (1998), Chavas (2001), Suhariyanto and Thirtle (2001), Suhariyanto *et al.* (2001), Coelli and Rao (2003), Trueblood and Coggins (2003), Nin *et al.* (2003a), Nin *et al*. (2003b) and Ludena *et al.* (2005 and 2007).

As mentioned earlier, DEA can be either input-orientated or output-orientated. In the input-orientated case, the DEA method defines the frontier by seeking the maximum possible proportional reduction in input usage, with output levels held constant, for each country. While, in the output orientated case, the DEA method seeks the maximum proportional increase in output production, with input levels held fixed. The two measures provide the same technical efficiency scores when a constant returns to scale (CRS) technology applies, but are unequal when variable returns to scale (VRS) is assumed. It is worth mentioning that returns to scale properties of the technology are very important in TFP measurement. It is preferable to use a CRS technology in this study for two reasons. First, given that it is using aggregate country-level data, it does not appear to be sensible to consider a VRS technology. In addition to the above comment regarding the use of aggregate data, a second argument for the use of a CRS technology is applicable to both firm-level and aggregate data. Grifell-Tatjé and Lovell (1995) use a simple one-input, one-output example to illustrate that a Malmquist TFP index may not correctly measure TFP changes when VRS is assumed for the technology.

Hence, it is important that CRS be imposed upon any technology that is used to estimate distance functions for the calculation of a Malmquist TFP index. Otherwise, the resulting measures may not properly reflect the TFP gains or losses resulting from scale effects.

The popularity of Malmquist TFP indices is notably due to certain attractive features that: (1) It requires only data on quantities (of inputs and outputs) thus avoiding the difficult problem of measurement for fixed factors. (2) It does not require information on prices of inputs and outputs (as the Tornqvist index), in which, without this information, parametric approaches cannot be used. Both index numbers and econometric methods require price information for the calculation of costs, profits and other functions. (3) It does not require any assumptions to be made about the optimizing behaviour of economic units (in contrast to traditional index numbers). (4) It does not require econometric estimations to be made, but can be implemented using a data envelopment technique. Moreover, Malmquist TFP may not only be used in order to measure the productivity changes over time, but it can be also be further decomposed into two meaningful components, one measuring the technical change (TNCh) and the other the technical efficiency change (TECh). On the other hand, this approach is susceptible to data noise effects and to degrees of freedom problems when the sample is relatively small.

Bushara and Mohayidin. (2009) argued that improvements in total factor productivity could occur as a result of either improvement in technical efficiency (moving closer to the production frontier) or improvements in technology (outwards shifts of the production frontier). The use of the Malmquist productivity index enabled the determination of what portion of a sector or firm productivity change was due to each of these two factors Domazlicky and Weber (1997).

Distance functions offered by Malmquist index allow one to describe a multi-input, multi-output production technology without the need to specify a behavioral objective (such as cost minimization or profit maximization). One may define input distance functions and output distance functions. An input distance function characterizes the production technology by looking at a minimal proportional contraction of the input vector, given an output vector. An output distance function considers a maximal proportional expansion of the output vector, given an input vector. However, an output distance function is only considered in detail in this paper. Anyhow, input distance functions can be defined and used in a similar manner.

4.2. Malmquist TFP Index (Output Oriented)

A production technology may be defined using the output set, *P(x)*, which represents the set of all output vectors, *y*, which can be produced using the input vector, *x.* That is, *P(x) ={y: x can produce y}*

It assumes that the technology satisfies the axioms listed in Coelli *et al.* (1998, Ch. 3). The output distance function is defined on the output set, P(x), as:

$$d_0(x, y) = \min\left[\delta : (y/\delta) \in P(x)\right]$$

The distance function, $d_0(x, y)$, will take a value which is less than or equal to one if the output vector, y, is an element of the feasible production set, P(x). Furthermore, the distance function will take a value of unity if y is located on the outer boundary of the feasible production set, and will take a value greater than one if y is located outside the feasible production set. This study uses DEA-like methods to calculate the distance measures.

Owing to Mahadevan (2002), Coelli and Rao (2003), Sufian (2007), Belloumi *et al*. (2009) and Shahabinejad and Akbari (2010), the Malmquist TFP index measures the TFP change between two data points (e.g., those of a particular country in two adjacent periods) by calculating the ratio of the distances of each data point relative to a common technology. Following Färe *et al* (1994), the Malmquist (output-orientated) TFP change index between period (s) (the base period) and period (t) is given by:

$$m_0(y_s, x_s, y_t, x_t) = \left[\frac{d_0^s(y_t, x_t)}{d_0^s(y_s, x_s)} \times \frac{d_0^t(y_t, x_t)}{d_0^t(y_s, x_s)}\right]^{1/2} \quad \text{.....(1)}$$

Where, the notation $d_0^s(x_t, y_t)$ represents the distance from the period (*t*) observation to the period (*s)* technology, (*y*) represents output and (*x*) represents

input. .A value of m_0 greater than one will indicate positive TFP growth from period (*s*) to period (*t*) while a value less than one indicates a TFP decline. Note that equation 1 is, in fact, the geometric mean of two TFP indices. The first is evaluated with respect to period (*s*) technology and the second with respect to period (*t*) technology. An equivalent way of writing this productivity index is:

$$m_0(y_s, x_s, y_t, x_t) = \underbrace{\frac{d_0^t(y_t, x_t)}{d_0^s(y_s, x_s)}}_{\text{Efficiency change}} \underbrace{\left[\frac{d_0^s(y_t, x_t)}{d_0^t(y_t, x_t)} \times \frac{d_0^s(y_s, x_s)}{d_0^t(y_s, x_s)}\right]^{1/2}}_{\text{Technical Change}} \quad \text{.....(2)}$$

Where, the ratio outside the square brackets measures the change in the output-oriented measure of Farrell technical efficiency between periods (s) and (t). That is, the efficiency change is equivalent to the ratio of the Farrell technical efficiency of period (t) to the technical efficiency in period (s). The efficiency change component measures whether production is catching up with or falling behind the production frontier and assumed that this component captures diffusion of technology related to differences in knowledge and institutional setting (Rungsuriyawiboon and Lissitsa, 2006). The remaining part of the index in equation (2) is a measure of technical change, which is the geometric mean of the shift in technology between the two periods, evaluated at xt and xs. In other words, TFP growth can be rewritten as,

TFP Growth = Technical Efficiency Change × **Technical Change**.....(3)

(Catching up effect) ***(Frontier effect)***

This decomposition can be illustrated as cited in Rao *et al.,* (2004), using the diagram in Figure 4 (after Coelli, *et al.,* 1998), which depicts a constant returns-to-scale technology involving a single input and a single output. The firm produces at the points D and E in periods *s* and *t* respectively. In each period, the firm is operating below the technology for that period.

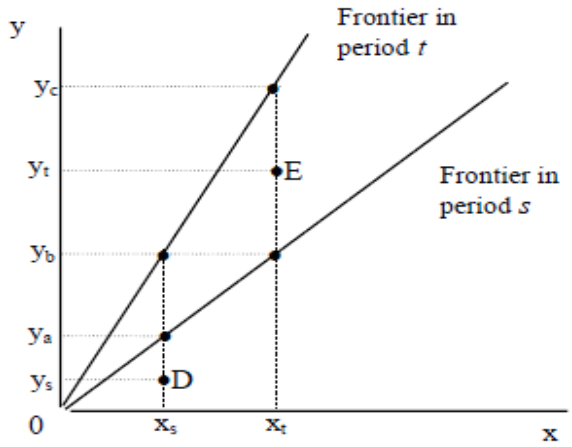

Figure (4) : Malmquist productivity indices

Source: Rao *et al.* (2004)

Hence, there is technical inefficiency in both periods. Using equations 1 and 2 we obtain:

$$\text{Efficiency Change} = \frac{y_t / y_c}{y_s / y_a} \quad \& \text{ Technical change} = \left[\frac{y_t / y_b}{y_t / y_c} \times \frac{y_s / y_a}{y_s / y_b} \right]^{1/2}$$

According to Grifell-Tatj´e and Lovell (1995), the constant returns to scale (CRS) technology must however be imposed to estimate the above distance functions for the accurate calculation of a Malmquist TFP index. However, Fare *et al*. (1994) decomposed the catching up effect (given by technical efficiency change under the CRS technology) into 'pure' technical efficiency change and scale efficiency change. Pure efficiency depicts the effect on the ability of a firm to be more efficient due new technologies (Färe, *et al.,* 1994). That,

Technical Efficiency Change Index =

Pure Technical Efficiency Change Index×**Scale Efficiency Change Index**…….. (4)

Following Färe *et al*. (1994) and given that suitable panel data are available, we can calculate the required distance measures for the Malmquist TFP index using DEA linear programm. For the i-th country, we must calculate four distance functions to measure the TFP change between two periods, s and t. This requires solving four linear-programming (LP) problems. Färe *et al*. (1994) assume a constant returns-to-scale (CRS) technology in their analysis. The required LPs are

$\left[d_0^t(y_t, x_t)\right]^{-1} = \max_{\phi,\lambda} \phi$ *Subject to*

$-\phi y_{it} + Y_t \lambda \geq 0,$

$x_{it} - X_t \lambda \geq 0,$

$\lambda \geq 0$ ……(5)

$\left[d_0^s(y_s, x_s)\right]^{-1} = \max_{\phi,\lambda} \phi$ *Subject to*

$-\phi y_{is} + Y_s \lambda \geq 0,$

$x_{is} - X_s \lambda \geq 0,$

$\lambda \geq 0$ ……(6)

$\left[d_0^t(y_s, x_s)\right]^{-1} = \max_{\phi,\lambda} \phi$ *Subject to*

$-\phi y_{is} + Y_t \lambda \geq 0,$

$x_{is} - X_t \lambda \geq 0,$

$\lambda \geq 0$ ……(7)

and

$\left[d_0^s(y_t, x_t)\right]^{-1} = \max_{\phi,\lambda} \phi$ *Subject to*

$-\phi y_{it} + Y_s \lambda \geq 0$,

$x_{it} - X_s \lambda \geq 0$,

$\lambda \geq 0$ ……..(8)

y_{it} is a M×1 vector of output quantities for the i-th country in the t-th period;
x_{it} is a K×1 vector of input quantities for the i-th country in the t-th period;
Y_t is a N×M matrix of output quantities for all N countries in the t-th period;
X_t is a N×K matrix of input quantities for all N countries in the t-th period;14
λ is a N×1 vector of weights; and
ϕ is a scalar.with $1 \leq \phi \leq \infty$, $\phi - 1$ is the proportional increase in outputs that could be achieved by the i-th unit, with input quantities held constant (Nkamleu, 2004).

Note that in LPs (7) and (8), where production points are compared with technologies from different time periods, the φ parameter need not be greater than or equal to one (as it must be when calculating standard output-orientated technical efficiencies). The data point could lie above the production frontier. This will most likely occur in LP (8) where a production point from period t is compared to technology in an earlier period, s. If technical progress has occurred, then a value of φ<1 is possible. Note that it could also possibly occur in LP (7) if technical regress has occurred, but this is less likely. However, more detailed reviews of DEA methodology could be reviewed in Seiford and Thrall (1990), Lovell (1993), Ali and Seiford (1993). Lovell (1994), Charnes *et al*. (1995) and Seiford (1996)

However, Total factor productivity (TFP) is the ratio of total output (crop and livestock products) to total production inputs (land, labor, capital, and materials). An increase in TFP implies that more output is being produced from a constant amount of resources used in the production process.

In the long run, TFP is the main driver of growth in agriculture and can be affected by policies and investment. Partial factor productivity (PFP) measures, such as labor and land productivity, are often used to measure agricultural-production performance because they are easy to estimate. These measures of productivity normally show higher rates of growth than TFP because growth in land and labor productivity could result from more intensive use of inputs, including fertilizer and machinery, rather than TFP increase. If productivity increases without the addition of more inputs, then the only source of growth is TFP.

5. ESTIMATION PROCESS

In line with Coelli and Rao (2003), Belloumi and Matoussi (2009), Shahabinejad and Akbari (2010) and other studies, the study estimates the Malmquist indexes of efficiency and total factor productivity employing a panel data. The analysis uses two outputs (crops and livestock production) and six inputs (land, tractors, labor, fertilizer consumption, animal livestock and irrigation).

5.1 Output Series

Agricultural output for crops and livestock is expressed as (constant 2004-2006) “international dollars”.

5.2 Input Series

As mentioned earlier, the study considers only six input variables. Details of these variables are given below:

5.2.1 Land

This variable covers the number of hectares of arable and permanent cropland

5.2.2 Tractors

This variable is measured as total number of tractors used in agriculture (excluding garden tractors).

5.2.3 Labor

This variable is measured as the total economically active agricultural population.

5.2.4 Fertilizer

Following other studies that applied DEA such as Hayami and Ruttan (1970), Fulginiti and Perrin (1997), Shahabinejad and Akbari (2010), the study uses consumption of Nitrogen (N), Potassium (K_2O) and Phosphate (P_2O_2) in metric tons.

5.2.5 Livestock

The livestock input variable is calculated by the animal-equivalent of five categories of animals. The considered categories are buffaloes, cattle, sheep, goats, horses, camels, chicken and ducks. Numbers of these animals are converted into animal equivalents using conversion factors adopted by Coelli and Rao (2003), El-Kholei *et al*. (2008) and Shahabinejad and Akbari (2010) as follows: 1.0 for buffalo and cattle; 0.1 for sheep and goats, 1 for horses, 1.1 for camels, 0.01 for chickens and ducks.

5.2.6 Irrigation

The study employs the area under irrigation as a proxy for the capital infrastructure associated with the irrigation of farmlands.

After gathering the suitable panel data for the above-mentioned outputs and inputs variables and assuming constant returns to scale (CRS) as mentioned earlier, then the required distance measures for the Malmquist TFP index could be calculated using DEA-like linear programs. However, a number of $N \times (3T-2)$ LP's would be solved. In this study N= nine countries and T = thirty-three periods (1980-2012), this requires the solving of $[9 \times (3 \times 33 - 2)] = 873$ LP's.

6.RESULTS

Conceptually, a country can increase its agricultural productivity by two different ways. One way is to improve efficiency change through the "best practice" by increasing the diffusion of technology, and the other way is to promote technical change, through importation and adaptation of new technology. Of course, a combination of both also increases agricultural productivity.

There is massive computer output on efficiency scores for each country in each year to illustrate. The results have measures of technical efficiency change; technical change and TFP change for each country in each pair of adjacent years (see Appendixes 1 to 5). However, the paper would be selective in what results to present.

An output-orientated technical efficiency level shows the ratio of each country's actual output in relation to what is feasible (given the available technology in that period). Technology in each period, identified using the DEA technique, is a piece-wise linear envelopment of all the observed points in the multi

output and multi-input Euclidean space. The countries that determine the technology frontier are known as the “peers” or best-performing countries. Peer countries have a technical efficiency score of one and usually there are several peers in each year.

Results for technical efficiency scores and their averages in 1980s, 1990s and 2000s are shown in Table 1. They reveal that, except for Morocco, Yemen and Tunisia, all sampled countries are technically efficient all over the three periods. However, 1980-2012 average score shows that Morocco and Iraq achieved the highest level in mean technical efficiency reaching 1.008 and 1.004 respectively; whereas, all other sampled countries achieved unity meaning that there was no change in efficiency over those periods. (see Figure 5). In general, the results depict that all of the sampled countries reached frontier technical efficiency throughout the three successive periods. However, the sampled countries achieved the highest level in mean technical efficiency (1.002) during the first and second periods. Meanwhile, producing 99% during the second period of the output that could be potentially produced using the observed input quantities.

Telleria and Hassan (2001) argued that Arnade (1998) gives a possible explanation for this particular result. He argues that when there are no apparent changes in efficiency levels (i.e., when Effch = 1), in the case of developing countries in which extraordinarily low levels of inputs are used, then this may be interpreted as either no change, or a slight improvement, in the use of outdated technology.

Table (1): Technical Efficiency Change (Effch) for Sampled Arab Countries during the period (1980-2012).

	1980-1990 1st Period	1991-2000 2nd Period	2001-2012 3rd Period	1980-2012 Average
Morocco	1.027	0.976	1.019	1.008
Iraq	1.002	1.011	1.000	1.004
Yemen	0.993	1.007	1.000	1.000
Algeria	1.000	1.000	1.000	1.000
Egypt	1.000	1.000	1.000	1.000
Jordan	1.000	1.000	1.000	1.000
Sudan	1.000	1.000	1.000	1.000
Syria	1.000	1.000	1.000	1.000
Tunisia	1.000	0.998	1.001	1.000
Average	1.002	0.999	1.002	**Average**

Source: Author calculation via DEA analysis results (all figures are geometric mean)

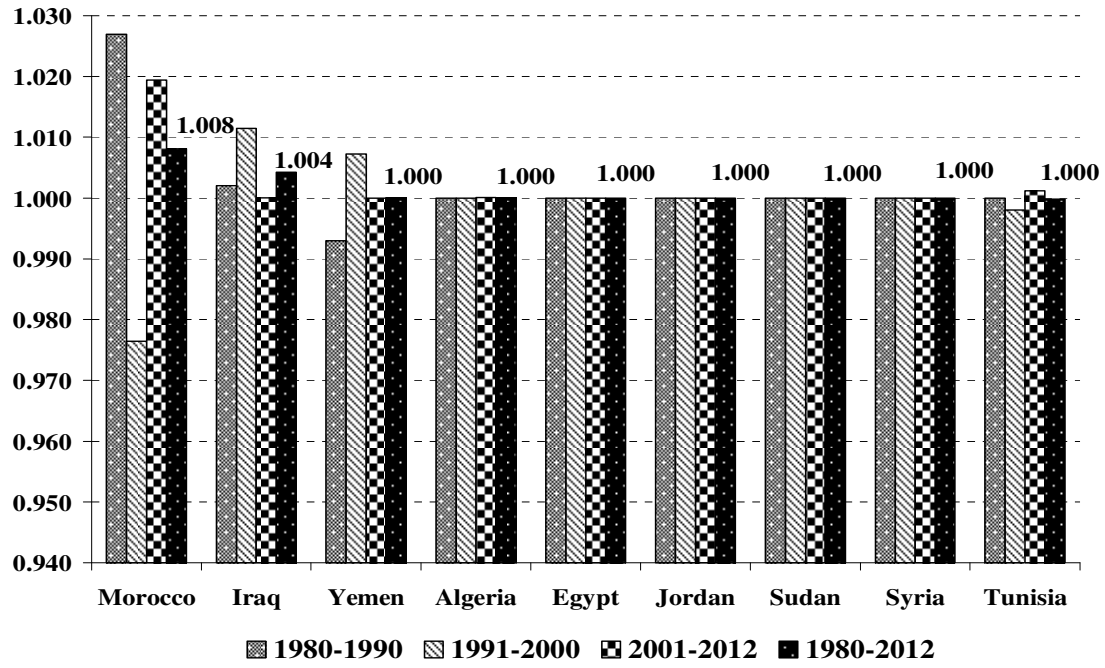

Figure (5): Technical Efficiency Change during the period 1980-90, 1991-2000, 2001-2012 and 1980-2012 (on average)

Source: Appendix 1

As cited by Belloumi *et al* (2009), this average technical efficiency change gives us information only on the "catch-up" part of the productivity (mentioned in Equation 3). In fact, a country will have a positive efficiency change over time if it is catching up. The degree of catching up or the efficiency change can be related to institutional factors, as well as domestic and trade policies of specific countries. TFP change can also appear in the form of technical change (or frontier-shift). In other words, Movements in total factor productivity are measured using the Malmquist productivity index. Using the output-oriented approach, the index provides a measure of how much more can be produced using observed input data – at the technologies observed at two different points of time. The Malmquist productivity index can be decomposed into output increases due to efficiency change and those due to shifts in frontier technology.

The Malmquist index measures year-to-year changes in productivity. These indices as well as their associated efficiencies and technical change components for considered countries in the analysis are presented in Appendixes 1, 2 and 3.

Some salient features of these findings are summarized in Table 2. It shows the annual mean technical efficiency change, technical change and TFP change, averaged throughtout the period 1980-2012. The average (across all countries) growth in TFP is 1.2%, which is due to 0.2% growth in efficiency change and 1% in technical change.

In general, except for Iraq (for some extent) and Syria, all the sampled countries showed to be innovative and efficient at the same time. The country with

the highest TFP growth is Jordan, with an impressive 3.7% average annual growth in TFP, mainly attributable to technical change indicating the highest agricultural productivity relative to the other countries considered in the study. Similar results could be seen for Yemen and Algeria (about 3% each), Egypt (2%), Sudan (0.8%), Tunisia and Iraq (0.4%). This may reflect improvements in the agricultural extension services in those countries. Whereas, Morocco is the only Arab country where its TFP growth (2.5%), is largely attributable to both efficiency change and technical change accounting 0.8% and 1.6% respectively (see Table 2 and Figure 6).

Table (2): Technical Efficiency Change, Technical Change and Total Factor Productivity for Sampled Arab Countries during the period (1980-2012)

	Efficiency Change (Effch)	Technical Change (Techch)	TFP Change (TFPch)
Algeria	1.000	1.030	1.030
Egypt	1.000	1.020	1.020
Iraq	1.004	0.999	1.003
Jordan	1.000	1.037	1.037
Morocco	1.008	1.016	1.025
Sudan	1.000	1.008	1.008
Syria	1.000	0.951	0.951
Tunisia	1.000	1.004	1.004
Yemen	1.000	1.031	1.031
Geo.Mean	1.002	1.010	1.012

Source: Appendixes 1, 2 and 3

On the other hand, Iraq's TFP growth of 0.3% is mainly attributable to efficiency change. Meanwhile, Syria showed the lowest TFP index (0.951) Techch and TFP change are both negative (- 4.9% and - 4.9% respectively), this is presumably due to political tension and uprising riots that resulted lack of improvements as the annual average Techch fell from 1.005 during the period 1980-2007 to only 0.707 during the period 2008-2012 (on average).

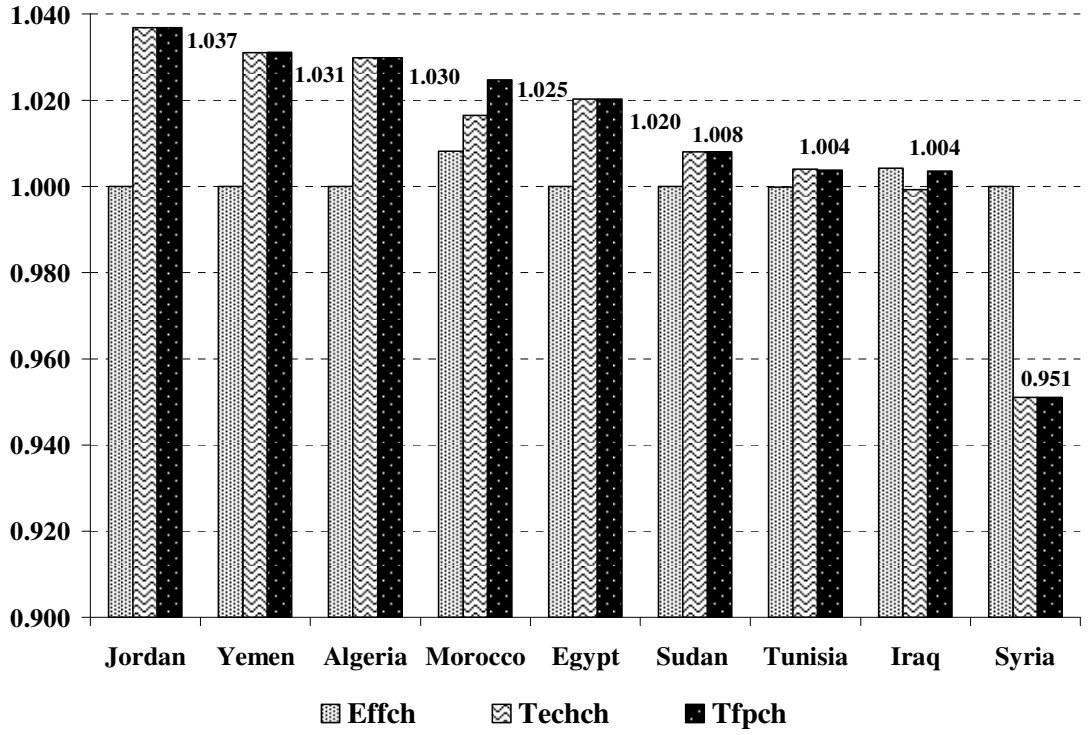

Figure (6): Effch, Techch and TFPch Results during the period (1980-2012)

Source: Appendixes 1, 2 and 3

In order to trace the development of TFP index results and its components, the study disaggregated the study period 1980-2012 into six successive periods 1980-85, 1986-90, 1991-95, 1996-2000, 2001-2005 and 2006-1012 shown in Figures 7, 7A and 7B.

In general, except for Morocco and to a mere extent Egypt, all TFP results fell in last period (2006-2012) compared to majority of previous periods with various levels (see Figure 7) This decline is mirrored by the decline in technological change for the same periods (see Figure 7A). Moreover, technical efficiency results showed stagnation of unity all over the study period (1980-2012) in countries such as Egypt, Jordan, Sudan and Syria, whereas, Morocco achieved a significant increase throughout the last three periods (1996-2000), (2001-2005) and (2006-2012) from 0.965 to 0.995 and further to 1.037 respectively (see Figure 7B). Reporting stagnant technical change (as achieved by majority of sampled countries) does not necessarily mean that no technical change has occurred at all. It may have occurred but at very low rates compared with those occurring in the best practice countries, considering that each country's technical change performance was measured only relative to the best countries in the sample.

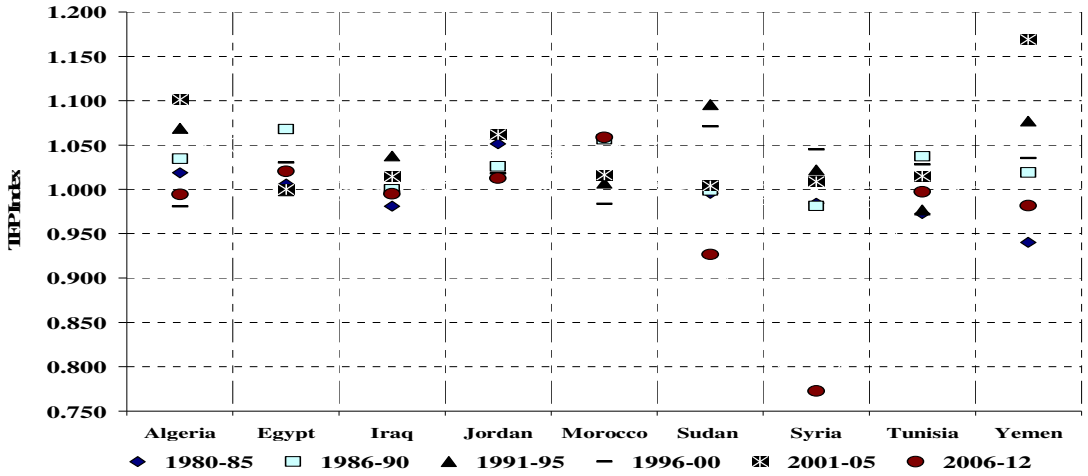

Figure (7): TFPch Results during the Disaggregated period (1980-2012)

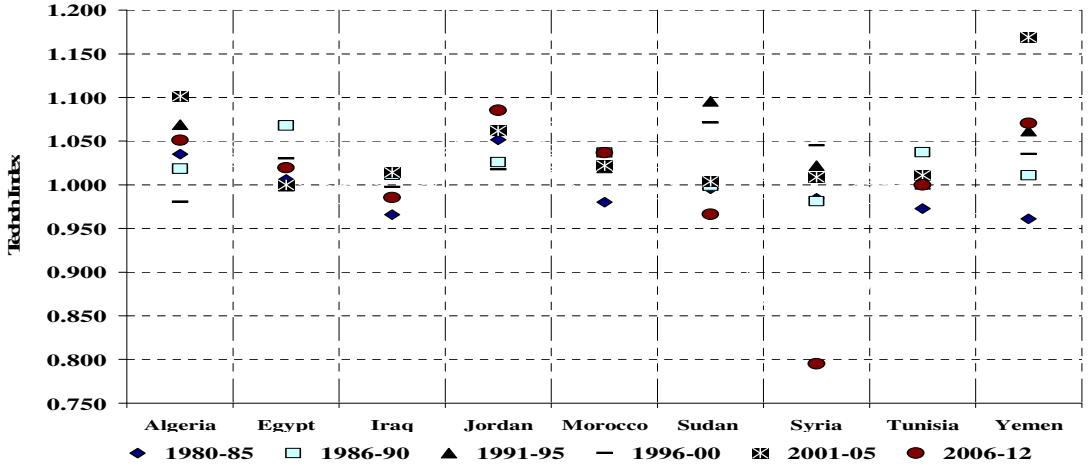

Figure (7A): Techch Results during the Disaggregated period (1980-2012)

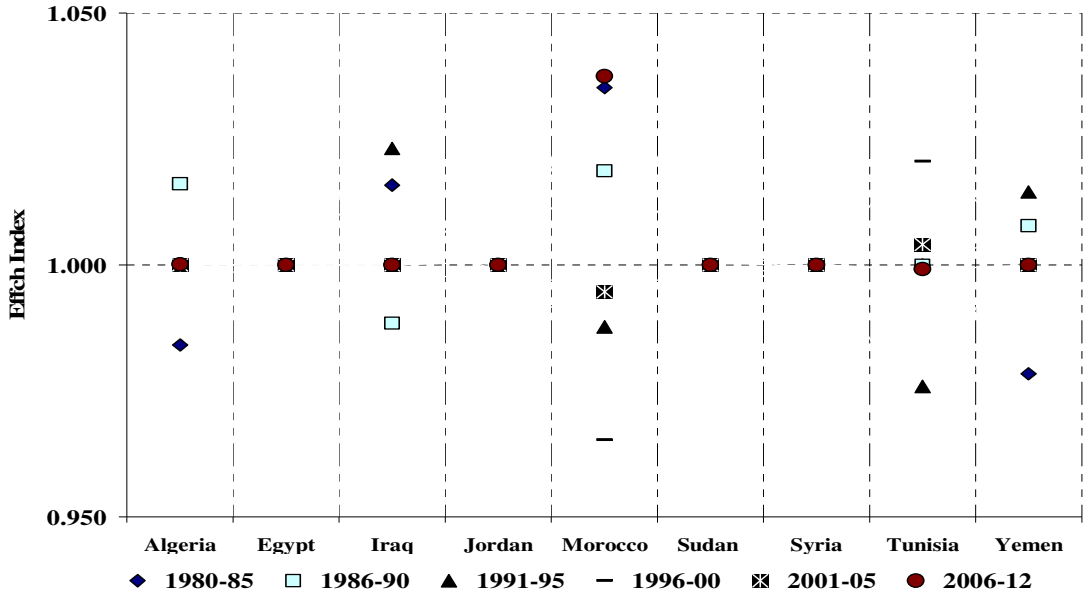

Figure (7B): Effch Results during the Disaggregated period (1980-2012)

Source: Appendix 3

However, it fell during the last two periods compared to previous decade in countries such as Yemen, Tunisia and Iraq. These poor results for TFP and its components during the last period, are presumably due to lack of agricultural infrastructure investment, the political tension and riots engaged to what so called "Arabian Spring"

As mentioned earlier, Morocco reached TFP growth rate of 2.5% during the whole period 1980 - 2012. TFP growth estimates for the last three decades are, 3.5%, -0.5% and 4.1% respectively. Fortunately, the positive increase offsets the earlier losses. Agriculture TFP growth in Morocco needs to be higher because even agriculture accounts for about 14% of the country's total GDP, it employs nearly 36% of the local labor force and drives the country's economic growth. Morocco is probably the most volatile grain production country in the world.

Egypt shows a 2% average growth in TFP throughout the study period (1980-2012), which is due to 2% growth in technical change. TFP growth in Egypt fell from 3.6% in the 1980s to 1.4 % and further to 1.2% during the 1990s and 2000s respectively. The same pattern could be seen for Jordan.

Sudan and Syria reached their highest TFP during the 1990s that estimated at average growth 8.3% and 3.4% respectively; however, it fell during the 2000s to nearly -4.2% and -3.7% respectively.

In short, the above findings allow the ranking of the more and less productive countries, and have useful agricultural policy implications

7. CONCLUSION

As argued by Telleria and Hassan (2011), there are two fundamental approaches used to measure agricultural productivity, frequently known as parametric and non-parametric approaches. In the past, the parametric approach has widely used the Laspeyres Index (which uses base year prices and current quantities, i.e., base-period weights) to measure agricultural productivity through value added per unit of input. However, the Theil-Tornqvist Index, which uses prices from both the base period and the comparison period, is preferred to the Laspeyres Index because it does not require the unrealistic assumption that all inputs are perfect substitutes in production. However, the main problem with the Theil-Tornqvist Index is that it does not satisfy transitivity conditions, making it inapplicable for comparisons involving a set of three or more countries. It is observed that index numbers use local currencies (such as dollars) to aggregate heterogeneous outputs and inputs, but such currencies are not adjusted to account for changes in the value of the currency over time, thus limiting the understanding of trends in agricultural productivity. Lately, The Malmquist Index uses the non-parametric method, initiated as the Data Envelopment Analysis (DEA) by Charnes, Cooper and Rhodes (1978), builds on the individual firm evaluations of Farrell (1957) applying linear programming to estimate an empirical production technology frontier for the first time.

This paper has investigated the level and growth pattern in agricultural productivity in Arab countries whose agricultural sector plays a considerable role in the economy. Nine contries have been included in the analysis namely are Algeria, Egypt, Iraq, Jordan, Morocco, Sudan, Syria, Tunisia and Yemen. For this purpose, the sequential Malmquist approach was employed in order to calculate TFP indices. Results show that the most productive countries were Jordan, Yemen, Algeria, Morocco, Egypt, Sudan, Tunisia and Iraq. Finally, the agricultural sectors of and Syria was, in comparison, the least productive.

Technical efficiency change has been the main source of achievement of high levels of total factor productivity during the reference period. It is obvious that in all countries technical change is more than efficiency change. In other words, technical change is the main source of total factor productivity fluctuation over time, because the technical change component has had more fluctuation, rather than technical efficiency change. This average technical efficiency change gives us information only on the “catch-up” part of the productivity issue. In fact, a country will have a positive efficiency change over time if it is catching up. The degree of catching up or the efficiency change can be related to institutional factors, domestic and trade policies of specific countries.

The TFP results for Iraq and Syria (i.e., Techch smaller than Effch scores) imply that policy actions should focus more on accelerating the rate of Techch (agricultural innovation) than the rate of Effch (technology diffusion). The opposite applies to the case of Algeria, Egypt, Jordan, Morocco, Sudan, Tunisia and Yemen where Effch scores smaller than Techch scores, indicating the need for

strengthening policy actions focusing on accelerating the rate of agricultural services throughout the country.

It is a matter of serious concern that the overall contribution of technical change is greater than that of efficiency change to overall productivity changes in all the studied countries. This implies huge potential increase in production even with existing technology. It is important to reverse efficiency stagnation that appears in majority of countries and achieve a faster and large scale diffusion of technical innovations across regions.

In line with Telleria and Hassan (2011), the fact that Techch has been the main driving force of TPF indicates that investing in agricultural research is the main lever to increase productivity. Yet it must be acknowledged that low values of Effch usually indicate that long time lags between agricultural research investments and productivity response exist. This indicates that spending on agricultural research must be accompanied by agricultural extension programmes that not only contribute to broaden the use of new technology, but to agricultural capital formation as well.

Finally, government should take some necessary steps to focus on improving crop productivity and to provide farmers timely and extensive services and support so that crop farming can be made more efficient.

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APPENDIXES:

Appendix (1): Technical Efficiency Change Results during 1980-2012

Effch	Algeria	Egypt	Iraq	Jordan	Morocco	Sudan	Syria	Tunisia	Yemen	Average
1981*	1.000	1.000	1.008	1.000	1.038	1.000	1.000	1.000	1.000	1.005
1982	1.000	1.000	1.135	1.000	1.254	1.000	1.000	0.823	1.000	1.018
1983	1.000	1.000	1.000	1.000	0.894	1.000	1.000	1.215	0.912	0.999
1984	1.000	1.000	0.830	1.000	1.107	1.000	1.000	1.000	1.097	1.001
1985	0.923	1.000	1.139	1.000	0.923	1.000	1.000	1.000	0.896	0.985
1986	1.083	1.000	0.904	1.000	1.097	1.000	1.000	1.000	1.098	1.018
1987	1.000	1.000	1.009	1.000	0.999	1.000	1.000	1.000	1.017	1.003
1988	1.000	1.000	0.952	1.000	1.001	1.000	1.000	0.850	1.000	0.977
1989	1.000	1.000	1.218	1.000	1.000	1.000	1.000	1.176	1.000	1.041
1990	1.000	1.000	0.892	1.000	1.000	1.000	1.000	1.000	0.931	0.980
1991	1.000	1.000	1.121	1.000	1.000	1.000	1.000	1.000	0.898	1.001
1992	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.193	1.020
1993	0.966	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.003	0.996
1994	1.004	1.000	1.000	1.000	0.997	1.000	1.000	0.878	1.000	0.986
1995	1.031	1.000	1.000	1.000	0.943	1.000	1.000	1.008	1.000	0.998
1996	1.000	1.000	1.000	1.000	1.064	1.000	1.000	1.130	1.000	1.021
1997	1.000	1.000	1.000	1.000	0.865	1.000	1.000	1.000	1.000	0.984
1998	0.993	1.000	1.000	1.000	1.128	1.000	1.000	1.000	1.000	1.013
1999	1.007	1.000	1.000	1.000	0.841	1.000	1.000	1.000	1.000	0.982
2000	1.000	1.000	1.000	1.000	0.960	1.000	1.000	0.980	1.000	0.993
2001	1.000	1.000	1.000	1.000	1.046	1.000	1.000	0.932	1.000	0.997
2002	1.000	1.000	1.000	1.000	1.038	1.000	1.000	0.924	1.000	0.995
2003	1.000	1.000	1.000	1.000	1.077	1.000	1.000	1.185	1.000	1.027
2004	1.000	1.000	1.000	1.000	1.087	1.000	1.000	1.000	1.000	1.009
2005	1.000	1.0 00	1.000	1.000	0.766	1.000	1.000	1.000	1.000	0.971
2006	0.869	1.000	1.000	1.000	0.964	1.000	1.000	0.992	1.000	0.980
2007	0.857	1.000	1.000	1.000	0.915	1.000	1.000	1.009	0.995	0.974
2008	1.344	1.000	1.000	1.000	1.313	1.000	1.000	1.000	1.005	1.066
2009	1.000	1.000	0.972	1.000	1.127	1.000	1.000	1.000	1.000	1.010
2010	1.000	1.000	1.029	1.000	1.000	1.000	1.000	0.943	1.000	0.997
2011	0.993	1.000	1.000	1.000	0.906	1.000	1.000	0.919	1.000	0.979
2012	1.007	1.000	1.000	1.000	1.094	1.000	1.000	1.146	1.000	1.026
Average	1.000	1.000	1.004	1.000	1.008	1.000	1.000	1.000	1.000	Average

* Note that 1981 refers to the change between 1980 and 1981.

Appendix (2): Technical Change Results during 1980-2012

Techch	Algeria	Egypt	Iraq	Jordan	Morocco	Sudan	Syria	Tunisia	Yemen	Average
1981*	1.042	0.986	1.076	1.203	1.004	1.123	0.998	0.848	0.968	1.023
1982	1.058	1.015	0.923	0.793	0.961	0.883	1.009	0.994	0.972	0.953
1983	1.002	1.005	0.881	1.098	0.962	1.377	0.935	1.083	0.906	1.019
1984	1.003	0.989	0.909	1.168	0.945	0.633	0.906	0.846	0.836	0.904
1985	1.073	1.035	1.056	1.050	1.032	1.132	1.085	1.128	1.150	1.082
1986	0.925	1.023	0.982	1.138	1.011	1.199	1.027	0.904	1.167	1.037
1987	1.027	1.034	0.932	0.876	0.970	1.182	0.852	1.077	1.179	1.008
1988	1.090	0.985	1.104	0.818	1.178	0.791	1.206	0.869	0.818	0.972
1989	1.086	1.025	0.870	0.972	1.085	1.132	0.812	1.045	1.058	1.004
1990	0.974	1.301	1.205	1.434	0.957	0.783	1.063	1.358	0.887	1.086
1991	1.093	1.019	1.061	0.998	1.077	1.321	0.989	1.161	1.085	1.085
1992	1.021	1.041	0.916	1.155	0.989	1.049	1.035	0.830	1.207	1.021
1993	1.021	0.908	1.096	0.961	0.996	0.966	1.050	1.109	1.126	1.023
1994	1.020	1.047	1.001	1.180	1.043	1.100	0.991	0.933	0.939	1.026
1995	1.201	0.984	1.006	1.033	0.994	1.071	1.047	1.007	0.974	1.033
1996	1.274	1.100	1.111	0.985	1.108	0.835	1.097	1.261	1.188	1.099
1997	0.634	1.015	0.916	0.941	0.935	1.106	0.961	0.730	0.760	0.877
1998	0.995	0.974	1.096	1.079	1.048	1.508	1.152	1.207	1.185	1.129
1999	1.073	1.014	0.942	0.903	0.994	0.998	0.899	1.097	1.032	0.992
2000	1.052	1.053	0.941	1.210	1.018	1.014	1.142	0.850	1.077	1.035
2001	0.952	0.948	1.098	0.907	0.975	0.764	1.088	0.891	1.030	0.956
2002	1.037	1.037	1.244	1.075	1.016	1.092	1.075	1.083	1.188	1.092
2003	1.609	0.968	0.815	1.262	0.970	1.105	0.932	1.324	1.488	1.136
2004	0.658	1.038	1.048	0.623	1.002	0.854	0.982	0.816	0.610	0.830
2005	1.549	1.012	0.920	1.761	1.158	1.296	0.975	1.013	1.966	1.249
2006	0.929	1.154	0.950	1.068	1.138	0.985	0.993	1.128	0.747	1.002
2007	1.123	1.040	0.917	1.107	1.042	0.818	0.938	0.968	0.809	0.967
2008	0.905	0.918	0.900	0.641	0.828	0.927	1.011	0.931	1.036	0.892
2009	1.026	1.089	1.045	0.885	1.123	0.850	1.331	0.922	1.162	1.039
2010	0.897	0.911	1.159	1.466	1.043	0.908	0.135	1.031	0.784	0.806
2011	1.150	1.021	1.045	1.253	1.060	1.493	0.951	1.059	1.358	1.143
2012	0.962	1.033	0.973	0.887	0.945	0.681	1.020	0.965	1.134	0.948
Average	1.030	1.020	0.999	1.037	1.016	1.008	0.951	1.004	1.031	Average

*Note that 1981 refers to the change between 1980 and 1981.

Appendix (3): Total Factor Productivity Results during 1980-2012

tfpch	Algeria	Egypt	Iraq	Jordan	Morocco	Sudan	Syria	Tunisia	Yemen	Average
1981*	1.042	0.986	1.085	1.203	1.042	1.123	0.998	0.848	0.968	1.028
1982	1.058	1.015	1.048	0.793	1.205	0.883	1.009	0.818	0.972	0.970
1983	1.002	1.005	0.881	1.098	0.860	1.377	0.935	1.316	0.826	1.018
1984	1.003	0.989	0.754	1.168	1.046	0.633	0.906	0.846	0.917	0.905
1985	0.990	1.035	1.203	1.050	0.953	1.132	1.085	1.128	1.030	1.065
1986	1.002	1.023	0.888	1.138	1.109	1.199	1.027	0.904	1.281	1.056
1987	1.027	1.034	0.940	0.876	0.969	1.182	0.852	1.077	1.199	1.011
1988	1.090	0.985	1.051	0.818	1.179	0.791	1.206	0.739	0.818	0.950
1989	1.086	1.025	1.060	0.972	1.085	1.132	0.812	1.229	1.058	1.045
1990	0.974	1.301	1.075	1.434	0.957	0.783	1.063	1.358	0.826	1.064
1991	1.093	1.019	1.189	0.998	1.077	1.321	0.989	1.161	0.974	1.086
1992	1.021	1.041	0.916	1.155	0.989	1.049	1.035	0.830	1.440	1.042
1993	0.986	0.908	1.096	0.961	0.996	0.966	1.050	1.109	1.129	1.020
1994	1.024	1.047	1.001	1.180	1.040	1.100	0.991	0.819	0.939	1.011
1995	1.238	0.984	1.006	1.033	0.937	1.071	1.047	1.015	0.974	1.031
1996	1.274	1.100	1.111	0.985	1.179	0.835	1.097	1.425	1.188	1.121
1997	0.634	1.015	0.916	0.941	0.809	1.106	0.961	0.730	0.760	0.863
1998	0.988	0.974	1.096	1.079	1.182	1.508	1.152	1.207	1.185	1.143
1999	1.081	1.014	0.942	0.903	0.836	0.998	0.899	1.097	1.032	0.974
2000	1.052	1.053	0.941	1.210	0.977	1.014	1.142	0.833	1.077	1.028
2001	0.952	0.948	1.098	0.907	1.020	0.764	1.088	0.830	1.030	0.954
2002	1.037	1.037	1.244	1.075	1.055	1.092	1.075	1.001	1.188	1.087
2003	1.609	0.968	0.815	1.262	1.045	1.105	0.932	1.569	1.488	1.167
2004	0.658	1.038	1.048	0.623	1.089	0.854	0.982	0.816	0.610	0.838
2005	1.549	1.012	0.920	1.761	0.887	1.296	0.975	1.013	1.966	1.213
2006	0.807	1.154	0.950	1.068	1.097	0.985	0.993	1.119	0.747	0.982
2007	0.962	1.040	0.917	1.107	0.953	0.818	0.938	0.977	0.805	0.942
2008	1.216	0.918	0.900	0.641	1.087	0.927	1.011	0.931	1.041	0.951
2009	1.026	1.089	1.016	0.885	1.266	0.850	1.331	0.922	1.162	1.049
2010	0.897	0.911	1.193	1.466	1.043	0.908	0.135	0.972	0.784	0.803
2011	1.142	1.021	1.045	1.253	0.960	1.493	0.951	0.973	1.358	1.119
2012	0.969	1.033	0.973	0.887	1.034	0.681	1.020	1.106	1.134	0.972
Average	1.030	1.020	1.004	1.037	1.025	1.008	0.951	1.004	1.031	Average

*Note that 1981 refers to the change between 1980 and 1981.

Appendix (4): Scale Efficiency Results during 1980-2012

Seff	Algeria	Egypt	Iraq	Jordan	Morocco	Sudan	Syria	Tunisia	Yemen	Average
1981*	1.000	1.000	0.883	1.000	0.966	1.000	1.000	1.000	1.000	0.982
1982	1.000	1.000	1.135	1.000	1.048	1.000	1.000	0.958	1.000	1.015
1983	1.000	1.000	1.000	1.000	0.999	1.000	1.000	1.044	0.912	0.994
1984	1.000	1.000	0.892	1.000	1.001	1.000	1.000	1.000	1.097	0.998
1985	0.923	1.000	1.087	1.000	0.985	1.000	1.000	1.000	0.896	0.987
1986	1.083	1.000	0.913	1.000	1.018	1.000	1.000	1.000	1.098	1.011
1987	1.000	1.000	0.973	1.000	0.999	1.000	1.000	1.000	1.017	0.999
1988	1.000	1.000	0.952	1.000	1.001	1.000	1.000	0.935	1.000	0.987
1989	1.000	1.000	1.218	1.000	1.000	1.000	1.000	1.069	1.000	1.030
1990	1.000	1.000	0.892	1.000	1.000	1.000	1.000	1.000	0.931	0.980
1991	1.000	1.000	1.121	1.000	1.000	1.000	1.000	1.000	0.898	1.001
1992	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.193	1.020
1993	0.966	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.003	0.996
1994	1.004	1.000	1.000	1.000	0.997	1.000	1.000	0.878	1.000	0.986
1995	1.031	1.000	1.000	1.000	0.943	1.000	1.000	1.008	1.000	0.998
1996	1.000	1.000	1.000	1.000	1.064	1.000	1.000	1.130	1.000	1.021
1997	1.000	1.000	1.000	1.000	0.871	1.000	1.000	1.000	1.000	0.985
1998	0.993	1.000	1.000	1.000	1.120	1.000	1.000	1.000	1.000	1.012
1999	1.007	1.000	1.000	1.000	0.911	1.000	1.000	1.000	1.000	0.990
2000	1.000	1.000	1.000	1.000	0.978	1.000	1.000	0.980	1.000	0.995
2001	1.000	1.000	1.000	1.000	1.003	1.000	1.000	0.932	1.000	0.993
2002	1.000	1.000	1.000	1.000	1.034	1.000	1.000	0.924	1.000	0.995
2003	1.000	1.000	1.000	1.000	1.110	1.000	1.000	1.185	1.000	1.031
2004	1.000	1.000	1.000	1.000	1.001	1.000	1.000	1.000	1.000	1.000
2005	1.000	1.000	1.000	1.000	0.850	1.000	1.000	1.000	1.000	0.982
2006	0.869	1.000	1.000	1.000	1.010	1.000	1.000	0.992	1.000	0.985
2007	0.857	1.000	1.000	1.000	0.957	1.000	1.000	1.009	0.995	0.979
2008	1.344	1.000	1.000	1.000	1.114	1.000	1.000	1.000	1.005	1.046
2009	1.000	1.000	0.972	1.000	1.091	1.000	1.000	1.000	1.000	1.007
2010	1.000	1.000	1.029	1.000	1.000	1.000	1.000	0.943	1.000	0.997
2011	0.993	1.000	1.000	1.000	0.906	1.000	1.000	0.919	1.000	0.979
2012	1.007	1.000	1.000	1.000	1.094	1.000	1.000	1.146	1.000	1.026
Average	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	Average

*Note that 1981 refers to the change between 1980 and 1981.

Appendix (5): Pure Efficiency Results during 1980-2012

Peff	Algeria	Egypt	Iraq	Jordan	Morocco	Sudan	Syria	Tunisia	Yemen	Average
1981*	1.000	1.000	1.142	1.000	1.074	1.000	1.000	1.000	1.000	1.023
1982	1.000	1.000	1.000	1.000	1.196	1.000	1.000	0.859	1.000	1.003
1983	1.000	1.000	1.000	1.000	0.895	1.000	1.000	1.164	1.000	1.005
1984	1.000	1.000	0.930	1.000	1.106	1.000	1.000	1.000	1.000	1.003
1985	1.000	1.000	1.048	1.000	0.937	1.000	1.000	1.000	1.000	0.998
1986	1.000	1.000	0.990	1.000	1.078	1.000	1.000	1.000	1.000	1.007
1987	1.000	1.000	1.037	1.000	1.000	1.000	1.000	1.000	1.000	1.004
1988	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.909	1.000	0.989
1989	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.100	1.000	1.011
1990	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1991	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1992	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1993	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1994	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1995	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1996	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1997	1.000	1.000	1.000	1.000	0.993	1.000	1.000	1.000	1.000	0.999
1998	1.000	1.000	1.000	1.000	1.007	1.000	1.000	1.000	1.000	1.001
1999	1.000	1.000	1.000	1.000	0.923	1.000	1.000	1.000	1.000	0.991
2000	1.000	1.000	1.000	1.000	0.982	1.000	1.000	1.000	1.000	0.998
2001	1.000	1.000	1.000	1.000	1.043	1.000	1.000	1.000	1.000	1.005
2002	1.000	1.000	1.000	1.000	1.004	1.000	1.000	1.000	1.000	1.000
2003	1.000	1.000	1.000	1.000	0.970	1.000	1.000	1.000	1.000	0.997
2004	1.000	1.000	1.000	1.000	1.086	1.000	1.000	1.000	1.000	1.009
2005	1.000	1.000	1.000	1.000	0.901	1.000	1.000	1.000	1.000	0.988
2006	1.000	1.000	1.000	1.000	0.954	1.000	1.000	1.000	1.000	0.995
2007	1.000	1.000	1.000	1.000	0.956	1.000	1.000	1.000	1.000	0.995
2008	1.000	1.000	1.000	1.000	1.179	1.000	1.000	1.000	1.000	1.018
2009	1.000	1.000	1.000	1.000	1.033	1.000	1.000	1.000	1.000	1.004
2010	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2011	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2012	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Average	1.000	1.000	1.004	1.000	1.008	1.000	1.000	1.000	1.000	Average

*Note that 1981 refers to the change between 1980 and 1981.

الملخص العربى

تقدير مؤشر مالمكويست للإنتاجية الكلية للعوامل الزراعية لبعض الدول العربية مستخدماً طريقة مغلف البيانات المنهج اللا معلمى

أحمد الخولى

قسم الاقتصاد الزراعى- كلية الزراعة - جامعة المنوفية

ستستمر الزراعة تلعب دورا حيويا للإنسانية على المستوى العالمى لان الرفاهية البشرية تتوقف على مقدار واستمرار الناتج الزراعى الذى يتحدد وفقا لكل من إنتاجية المحاصيل والمساحة المزروعة ، وينظر إلى النمو الاقتصادى على انه العمليات التى تستخدم لتحقيق الناتج والتى تتوقف على إنتاجية الدولة وعلى الجانب الأخر فان الإنتاجية ما هى إلا موضوع جزئى يتناول كيفية قيام الوحدات الإنتاجية باستخدام وتأجير رأس المال والعمل والمدخلات الأخرى في تحقيق الناتج من السلع و الخدمات . والارتباط المباشر بين النمو الاقتصادى والإنتاجية يظهر بعدة طرق ، فمصادر نمو الإنتاجية مع الزمن تتحقق من النمو والتنمية .

ومن الصعب الوصول إلى نمو الإنتاجية كهدف لسياسة التنمية في العديد من الدول ، لهذا السبب فان الدراسات الخاصة بمصادر النمو أصبحت ذات أهميه كبيرة لصناع السياسة ، لذلك فان نمو الإنتاجية قد نال الاهتمام الكبير خلال العقود القليلة الأخيرة لمواجهة الطلب المتزايد على الغذاء والمواد الخام بسبب النمو السكانى ،حتى أن الدول التى تحقق معدلات منخفضة من نمو الإنتاجية تعاني تدهورا كبيرا فى كلا من ميزان التبادل التجارى وشرط التجارة الداخلى.

وقد ألقت العديد من الدراسات الضوء على هذا الموضوع سواء باستخدام أولا مقياس الإنتاجية الجزئية (PFP)[1] والتى تناولت غالبيتها إنتاجية العمل وثانيا مقياس الإنتاجية الكلية (TFP)[2] و الأخير هو التحليل الذى يتناول استخدام كل من (١) مدخل الدالة الإنتاجية (٢) مدخل الرقم القياسى (٣) تحليل مغلف البيانات (DEA)[3] على أساس مؤشر مالمكويست .

وقد تم تأسيس كلا من موديل الدالة الإنتاجية القياسية باستخدام المربعات الصغرى واجمالى الإنتاجية العامليه عادة باستخدام بيانات السلاسل الزمنية مع افتراض أن جميع الوحدات الإنتاجية تحقق الكفاءة التكنولوجية بينما تحليل مغلف البيانات يكون باستخدام البيانات القطاعية على مستوى المنشآت أو المزارع أو المناطق أو الدول وذلك لمقارنة الإنتاجية النسبية ، فإذا توافرت جداول البيانات فانه يمكن استخدام الدالات الإنتاجية ، مغلف البيانات ، الدالة الحدوديه العشوائيه لقياس كل من التغير التكنولوجى (Technical Change) وتحسين الإنتاجية (Efficiency Change) .

[1] Partial Factor Productivity (PFP)
Total Factor Productivity (TFP)[2]
Data Envelopment Analysis(DEA)[3]

ورقم أو مؤشر مالمكويست والذى أصبح الأوسع استخداما لقياس وتحليل الإنتاجية بعد موديل فاريل ويمكن تقديره باستخدام المدخل اللابرامترى (DEA) وأنة لا يحتاج إلى الفروض الخاصة بالسلوك الإقتصادى (كتعظيم الربح أو تدنية التكاليف) وبناء على ذلك لا يتطلب إدخال الأسعار في عمليات التقدير هذا بالإضافة إلى إمكانيتها على تقسيم نمو الإنتاجية إلى شقيها وهى التغيرات في الكفاءة الإنتاجية مع الزمن أو ما يعرف باقتباس التأثيرات (Catching up Effect) والشق الثانى نقل التكنولوجيا مع الزمن أو التغير التكنولوجى أو ما يعرف بالتأثير الحدودى (Frontier Effect) . ورقم أو مؤشر مالمكويست لاجمالى الإنتاجية العامليه (TFP) يقيس المسافة بين النقط البيانية لدولة معينة في فترتين وبحساب نسبة المسافات لجميع النقط البيانية بالنسبة إلى التكنولوجيا الشائعة فان رقم أو مؤشر مالمكويست يمكن الحصول علية بقسمة المتوسط الهندسى للرقم القياسى لاجمالى الإنتاجية العامليه للفترة الحالية مقسومة على نظيرة لفترة الأساس (معادلة ١) فإذا كان أكبر من الواحد يكون نمو اجمالى الإنتاجية العامليه موجب بينما إذا كان أقل من الواحد يكون النمو سالب .

وتتناول الدراسة اختبار التغيرات في الإنتاجية الزراعية للدول العربية التى تتسم بارتفاع نسبة مساهمة ناتجها الزراعى في اجمالى الناتج المحلى خلال الفترة (٢٠٠٨-٢٠١٢) وهى على الترتيب التنازلى السودان بحوالى ٣٢% وسوريا بحوالى ٢١% ثم المغرب ومصر واليمن بحوالى ١٤% بينما الجزائر وتونس بحوالى ٨%وكل من لبنان والعراق بحوالى ٥% والأردن وليبيا والسعودية بحوالى ٢,٥% وأخيرا الأمارات العربية وعمان بحوالى ٠,٩% وأخيرا البحرين والكويت بحوالى ٠,٠٣% واستبعدت الدراسة الدول العربية التى تتسم بضآلة ناتجها الزراعى مثل البحرين وقطر والكويت وعمان والإمارات العربية المتحدة بالإضافة إلى الدول العربية التى لا تتوافر لها بيانات مثل موريتانيا وليبيا وجيبوتى والصومال وفلسطين ولبنان والسعودية . وعلى ذلك تناولت الدراسة كل من الجزائر ،مصر،العراق ، الأردن ،المغرب ،السودان ، سوريا ، تونس ، اليمن اى الدول الأكبر انتاجا واستيرادا للطعام والحبوب وتمثل السوق الرئيسية للمنتجات والأطعمة الزراعية حيث تمثل مصر أكبر مستورد للحبوب على المستوى العالمى .

واستخدم التحليل نوعين من المخرجات هما الإنتاج النباتى والإنتاج الحيوانى وتناول ستة مدخلات هى الأرض ، الآلات ، العمل ، الأسمدة المستهلكة ، الإنتاج الحيوانى والرى .وأسفرت نتائج الدراسة على الأتى :

أولا : يمكن للدولة زيادة إنتاجيتها الزراعية بطريقتين مختلفتين أولهما عن طريق تحسين الكفاءة من خلال تحسين العمل وذلك بنشر التكنولوجيا وثانيهما عن طريق تطبيق التغيرات التكنولوجية من خلال استيراد وتبنى التكنولوجيات الجديدة ومن المؤكد أن الطريقتين معا تزيد من الإنتاجية الزراعية .

ثانيا : توافرت بكثافة نتائج الكمبيوتر التوضيحية الخاصة بالكفاءة لكل دولة لكل سنة على حدة وذلك بقياس كل من تغير الكفاءة التكنولوجية والتغير التكنولوجى وتغير اجمالى الإنتاجية العاملية لكل دولة في الملاحق من ١-٥ .

ثالثا : أظهرت مستويات الكفاءة التكنولوجية لكل دولة النسبة بين الناتج الفعلى والتكنولوجيا الممكنة في كل فترة .

رابعا : أظهرت النتائج الخاصة بالكفاءة التكنولوجية على أساس متوسطات فترات الثمانينات والتسعينات والالفينينات انة فيما عدا المغرب واليمن وتونس ان بقية الدول المختارة كانت جميعها ذات كفاءة تكنولوجية خلال الثلاث فترات .

الكلمات الدالة: نموذج مغلف البيانات ، مالمكويسيت ، الانتاجية الكلية للعوامل الزراعية .

مستوى الإستفادة المعرفية للريفيات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) ببعض قرى محافظة البحيرة

أبو زيد محمد محمد الحبال و *جمال بخيت حسين عامر و سوزان إبراهيم السيد الشربتلي و *حنان نجيب علي طحاوي

كلية الزراعة سابا باشا – جامعة الإسكندرية

*معهد بحوث الإرشاد الزراعي والتنمية الريفية – مركز البحوث الزراعية

الملخص : إستهدف هذا البحث التعرف على مستوى الإستفادة المعرفية للريفيات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) ببعض قرى محافظة البحيرة ، وإنحصرت وسائل تحقيق هذا الهدف في : التعرف على بعض الخصائص المميزة للريفيات المبحوثات ، والتعرف على مستوى الإستفادة المعرفية للمبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) ، دراسة العلاقات الإرتباطية والإنحدارية بين مستوى الإستفادة المعرفية للمبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) والمتغيرات المستقلة المدروسة ، والتعرف على المشكلات التي تواجه المبحوثات عند الإتصال بشبكة الإتصال (رادكون) والحلول المقترحة لحلها من وجهة نظرهن .

تمثلت شاملة البحث في جميع الريفيات اللآتي تعرضن لشبكة إتصال التنمية الريفية والزراعية (رادكون) ببعض مراكز محافظة البحيرة ، وقد تم إستيفاء البيانات البحثية من ١٦٠ ريفية مبحوثة ، من خلال إستمارة الإستبيان بالمقابلة الشخصية ، وتمثلت الأساليب الإحصائية المستخدمة في : النسب المئوية ، والمتوسط الحسابي ، والإنحراف المعياري ، وتحليل التباين ، والإرتباط البسيط ، ومربع كاي ، وتحليل الإنحدار المتعدد ، وإختبار T ونسبة F وكانت أهم النتائج كالآتي :

١- أن نسبة ذوي مستوى الإستفادة المعرفية المنخفض ١٦.٢٥ % ، والمتوسط ٦٦.٧٥% ، والمرتفع ١٧% .

٢- وجود علاقة إرتباطية موجبة وذات دلالة إحصائية بين مستوى الإستفادة المعرفية للريفيات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) وكل من : الحالة التعليمية ، والمستوى الطموحي ، والإنفتاح الإنتقالي ، والتجددية ، وتعدد مصادر المعلومات ، وإمتلاك الأسرة لجهاز الحاسب الآلي ومستوى الإستفادة منه ، ومستوى التعرض للشبكة ، والمعرفة بأنظمة الشبكة ، والرضا عن الشبكة ، والمستوى التقييمي لخصائص محتوى الشبكة .

٣- أن المتغيرات المستقلة الخمسة وهي : تعدد مصادر المعلومات ، و التجددية ، والمعرفة بأنظمة الشبكة ، والرضا عن الشبكة ، والمستوى التقييمي لخصائص محتوى الشبكة مجتمعة تفسر حوالي ٥٨% من التباين الحادث في مستوى الإستفادة المعرفية للريفيات من متضمنات أنظمة الشبكة .

٤) تمثلت أهم المشكلات التي تواجه الريفيات عند الإتصال بالشبكة في : عطل جهاز الكمبيوتر، وسقوط الشبكة .

الكلمات الدلالية : الإستفادة المعرفية – الإتصال – تكنولوجيا الإتصالات والمعلومات – شبكة إتصال التنمية الريفية والزراعية (رادكون) .

المقدمة والمشكلة البحثية :

تعد التنمية الريفية المتكاملة والمستدامة هي غاية المؤسسات التي تعمل في الريف ونشاط كل مؤسسة تشارك في القرية ، وهي أداة تساعد على تحقيق هذه التنمية وأن لكل مؤسسة نشاطها الذي يميز طبيعة إختصاصها وحدود مسئوليتها في عجلة التنمية ، وأن تقصير أي مؤسسة في القيام بالدور المحدد لها يعتبر نقطة ضعف وخلل في التنمية ولا تستطيع أي مؤسسة أخرى القيام بهذا الدور لعدم إختصاصها ، وتوجد علاقة قوية بين التنمية الريفية والإرشاد الزراعي وكلاهما يهتم بالعنصر البشري وإعداده للمشاركة الفاعلة ، وأن الإرشاد الزراعي يمثل أحد روافد التنمية في مجال الزراعة من خلال التعامل مع الريفيين المشتغلين بالزراعة بشكل مباشر أو بشكل غير مباشر، وكذلك الأنشطة المرتبطة بالزراعة في القرية (قشطة ، ٢٠١٢) .

ولما كان العنصر البشري هو الأساس في نجاح برامج التنمية وأن الاستثمار الأمثل لدور المرأة التي تمثل ما يقرب من نصف المجتمع يعتبر أحد المداخل الأساسية لعملية التنمية وتمثل المرأة نسبة لا يستهان بها من الموارد البشرية ، حيث تعد قوة إنتاجية واضحة بما تؤديه من دور بارز في تلبيه إحتياجاتها الأسرية المتعددة (طلبه وآخرون ، ٢٠٠١) ،ونجد أن الإرشاد الزراعي لا يقتصر دوره على الزراع بل يمتد هذا الدور إلى المرأة الريفية لتوعيتها بالأعمال الزراعية الحقلية والمنزلية لمساعدتها على إستيعابها والقيام بها على الوجه الأكمل بإعتبارها جزءً أساسياً من الإرشاد الزراعي (قشطة ، ٢٠١٢) .

وتساعد تكنولوجيا المعلومات والإتصال في إستيفاء الإحتياجات وتحديث الخبرات التعليمية من خلال فتح آفاق جديدة لإدارة المعرفة بما ينطوي عليه ذلك من أنشطة نشر وتبادل وتخزين وإسترجاع المعلومات ، فالغرض الأساسي لإدارة المعرفة هو تحويل الثورة المعلوماتية والحصيلة المعرفية المملوكة للمنظمات والأفراد إلى قيمة يتحقق الإستفادة منها بصورة مستمرة ، الأمر الذي يعمل على تقوية ودفع المنظمات نحو التقدم والإزدهار (فتحي ، ٢٠٠٩) .

ومن هنا فإن الإستفادة بالتطورات السريعة والمتلاحقة في مجال الإتصال عن بعد وتكنولوجيا المعلومات القائمة على إستخدام الحاسب الآلي والإنترنت يمكن أن تسهم في تطوير وتحديث العمل الإرشادي الزراعي ، فتكنولوجيا المعلومات سوف تقدم خدمات معلوماتية جديدة للمناطق الريفية تساعدهم على إتخاذ القرارات المزرعية المناسبة لما توفرة لهم من حلول دقيقة ، وتساعد تكنولوجيا الإتصال على نقلها وتوصلها في الوقت والمكان المناسبين وفي الإتجاه العكسي (البنداري ،٢٠٠٥) . وتعتبر شبكات الإتصال المعتمدة على الحاسب الآلي وسيلة يمكن من خلالها نشر المعلومات على وجه السرعة لعدد كبير من المستخدمين ، حيث يعتمد على إستخدام الربط بين كل من السياسة الزراعية والبحوث الزراعية والزراع وأسرهم و بين المكونات التكنولوجية(شبانه، ٢٠١٠) .

وحول الدراسات الإرشادية المرتبطة بمجال إستخدام تكنولوجيا المعلومات والإتصال فى العمل الإرشادي فقد تباينت إتجاهاتها ، فقد ركزت بعضها على التعرف على الأثرالمعرفى للزراع مستخدمى نظام مشكلات الزراع وتتبع حلولها على شبكة(فيركون)(شاكر وآخرون ،٢٠٠٤) ، وركز بعضها على النظم الخبيرة كمصادر للمعلومات (هيكل ،٢٠١٢) ، (النحاس ،٢٠١١) ،كما إهتم بعضها بتقييم شبكة إتصال البحوث والإرشاد(فيركون) وتقييم أثر نظام مشكلات الزراع وتتبع حلولها (سجري ،٢٠١٠) ، (وعبد المجيد وآخرون ، ٢٠١١) ، وركز بعضها على تحليل المشكلات المنشورة على نظام المشكلات وتتبع حلولها (شبانه ،٢٠١٠) ، (قاسم ، ٢٠٠٧) ، وإهتم بعضها بدراسة الأثر المعرفي لإستخدام شبكة إتصال البحوث بالإرشاد (فيركون) ، (عبد الواحد وآخرون ، ٢٠١٠) ، كما

ركز البعض الآخر على مضمون شبكة إتصال التنمية الريفية والزراعية (رادكون) (حسيب والبندارى،٢٠١٠)، و(الذهبي والشافعي ، ٢٠١٢) ، و(واكد والجزار ، ٢٠١٢) .

ومن أهم تطبيقات إستخدام التكنولوجيا الحديثة فى العمل الزراعي والتي بدأ إستخدامها فى مصر عام ٢٠٠٠ كأول تطبيق لتكنولوجيا المعلومات والإتصالات فى المجال الإرشادي كانت شبكة إتصال البحوث بالإرشاد الزراعي Virtual extension and research communication Net Work (VERCON) وذلك كأحد مشروعات برنامج التعاون الفني لمنظمة الأغذية والزراعة للأمم المتحدة (FAO) (قاسم ،٢٠٠٧) .

ولتحقيق الإستفادة من تكنولوجيا المعلومات والإتصال في القطاع الزراعي قامت وزارة الزراعة واستصلاح الأراضي بإنشاء العديد من مراكز المعلومات ووحدات الحاسب الآلي المتخصصة في المجالات الزراعية المختلفة البحثية والإرشادية والخدمية والإدارية ، لخدمة أغراض العمل الزراعي وسرعة تدفق المعلومات وترشيد إتخاذ القرارات المزرعية المناسبة .

وفي هذا الإطار تباشر شبكة إتصال التنمية الريفية والزراعية (رادكون) عملها كسبيل لتنمية القطاع الريفي حيث تستهدف تنمية الأسر والمجتمعات الريفية وتلبية إحتياجاتهم من المعلومات والخبرات لتوفير فرص الحياة الكريمة والحد من الفقر ، كما تمكن هذه الشبكة المجتمعات من المشاركة الإيجابية للتعرف على مشكلاتهم والإستجابة لها من خلال توفير وسائل التواصل وتبادل المعلومات والخبرات من أجل خدمة مجتمعاتهم الريفية المحلية (شاكر، ٢٠٠٨) .

لذا فقد أولت الدولة عناية وإهتماماً بالأسرة والمرأة الريفية والإستفادة من التقدم الهائل فى مجال تكنولوجيا المعلومات والإتصالات لتنميتها وتثقيفها وإثارة وعيها وإعدادها لتمكينها من القيام بأدوارها المختلفة سواءً المنزلية والأسرية والإنتاجية الزراعية و المجتمعية من أجل النهوض بالمستويات المعيشية للأسرة الريفية ، وذلك من خلال البرامج والأنشطة المتضمنة بشبكة إتصال التنمية الريفية والزراعية (رادكون) .

ونظراً لندرة الدراسات التي إهتمت بدراسة مدى الإستفادة المعرفية من شبكة إتصال التنمية الريفية والزراعية (رادكون) ، وأهمية تلك الدراسات في رسم الخطط المستقبلية لتلك المشروعات ، من حيث معرفة أوجه الإستفادة منها والقصور وأثارها على الريفيات لكي يمكن التركيز على أوجه هذه الإستفادة عند تطبيقها مستقبلاً في أماكن أخرى (محافظات أخرى) ، وكذا معرفة نقاط الضعف لتجنبها وعلاجها عند تطبيقها مرة ثانية ، لذلك فإن هذه الدراسة بصدد معرفة مستوى الإستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون)، وذلك لمحاولة معرفة مدي إسهام هذه الشبكة في تزويد الريفيات بالمعلومات الجديدة التي تمكنهن من النهوض بمستوياتهن المعرفية فى المجالات المختلفة ، وكذا معرفة نقاط الضعف التي يمكن تجنبها عند التطبيق مرة ثانية مستقبلاً .

الأهداف البحثية :

تتلخص أهداف هذه الدراسة في :

١- التعرف على بعض الخصائص المميزة للريفيات المبحوثات .

٢- التعرف على مستوى الإستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) .

٣- دراسة العلاقات الإرتباطية والإنحدارية بين مستوى الإستفادة المعرفية من متضمنات شبكة إتصال التنمية الريفية والزراعية (رادكون) والمتغيرات المستقلة المدروسة.

٤- التعرف على المشكلات التي تواجه الريفيات عند الإتصال بشبكة إتصال التنمية الريفية والزراعية (رادكون) والحلول المقترحة لها من وجهة نظرهن .

الإطار النظري :

يسعى الإرشاد الزراعي بإعتباره عملية تعليمية إلى إحداث تغييرات سلوكية في جمهور الزراع محددة في ثلاثة مجالات هى : المجال المعرفي ، والمجال العاطفي (الإتجاهي) ، والمجال المهاري . وتعتبر المعرفة هى الأساس الذي تستند عليه كافة النشاطات الإنسانية ، ويعتبر هذا المجال جوهر ومحور بحوث العمل الإرشادي ، وميدان لبناء وتطوير الأنشطة والبرامج الإرشادية .ويعرف(حسن،١٩٧١) المعرفة بأنها مجموعة من المعاني والمعتقدات والأحكام والمفاهيم والتصورات الفكرية التي تتكون لدى الإنسان نتيجة لمحاولاته المتكررة لفهم الظواهر والأشياء المحيطة به.ويختلف البنيان المعرفي من فرد إلى آخر ، ويرجع هذا الإختلاف إلى تباين البيئة الطبيعية والإجتماعية للأفراد وإختلاف تركيبهم الفسيولوجي . وتعزى الفجوة المعرفية بين الأفراد إلى : مستوى المهارات الإتصالية للفرد، ومستوى المعرفة الموجودة لديه ، ومستوى العلاقات الإجتماعية ، وعدد الجماعات التي ينتمي إليها الفرد ، والإتصال الشخصي ، وطبيعة النظام الإعلامي ، والعمليات الإنتقائية في التعرض والإدراك والتذكر (حلمي ، ١٩٩٠) .

هذا ويعتبر الإتصال في المجتمع البشري هو بمثابة الجهاز العصبي في الكائن الحي فهو الذي يربط بين أفراد المجتمع وجماعاته ومنظماته في نسيج واحد ، وبقدر ما يكون الإتصال قوياً ومتيناً بين أفراد وقطاعات المجتمع ، كلما تقدم المجتمع وأمكنه حل ما يصادفه من مشكلات وأصبح قادر على تحقيق أهدافه في التنمية (الصياد ، ٢٠٠٨) . ويضيف (فتحي وآخرون ، ٢٠٠٥) أن الإتصال هو النشاط الإنساني الذي لا يمكن للحياة أن تستمر بدونه ، فيعتبر الإتصال بمثابة المركز أو المحور للسلوك الإنساني فالفرد لا يستطيع أن يتفاعل إجتماعياً بدون الإتصال ومن خلال الرموز المشتركة يستطيع الفرد نقل المعلومات والأفكار والعواطف إلى الآخرين.

كما أن الإتصال الذي يتم داخل الفرد يكون إما بالتفكير في شئ ما أو معرفة سبب أو تقييم الفرد لنفسه ، بينما عندما يتصل بفرد آخر فإنه يتعلم منه ويسمعه وذلك يساعد على توطيد علاقته به ، أما عندما يمارس الاتصال داخل مجموعة فإنه يستطيع التفاعل مع الآخرين ، وأيضاً يساعده ذلك على تبادل المعلومات وتطوير الأفكار ، وإتخاذ القرارات ، وحل المشكلات وتقديم الحلول لها بينما من خلال الإتصال الجماهيري يستطيع الفرد أن يرسخ القيم والمواقف ويؤكد الإتجاهات (Gamble and chael. 2010) .

إن الغرض الأساسي من الإتصال هو توجه المتصل نحو المعلومات بإعطائها إهتمامه والتفاعل معها والإستجابة لها ، ويتم في عملية الإتصال نقل المعرفة بأنواعها والمعلومات المختلفة من شخص آخر ومن نقطة لأخرى وتتخذ لها مساراً يبدأ من المصدر الذي تتبع منه إلى الجهة التي تستقبلها ثم يرتد ثانية إلى المصدر وهكذا (نصر الله ، ٢٠١٠) . ويعرف الإتصال على أنه عملية نقل المعلومات والإتجاهات وهو عملية مشاركة بين المستقبل والمرسل والمشاركة في الإزدواج في الوجود وهو الإقتراب إلى واقع العملية الإتصالية ، وأيضاً هو عملية مشاركة في الأفكار والمعلومات عن طريق إرسال توجيه وتيسير ، ثم استقبال بكفاءة وخلق إستجابة معينة في وسط إجتماعي معين (مهنا ، ٢٠٠٧) . ويضيف (فتحي وآخرون ، ٢٠٠٥) أن الإتصال هو العملية التعاونية التي يتم من خلالها نقل وتبادل المعلومات بين المرشد والمسترشد بطريقة تمكن كل منهما من الوصول إلى الفهم المشترك لمعني وهدف الرسائل الإرشادية المتبادلة بينهما وإتخاذ الأفعال المناسبة بواسطة المسترشد .

يذكر(إبراهيم ، ٢٠٠٤) أن للإتصال أهداف كثيرة ، ويمكن تقسيمها إلى أهداف عامة ، وأهداف خاصة ، تتمثل الأهداف العامة للإتصال فيما يلي : ١- أهداف معرفية : عندما يكون الهدف أساساً توصيل المعلومات والخبرات ٢- أهداف إقناعية: عندما يكون الهدف أساساً تغيير وجهة نظر أو الإقتناع بشئ ٣- أهداف ترويحية : وترقى أساساً إلى الترويج عن النفس ، وهذه الأهداف وإن كانت موجودة بالنسبة لكل عملية إتصال إلا أن أحد الأهداف قد تغلب قيمته ووزنه على الآخر في عملية إتصال معينة ، بينما تتمثل الأهداف الخاصة للإتصال في أن هناك أهداف خاصة لكل مؤسسة تتوقف هذه الأهداف على نوعية المؤسسة .

ويفترض(Crokhite. ،1976) وجود ثلاثة وظائف رئيسية للإتصال ليصبح أكثر تحديداً ومساهمة لبقاء البشرية ، حيث أن الإتصال يحافظ على البقاء على قيد الحياة ، كما أنه يجعل الفرد قادر على جمع المعلومات عن بيئته ، وأيضاً يسمح للناس بالتفاعل مع بعضهم بشكل تعاوني .

تكنولوجيا المعلومات والإتصالات :

لتكنولوجيا المعلومات والإتصالات دور هام في تعزيز التنمية البشرية والإقتصادية والإجتماعية والثقافية ، وذلك لما لهذه الأجهزة من خصائص متميزة أكثر كفاءة من الوسائل التقليدية فتكنولوجيا المعلومات والإتصال واسعة الإنتشار ، تتخطى بذلك الحدود الجغرافية والسياسية للدول لتصل إلى أي نقطة في العالم عجزت أن تصل إليها وسائل الإتصال القديمة ، ويمكن القول بأن التطور الذي حدث في تكنولوجيا المعلومات والإتصالات له أثر في تطوير وتحسين ومعالجة البيانات إليكترونياً وتوصيل هذه المعلومات إلى جميع المستخدمين المنتشرين في جميع أنحاء العالم بالوقت المناسب لإتخاذ قرارات رشيدة ، وهذا يعني ضرورة الإستفادة من هذه التكنولوجيا في جميع المجالات (عاصم ، ٢٠١٣) . وقد أدى التقدم الهائل في تكنولوجيا المعلومات والإتصالات إلى تغييرات جوهرية في أنماط الحياة بمختلف مجالاتها سواء على المستوى الفردي أو الأسري أو مستوى المجتمعات الإقتصادية والتنمية (شبانة ،٢٠٠٩) .

ويرى (Blake. and Harold sen R.H. 1975) أن تكنولوجيا المعلومات والإتصالات هي مجموعة من التقنيات أو الأدوات أو الوسائل أو النظم المختلفة التي يتم توظيفها لمعالجة المضمون أو المحتوى الذي يراد توصيله من خلال الحاسبات الإلكترونية ، ثم تخزينها ثم إسترجاعها في الوقت المناسب ، ثم نشر هذه الرسائل وفقاً لطبيعتها ونقلها من مكان إلى آخر وتبادلها . ومهدت كل التطورات التي شهدها قطاع الإتصالات وتنمية المعلومات السبل أمام أعداد كبيرة من الناس ليتحولوا إلى البيئة الإلكترونية (الإنترنت) للحصول على المعلومات التي قد تكون متوافرة في وسائل أخرى تقليدية ورقية كانت أم غير ورقية ، وهو ما جعل الإنترنت وسيلة وأداة ضرورية في الإتصالات بكافة أشكالها في القرن الحادي والعشرين وتتنافس مع وسائل الإعلام التقليدية في أهدافها (حسن ومحمد ،٢٠١١).

إن تحسين وضع المرأة الريفية وزيادة فعاليتها في تحقيق الأدوار المتوقعة منها في تنمية المجتمع لم تعد قضية من قضايا الرفاهية الإجتماعية ، وذلك من منطلق ما تقوم به هي من أدوار متعددة في البيئة الريفية حيث تقوم بتحمل العبء الأكبر سواء داخل المنزل أو خارجه (حسيب والبندارى ،٢٠١٠) .

نظريات الإتصال :

١- نظرية الإستخدامات والإشباعات :

تسمى نظرية المنفعة ، حيث أننا نتعرض وندرك الرسائل السارة لنا والتي تساعدنا على إشباع إحتياجاتنا و نتوقع منها أن تشبع هذه الإحتياجات ، وتساؤلها عن كيفية إستفادة الجمهور من وسائل الإتصال الجماهيري ،

وهناك العديد من الإشباعات مثل : البعد عن النفس وعن الآخرين ،التعلم عن كيفية التصرف في مختلف المواقف ، الإثارة ،والإسترخاء ، النسيان ، ولقضاء الوقت .

وبهذه النظرية يعتبر الجمهور نشطاً ويمكنه تحديد الإشباعات التي يريد الحصول عليها ويستخدم خبرته الإتصالية بوسائل الإتصال الجماهيري ويميز الباحثين بين نوعين من الإشباعات : هي إشباعات المحتوي التي تنتج من إستخدام وسائل الإتصال الجماهيري ، وإشباعات العملية الإتصالية والتي تنتج من العملية الإتصالية نفسها (سالم ، ٢٠١٣) . ويؤكد(درويش ،٢٠٠٥) أنه توجد نظريات عديدة للإتصال منها :

٢- نظريات التأثير الإنتقائي تشتمل على ما يلي:

أ- نظرية التأثير الإنتقائي القائم على الإختلافات الفردية : وتعتبر هذه النظرية أن رسائل وسائل الإتصال الجماهيري تدرك وتفسر بطريقة إنتقائية وهذا راجع لإختلاف عادات الإدراك بين أفراد المجتمع ، لأن لكل شخص نظامه الشخصي للإعتقادات والإتجاهات والقيم والإحتياجات وطرق إشباعها ، وكون الإدراك إنتقائي فإن التفسير والتذكير والإستجابة تكون إنتقائية لذلك فإن تأثيرات وسائل الإتصال الجماهيري لا تكون مباشرة ولا قوية فهي إنتقائية وتحدها الإختلافات النفسية .

ويضيف (مكاوي ،٢٠٠٩) أن جمهور وسائل الإعلام ليس جماعة متناسقة تصغى إلى الرسائل الإتصالية ، وتتأثر بها بشكل مباشر وموحد مثل الطلقات السحرية ، وإنما ظهر مبدأ الإنتقائية Selectivity الذي يشير إلى أن إستخدام وسائل الإعلام يخضع للإعتبارات الفردية ، وسمات الشخصية ، وظروفها الذاتية .

ب- نظرية الإنتقائية القائمة على أساس الفئات الإجتماعية : تعتبر هذه النظرية أن وسائل الإتصال الجماهيري تدرك وتفسر بطريقة إنتقائية وأساس هذه الإنتقائية هو مكانة الفرد في البناء الإجتماعي ، والأبنية الإجتماعية تستند إلى عوامل كالسن ، والنوع ، والدخل ، والتعليم ، والمهنة ، وإلى الإستجابة للإتصال الجماهيري متشابهة في كل منه وذلك لأن أنماط الإنتباه والإستجابة تتشابه.

ج- نظرية الإنتقائية على أساس العلاقات الإجتماعية : تعتبر أن رسائل وسائل الإتصال الجماهيري تدرك وتفسر إنتقائياً ، وأساس هذه الإنتقائية يعود إلى الأنماط المميزة للتأثيرات الإجتماعية من خلال الروابط القوية التي تربطهم ببعض ، والتأثيرات الإجتماعية تظهر عندما تعدل قرارات الفرد فيما يتعلق بسلوكه الإتصالي ،عند ظهور العائلة والأصدقاء ، والزملاء أو الآخرين ، وأن أنماط الإستجابة للإتصال الجماهيري تعكس الروابط الإجتماعية لكل أفراد المجتمع .

الأسلوب البحثي :

المفاهيم الإجرائية :

١- **الحالة التعليمية** : يقصد بها فى هذا البحث المستوى التعليمى للريفية المبحوثة ، من حيث كونها أمية أو لديها القدرة على القراءة والكتابة أو أتمت مرحلة تعليمية معينة ، معبراً عن ذلك بقيمة رقمية ،وذلك بإعطاء المبحوثة درجة واحدة فى حالة أمية ،ودرجتان فى حالة تقرأ وتكتب ،وثلاث درجات فى حالة حاصلة على شهادة إبتدائية ،وأربع درجات فى حالة حاصلة على شهادة إعدادية ،وخمس درجات فى حالة حاصلة على شهادة ثانوية ،وست درجات فى حالة حاصلة على شهادة جامعية ، وبذا تتراوح القيم الرقمية لهذا المتغير بين(١-٦) درجات .

٢- **الحالة الإجتماعية** : يقصد بها فى هذا البحث الوضع الإجتماعى للريفية المبحوثة من حيث كونها متزوجة أوغير متزوجة أو مطلقة أو أرملة ، معبراً عن ذلك بقيمة رقمية ،وذلك بإعطاء المبحوثة أربعة درجات فى حالة

متزوجة ،وثلاث درجات فى حالة غير متزوجة ،ودرجتان فى حالة أرمله ، ودرجة واحدة فى حالة مطلقة ، وبذا تتراوح القيم الرقمية لهذا المتغير بين (١-٤) درجات .

٣- **الإنفتاح الإنتقالى:** يقصد به فى هذا البحث مدى تردد الريفية المبحوثة على الأماكن التى بخارج قريتها سواء كانت قرى مجاورة أو المركز التابع له القرية أو عاصمة المحافظة التى تنتمى إليها أو المحافظات الأخرى ، معبراً عن ذلك بقيمة رقمية ،وذلك بإعطاء المبحوثة درجة واحدة لكل مكان تتردد عليه،وبذا تتراوح القيمة الرقمية لهذا المتغير بين (١-٤) درجات .

٤- **مصادر المعلومات** : يقصد بها فى هذا البحث عدد المصادر المرجعية التى تلجأ إليها الريفية المبحوثة للحصول على المعلومات التي تهمها ونوعية هذه المصادر ، معبراً عن ذلك بقيمة رقمية ،وذلك بإعطاء المبحوثة درجة واحدة لكل مصدر من مصادر المعلومات وبذا تتراوح القيمة الرقمية لهذا المتغير بين (١-١٠)درجات .

٥ -**إمتلاك الأسرة لجهاز الحاسب الآلي ومستوى الإستفادة منه** : يقصد به فى هذا البحث مدى إمتلاك الأسرة لجهاز كمبيوتر ومدى إستفادة الريفية المبحوثة منه فى المجالات التى تهمها ، معبراً عن ذلك بقيمة رقمية ،وذلك بإعطاء المبحوثة درجة واحدة فى حالة الإمتلاك ، وصفر فى حالة عدم الإمتلاك ،وأيضاً تعطى ثلاث درجات فى حالة الإستفادة الكبيرة ،ودرجتان فى حالة الإستفادة المتوسطة ،ودرجة واحدة فى حالة الإستفادة الضعيفة ، وبذا تتراوح القيمة المعبرة عن هذا المتغير بين (١-٤) درجات .

٦- **المستوى الطموحي** : يقصد به فى هذا البحث رأى الريفية المبحوثة فى بعض العبارات التى توضح مدى رغبتها القوية فى تحقيق شئ ما ، وذلك من خلال إجابتها على عشر عبارات بعضها إيجابي والبعض الآخر سلبى ، تتراوح إستجاباتها لها ما بين موافقة ، ومحايدة ، وغير موافقة ، ، وذلك بإعطاء المبحوثة درجتان فى حالة موافقة ، ودرجة واحدة فى حالة محايدة ،وصفر فى حالة غير موافقة ، وبذا تتراوح القيمة الرقمية المعبرة عن هذا المتغير بين (صفر- ٢٠) درجة .

٧- **التجددية** : يقصد بها فى هذا البحث إتجاه الريفية المبحوثة نحو التغيير وذلك من خلال إستجاباتها لعشر عبارات تتراوح درجة الإستجابة لها ما بين موافقة ، و محايدة ،وغير موافقة ، وذلك بإعطاء المبحوثة درجتان فى حالة موافقة ،ودرجة واحدة فى حالة محايدة ،وصفر فى حالة غير موافقة ، وبذا تتراوح القيمة الرقمية المعبرة عن هذا المتغير بين (صفر-٢٠) درجة.

٨- **الحيازة الأرضية المزرعية** : يقصد بها فى هذا البحث مساحة ما تحوزه أسرة الريفية المبحوثة من أرض زراعية مقدرة بالقيراط .

٩- **القيادية:** يقصد به فى هذا البحث الحكم الذى تصدره الريفية المبحوثة على نفسها من حيث إستشارة الريفيات فى القرية لها فى بعض الأمور التى تهمهم ، معبراً عن ذلك بقيمة رقمية ،حيث تمثلت هذة الأمور فى سبعة أمور كانت إستجاباتها لها تتراوح مابين دائماً ، أحياناً ، نادراً وذلك بإعطاء المبحوثة درجتان فى حالة دائماً ،ودرجة واحدة فى حالة أحياناً ،وصفر فى حالة نادراً ،وبذا تتراوح القيمة الرقمية المعبرة عن هذا المتغير بين (٠-١٤) درجة.

١٠- **مستوى الإستفادة المعرفية** : ويقصد بها الدرجة المعبرة عن إستفادة الريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) والمتمثلة في المجالين التاليين :

- المجال الإجتماعي ويشتمل على الغذاء والتغذية ،و صحة المرأة ، وصحة الطفل ، وصحة الغذاء ، والتغذية العلاجية والبيئة .
- المجال الإقتصادي ويشتمل على المشروعات الصغيرة .

ويعبر مستوى الإستفادة المعرفية عن مجموع القيم الرقيمة المعبرة عن إستفادة الريفيات المبحوثات من المجالات سالفة الذكر وتم إعطاء الدرجات (٢ ، ١ ، صفر) لمستوى الاستفادة (الكبيرة ، الجزئية ، المنعدمة) على الترتيب .

١١- **مستوى التعرض للشبكة** : ويقصد به في هذا البحث عدد مرات تعرض الريفيات المبحوثات لشبكة إتصال التنمية الريفية والزراعية (رادكون) في الشهر .

١٢- **المعرفة بأنظمة الشبكة** : يقصد بها في هذا البحث مدى معرفة الريفية المبحوثة بأنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) الستة وهى المرأة ، والبيئة ، والشباب ، والجمعيات الأهلية ،والمعلومات التسويقية ، والفيركون ، من حيث كونها تعرفها أم لا ، معبراً عن ذلك بقيمة رقيمة ، حيث تعطي المعرفة لكل نظام درجة واحدة ، وبذا تتراوح القيمة الرقمية المعبرة عن هذا المتغير بين (١-٦) درجات .

١٣- **رضا الريفيات المبحوثات عن الشبكة:** ويقصد به في هذا البحث مدى رضا الريفية المبحوثة عن بعض النقاط المتعلقة بالشبكة من حيث ، كونها راضية تماماً أو راضية إلى حد ما أو غير راضية ، معبراً عن ذلك بقيمة رقمية ،وذلك بإعطاء الدرجات التالية (٢ ، ١ ، صفر) وذلك لكل من (راضية تماما ، راضية إلى حد ما ، وغير راضية)على الترتيب ،وبذا تتراوح القيمة الرقمية المعبرة عن هذا المتغير بين (١-٦) درجات .

١٤-**المستوى التقييمي لخصائص محتوى الشبكة** : يقصد به فى هذا البحث آراء الريفيات المبحوثات فى شبكة الإتصال (رادكون) ، و المعلومات التى تتضمنها الشبكة ، وأيضا خصائص محتوى هذه الشبكة ، وذلك من خلال إستجابة المبحوثات إلى ١٣ عبارة ، بحيث تعطى المبحوثة درجتان فى حالة درجة التقييم الكبيرة ، ودرجة واحدة في حالة درجة التقييم الجزئية ، ،وصفر في حالة درجة التقييم المنعدمة ، وبذلك تتراوح القيمة الرقمية المعبرة عن هذا المتغير بين (صفر -٢٦) درجه .

المتغيرات البحثية :

تمثلت متغيرات هذه الدراسة في متغير تابع وهو مستوى الإستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) ، وأربعة عشر متغيراً مستقلاً هي : السن ،الحالة التعليمية ، الحالة الإجتماعية ، الإنفتاح الإنتقالي ، تعدد مصادر المعلومات ، إمتلاك الأسرة لجهاز الحاسب الآلي ومستوى الإستفادة منه ، الحيازة الأرضية المزرعية ، والقيادية ، والمستوى الطموحي ، والتجديدية ، درجة التعرض للشبكة ، والمعرفة بأنظمة الشبكة ، والرضا عن الشبكة ، والمستوى التقييمي لخصائص محتوى الشبكة

الشاملة والعينة ومنطقة البحث: تم حصر جميع الريفيات المتعرضات و المترددات على شبكة إتصال التنمية الريفية والزراعية (رادكون) ، وذلك من خلال الإستعانة بكشوف الحصر العددي لهن والموجودة لدى ميسرات الإتصال بالمراكز الإرشادية السته التي طبق بها المشروع بمحافظة البحيرة ، والتي تمثلت في المراكز التالية : كفر الدوار (كوم البركة) ، ودمنهور(سنهور) ، وأبوحمص(بسنتواي) ، وأبو المطامير(النجيلي) ، وحوش عيسى(الكردود وإسحق) ، ووادي النطرون(بني سلامه والحمرا) ، والبالغ عددهن ٥٢٨ ريفية ، تم أخذ عينة غرضية من الريفيات اللآتي تعرضن مرتين فأكثر شهرياً للشبكة حيث بلغ حجم العينة١٦٠ ريفية مبحوثة.

الفروض البحثية :

١-توجد علاقة إرتباطية معنوية بين مستوى الإستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) كمتغير تابع وبين كل من المتغيرات المستقلة المدروسة والمتمثلة فى : السن ، الحالة التعليمية ، الحالة الإجتماعية ، الإنفتاح الإنتقالي ، مصادر المعلومات ، إمتلاك الأسرة لجهاز

الحاسب الآلي ومستوى الإستفادة منه ، المستوى الطموحي ، التجددية ، الحيازة الأرضية المزرعية ،القيادية ، والمعرفة بأنظمة الشبكة ، مستوى التعرض للشبكة ، لرضا عن الشبكة ، والمستوى التقييمى لخصائص محتوى الشبكة .

ويتم إختبار هذا الفرض فى صورته الصفرية (فرض العدم) التالية :

"لا توجد علاقة إرتباطية بين مستوى الإستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة الشبكة كمتغير تابع وبين كل من المتغيرات المستقلة سالفة الذكر"

٢-يتأثر مستوى الإستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) كمتغير تابع بالمتغيرات المستقلة سالفة الذكر. ويتم إختبار هذا الفرض فى صورته الصفرية التالية :

"لايتأثر مستوى الإستفادة المعرفية المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) كمتغير تابع بالمتغيرات المستقلة سالفة الذكر".

تجميع وتحليل البيانات البحثية :

إعتمد البحث على الإستبيان بالمقابلة الشخصية كوسيلة لتجميع البيانات البحثية ، وإشتمل الإستبيان على ثلاثة محاور رئيسية ، تضمن الأول : بيانات عن الخصائص المميزة للريفيات المبحوثات ، وإنطوى الثاني على البيانات المتعلقة بمستوى الإستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) ، بينما إشتمل الثالث المشكلات التي تواجه الريفيات عند الإتصال بالشبكة والحلول المقترحة لها من وجهة نظرهن على وبعد إجراء المعالجة الكمية للمتغيرات الوصفية ، تم الإستعانة ببعض الأساليب بالطرق الإحصائية لتحليل البيانات البحثية وتحقيق أهداف الدراسة وتمثلت في : النسب المئوية ، والمتوسط الحسابي والإنحراف المعياري والإرتباط البسيط ، و الإنحدار المتعدد ، وقد إستخدم البرنامج الإحصائي (SPSS) وإختبار T ، ونسبة F في تحليل بيانات الدراسة .

النتائج البحثية :

أولا : الخصائص المميزة للريفيات المبحوثات :

١- **السن:** أوضحت نتائج الدراسة أن سن المبحوثات قد تراوح بين (١٨ – ٧٠) عاماً ، وبلغ متوسط السن بينهن (٤٩.٨١) عاماً ، وقد إتضح أن نسبة من سنهن (أقل من ٢٤ سنة) (١٨.٧٥%) ، وبلغت نسبة من يتراوح سنهن بين(٢٤– ٤٧)سنة (٦٥ %) ، وأن نسبة من بلغ سنهن(٤٧ سنة فأكثر) (١٦.٢٥%) من المجموع الكلي للريفيات المبحوثات.

٢-**الحالة التعليمية** :أظهرت النتائج البحثية أن القيم الرقيمة المعبرة عن الحالة التعليمية للريفيات المبحوثة تراوحت بين (١ – ٦) درجات وذلك بمتوسط حسابي قدره (٣.٤٦٢ درجة) ، وقد إتضح أن نسبة ذوات المستوى التعليمي المنخفض ٢ درجة فأقل (٣٦.٢٥%) ، وأن نسبة ذوات المستوى التعليمي المتوسط (٣ – ٥) درجات (٢٢.٥%) ، ونسبة ذوات المستوى التعليمي المرتفع (٥ درجة فأكثر) (٤١.٢٥%) من المجموع الكلي للريفيات المبحوثات .

٣- **الحالة الإجتماعية:** أبانت النتائج البحثية أن الحالة الإجتماعية للريفيات المبحوثات تمثلت في متزوجات ، وغير متزوجات ، وأرامل ، ومطلقات وذلك بالنسب التالية لكل منهن على الترتيب (٧٩.٥%) ، (١٢.٥ %) ، (١.٧٥%) ، (٦.٢٥%) من المجموع الكلي للريفيات المبحوثات .

٤- **الإنفتاح الإنتقالي:** أوضحت النتائج البحثية أن القيم الرقمية المعبرة عن الإنفتاح الإنتقالي للريفيات المبحوثات تراوحت بين (١– ٤) درجات وذلك بمتوسط حساب قدره (٢.٩٦٢) درجة ، حيث بلغت نسبة الريفيات ذوات

المستوى الإنتقالي المنخفض(٢درجة فأقل) (٣٥%) ، وأن نسبة ذوات المستوى الإنتقالي المتوسط (٣ – ٤) درجات (٢٣.٢٥%) ونسبة ذوات المستوى الإنتقالي المرتفع (٤ درجة فأكثر) (٤١٢.٧٥%) من المجموع الكلي للريفيات المبحوثات

٥- تعدد مصادر المعلومات: أظهرت النتائج البحثية أن عدد المصادر التي تستقي منها الريفيات المبحوثات معلوماتهن تراوحت بين (١ – ١٠) مصادر ، وذلك بمتوسط حسابي قدره (٥.٠١٢ درجة) ، حيث بلغت نسبة من يستقين معلوماتهن من (٤ – ٨) مصادر (٧٣.٧٥%) ، وأن نسبة من تستقين معلوماتهن من (٨مصادر فأكثر)(٩.٥%)من المجموع الكلي للريفيات المبحوثات .

٦-إمتلاك الأسرة لجهاز الحاسب الآلي ومستوى الإستفادة منه : أوضحت النتائج البحثية أن(٤٢.٥%)من الريفيات يمتلكن جهاز الحاسب الآلي ، في حين أن (٥٧.٥%) من الريفيات المبحوثات لا يمتلكن جهاز الحاسب الآلي ، كما أن مستوى الإستفادة منه كان منخفض بنسبة (١٤.٢٥%) ، و متوسط بنسبة (٤٤.٢٥%) ، و مرتفع بنسبة (٤١%) من المجموع الكلي للريفيات المبحوثات .

٧- المستوى الطموحي: أوضحت النتائج البحثية أن القيم الرقمية المعبرة عن هذا المتغير تراوحت بين (٦ – ٢٠) درجة وذلك بمتوسط حسابي قدره (١٣.٧٤٣) درجة ، حيث بلغت نسبة الريفيات ذوات المستوى الطموحي المنخفض (١١ درجة فأقل) (٨.٧٥%) ، ونسبة ذوات المستوى الطموحي المتوسط (١٢– ١٦ درجة) (٧١.٧٥%) وأن نسبة ذوات المستوى الطموحي المرتفع (١٦ درجة فأكثر) (١٩.٥%) من المجموع الكلي للريفيات المبحوثات .

٨- التجددية: أوضحت النتائج البحثية أن القيم الرقمية المعبرة عن هذا المتغير تراوحت بين (٤ – ١٨) درجة وذلك بمتوسط حسابي قدره (١١.٩١٢) درجة ، حيث بلغت نسبة الريفيات ذوات مستوى التجددية المنخفض (٩ درجات فأقل) (١٢.٥%) ، ونسبة ذوات مستوى التجددية المتوسط (١٠ – ١٥ درجة) (٧٧%) ، وأن نسبة ذوات مستوى التجددية المرتفع (١٥ درجة فأكثر) (١٠.٥%) من المجموع الكلي للريفيات المبحوثات .

٩- الحيازة الأرضية المزرعية: أوضحت النتائج البحثية أن الحيازات الأرضية المزرعية للريفيات المبحوثات تراوحت بين (صفر – ١٢٠) قيراط ، وذلك بمتوسط حسابي قدره (٢٧.١٦) قيراط ، حيث بلغت نسبة الريفيات ذوات الحيازة الصغيرة (٧ قيراط فأقل) (٣٦.٧٥%) ، ونسبة ذوات الحيازة المتوسطة (٨ – ٤٨) قيراط (٣٦.٧٥ %) ، وأن نسبة ذوات الحيازة الكبيرة (٤٨ قيراط فأكثر) (٢٤.٥%) من المجموع الكلي للريفيات المبحوثات .

١٠- القيادية: أوضحت النتائج البحثية أن القيم الرقمية المعبرة عن هذا المتغير تراوحت بين (صفر – ١٨) درجة ، وذلك بمتوسط حسابي قدره ٦.٦٢٥ درجة ، حيث بلغت نسبة الريفيات ذوات مستوى القيادية المنخفض (٣ درجات فأقل) (٢٠%) ، وأن نسبة الريقيات ذوات مستوى القيادية المتوسط (٤ – ١٠ درجة) (٥٦.٧٥%) ، وأن نسبة الريفيات ذوات مستوى القيادية المرتفع (١٠ درجات فأكثر) (٢٣.٢٥%) من المجموع الكلي للريفيات المبحوثات .

١١- مستوى التعرض لشبكة الإتصال (رادكون) : أوضحت النتائج البحثية أنه تراوح عدد مرات تعرض الريفيات المبحوثات لشبكة الإتصال (رادكون) في الشهر بين (٢ – ٦) مرات بمتوسط حسابي قدره (٣.١٥٦) مرات ، حيث بلغت نسبة الريفيات ذوات مستوى التعرض المنخفض (٢ – ٣) مرات (٤٤.٥%) ، وأن نسبة الريفيات ذوات مستوى التعرض المتوسط (٣ – ٥) مرات (٤٢.٥%) ، في حين بلغت نسبة الريفيات ذوات مستوى التعرض المرتفع (٥ مرات فأكثر) (١٣%) من المجموع الكلي للريفيات المبحوثات .

١٢- المعرفة بأنظمة شبكة الإتصال (رادكون) : أوضحت النتائج البحثية أن القيم الرقمية المعبرة عن هذا المتغير ترتفع بين (١- ٦) درجات ، وذلك بمتوسط حسابي قدره(٣.٧٥٦) درجة ، حيث بلغت نسبة الريفيات ذوات مستوى المعرفة المنخفض بأنظمة الشبكة (٢ درجة فأقل) (٢٣.٥%) ، وأن نسبة ذوات مستوى المعرفة المتوسط بأنظمة الشبكة (٤١.٧٥ %) ، في حين بلغت نسبة الريفيات ذوات مستوى المعرفة المرتفع بأنظمة الشبكة (٥ درجات فأكثر) (٣٥%) من المجموع الكلي للريفيات المبحوثات .

١٣- الرضا عن شبكة الإتصال (رادكون) : أوضحت النتائج البحثية أن القيم الرقمية المعبرة عن هذا المتغير تراوحت بين (صفر – ٢٤ درجة) ، وذلك بمتوسط حسابي قدره(١٦.٠١٢)درجة ، حيث بلغت نسبة الريفيات ذوات مستوى الرضا المنخفض (١١ درجة فأقل) (١٦.٢٥%) ، وأن نسبة الريفيات ذوات مستوى الرضا المتوسط (١٢ – ٢١ درجة) (٦١.٢٥%) ، في حين بلغت نسبة الريفيات ذوات مستوى الرضا المرتفع (٢١ درجة فأكثر) (٢٢.٥%) من المجموع الكلي للريفيات المبحوثات .

١٤- المستوى التقييمي لخصائص محتوى الشبكة : أوضحت النتائج البحثية أن القيم الرقمية المعبرة عن هذا المتغير تراوحت بين (صفر –٢٦درجة) وذلك بمتوسط حسابي قدره (١٨.١٧٤%) درجة ، حيث بلغت نسبة الريفيات ذوات المستوى التقييمي المنخفض (١٠درجات فأقل) (١٤.٥%) ، وأن نسبة الريفيات ذوات المستوى التقييمي المتوسط (١١–١٩درجة) (٧١.٧٥%) ، في حين بلغت نسبة الريفيات ذوات المستوى التقييمي المرتفع (١٩درجة فأكثر) (١٣.٧٥%) من المجموع الكلي للريفيات المبحوثات .

جدول رقم (١) توزيع الريفيات المبحوثات وفقا للخصائص المميزة لهن

الخصائص	%	الخصائص	%
١- السن :		**٥- تعدد مصادر المعلومات**	
٢٤ سنة فأقل	١٨.٧٥	قليل (٣ مصادر فأقل)	١٦.٧٥
(٢٥ – ٤٧) سنة	٠.٦٥	متوسط (٤ – ٨) مصادر	٧٣.٧٥
٤٧ سنة فأكثر	١٦.٢٥	كبير (٨ مصادر فأكثر)	٩.٥٠
المدى (٨ – ٧٠) سنة	١٠٠	المدى (١ – ١٠) مصادر	١٠٠
المتوسط ٣٤.٨١٨		المتوسط ٥.٠١٢	
الإنحراف المعياري ١٠.٩١٤ سنة		الإنحراف المعياري ١.٧١١	
٢- الحالة التعليمية		**٦- إمتلاك الأسرة لجهاز الحاسب الآلي ومستوى الإستفادة منه**	
منخفض (٢درجة فأقل)	٣٦.٢٥	* تمتلك	٤٢.٥٠
متوسط (٣ – ٥) درجة	٢٢.٥٠	* لا تمتلك	٥٧.٥٠
مرتفع (٥ درجات فأكثر)	٤١.٢٥	**مستوى الإستفادة	
		صغير	١٤.٧٥
		متوسط	٤٤.٢٥
		عال	٤١.٠٠
المدى (١ -٦) درجات	١٠٠	* ن = ١٦٠	
المتوسط ٣.٤٦٢		** ن = ٦٨	
الانحراف المعياري ١.٧٩٤			
٣ – الحالة الإجتماعية		**٧ - المستوى الطموحي**	
متزوجات	٧٩.٥٠	منخفض (١١ درجة فأقل)	٨.٧٥
غير متزوجات	١٢.٥٠	متوسط (١٢– ١٦) درجة	٧١.٧٥
أرامل	١.٧٥	مرتفع (١٦ درجة فأكثر)	١٩.٥٠
مطلقات	٦.٢٥		
	١٠٠	المدى (٦ – ٢٠)	١٠٠
		المتوسط (١٣.٧٤٣)	
		الإنحراف المعياري ٢.٣٧٩	
٤- الإنفتاح الإنتقالي		**٨- التجديدية**	
منخفض (٢ درجة فأقل)	٣٥.٠٠	منخفض (٩ درجات فأقل)	١٢.٥٠
متوسط (٣ – ٤) درجات	٢٣.٢٥	متوسط (١٠ – ١٥) درجة	٧٧.٠٠
مرتفع (٤ درجات فأكثر)	٤١.٧٥	مرتفع (١٥ درجة فأكثر)	١٠.٥٠
المدى (١ -٤) درجات	١٠٠	المدى (٤ – ٨) درجات	١٠٠
المتوسط ٢.٩٦٢		المتوسط الحسابي ١١.٩١٢	
الإنحراف المعياري ١.٠٧٥		الإنحراف المعياري ٢.٢٩٦	

تابع جدول رقم (١) توزيع الريفيات المبحوثات وفقاً للخصائص المميزة لهن

الخصائص	%	الخصائص	%
٩- الحيازة الأرضية المزرعية		**١٢- المعرفة بأنظمة الشبكة**	
صغيرة (٧ قيراط) فأقل	٣٦.٧٥	منخفض (٢ درجة فأقل)	٢٣.٥٠
متوسطة (٨ – ٤٨) قيراط	٣٨.٧٥	متوسط (٣ – ٥) درجة	٤١.٧٥
كبيرة (٤٨ قيراط) فأكثر	٢٤.٥٠	مرتفع (٥ درجات فأكثر)	٣٥.٠٠
المدى (صفر – ١٢٠) قيراط	١٠٠	المدى (١ – ٦) درجات	١٠٠
المتوسط ٢٧.١٦٢		المتوسط ١٣.٧٥٦	
الإنحراف المعياري ٢٠.١٣٣		الإنحراف المعياري ١.٦٦٦	
١٠ – القيادية		**١٣- الرضا عن الشبكة**	
منخفض (٣ درجات فأقل)	٢٠.٠٠	منخفض (١١ درجة فأقل)	١٦.٢٥
متوسط (٤ – ١٠) درجات	٥٦.٧٥	متوسط (١٢- ٢١) درجة	٦١.٢٥
مرتفع (١٠ درجات) فأكثر	٢٣.٢٥	مرتفع (٢١ درجة فأكثر)	٢٢.٥٠
المدى (صفر – ١٨) درجة	١٠٠	المدى (صفر – ٢٤)	١٠٠
المتوسط ٦.٦٢٥		المتوسط ١٦.٠١٢	
الإنحراف المعياري٣.٣١١		الإنحراف المعياري ٥.٣٨٦	
١١ – مستوى التعرض للشبكة		**١٤- المستوى التقييمي لخصائص محتوى الشبكة**	
منخفض (٢ درجة فأقل)	٤٤.٥٠	منخفض (١٠درجة فأقل)	١٤.٥٠
متوسط (٣ – ٥) درجات	٤٢.٥٠	متوسط (١١–١٩) درجة	٧١.٧٥
مرتفع (٥ درجات) فأكثر	١٣.٠٠	مرتفع (١٩درجة فأكثر)	١٣.٧٥
المدى (٢ – ٦) درجة	١٠٠	المدى (صفر –٢٦) درجة	١٠٠
المتوسط ٣.١٥٦		المتوسط١٨.١٧٤	
الإنحراف المعياري ١.٥٢٣		الإنحراف المعياري ٧.٤٤٧	

(ن = ١٦٠)

ثانيا : مستوى الإستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون)

مستوى الإستفادة المعرفية العام :

أوضحت النتائج البحثية أن مستوى الإستفادة المعرفية العام من المجالات المتضمنة بأنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) يتراوح بين (١٠ – ١٢٢) درجة ، وذلك بمتوسط حسابي قدره(٨١.٨١٢)درجة ، وإنحراف معياري قدره(٢٨.٦٧٣)درجة ، حيث أنه تم تقسيم مستوى الإستفادة المعرفية من المجالات المتضمنة بأنظمة الشبكة إلى ثلاث فئات، حيث إشتملت الفئة الأولى على مستوى الإستفادة المنخفض (٥٣ درجة فأقل) على (١٦.٢٥%) من إجمالي الريفيات المبحوثات وإشتملت الفئة الثانية على مستوى الإستفادة المتوسط (٥٤ – ١١٠) درجة وذلك بنسبة (٦٦.٧٥%) من إجمالي الريفيات المبحوثات ، في حين إشتملت الفئة الثالثة على مستوى الإستفادة المرتفع (١١٠ درجة فأكثر) وذلك بنسبة(١٧%)من إجمالي الريفيات المبحوثات ، جدول رقم (٢) .

جدول رقم (٢) توزيع الريفيات المبحوثات وفقاً لفئات مستوى الإستفادة المعرفية لمتضمنات أنظمة شبكة إتصال التنمية الريفية و الزراعية (رادكون)

مستوى الإستفادة المعرفية (درجة)	العدد	%
منخفض (٥٣ درجة فأقل)	٢٦	١٦.٢٥
متوسط (٥٤ - ١١٠) درجة	١٠٧	٦٦.٧٥
مرتفع(١١٠ درجة فأكثر)	٢٧	١٧.٠٠
المجمـوع	**١٦٠**	**١٠٠**

يتضح من الجدول السابق أن غالبية الريفيات المبحوثات(٨٣.٧٥%) يقعن في الفئة متوسطة ومرتفعة الإستفادة المعرفية ، مما يدل على أهمية شبكة إتصال التنمية الريفية والزراعية (رادكون) من تزويد الريفيات بالمعلومات في مختلف المجالات ، وأيضا الدور الحيوي الذي يمكن أن تقوم به تكنولوجيا الإتصالات والمعلومات في مجالات التنمية المختلفة .

أولاً: الإستفادة المعرفية فيما يتعلق بالمجال الإجتماعي والغذائي والصحي : ويتضمن هذا المجال ستة محاور فرعية تمثلت فيما يلي :

١-الغذاء والتغذية :

ويشتمل هذا المحور على سبعة مكونات فرعية تمثلت في : أطباق للمناسبات ، وأطباق يومية ، ووصفات جدتي ، ومكونات الوجبات المتكاملة ، وطرق حفظ وتخزين الغذاء ، وإنتاج الغذاء ، ومعلومات غذائية أخرى .

أ- أطباق للمناسبات:

جدول رقم (٣) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من مكون أطباق للمناسبات

الإستفادة / أطباق للمناسبات	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
الكعك والبسكويت	١١٠	٦٨.٧٥	٣٥	٢١.٧٥	١٦	٩.٥٠	١٦٠	١٠٠
تورتة عيد الميلاد	٦٠	٣٧.٥٠	٣٣	٢٠.٧٥	٦٧	٤١.٧٥	١٦٠	١٠٠
العاشوراء	٣١	١٩.٥٠	٢٥	١٥.٥٠	١٠٤	٦٥.٠٠	١٦٠	١٠٠
المتوسط العام للإستفادة	٦٧	٤١.٧٥	٣١	١٩.٥٠	٦٢	٣٨.٧٥	١٦٠	١٠٠

يتضح من الجدول السابق ان أكثر من نصف الريفيات المبحوثات (٦١.٢٥ %) كن ذوات إستفادة معرفية كبيرة وجزئية من مكون أطباق للمناسبات ، مما يدل على إسهام هذا المكون في تزويد الريفيات بالمعلومات التي قد يحتجن إليها لعمل أطباق معينة فى بعض المباسبات ، مما يساعد على إستفادة الريفيات المعرفية من هذا المكون وبالتالي أهميته بالنسبة لهن .

ب- أطباق يومية:

جدول رقم (٤) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من مكون أطباق يومية

الإستفادة / أطباق يومية	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
مكرونة بالبشاميل	٩٣	٥٨.٢٥	٤١	٢٥.٥٠	٢٦	١٦.٢٥	١٦٠	١٠٠
جلاش باللحم المفروم	٦٩	٤٣.٠٠	٢	٣٢.٥٠	٣٩	٢٤.٥٠	١٦٠	١٠٠
أطباق أخرى	٤٩	٣٠.٥٠	٣	٢.٠٠	١٠٨	٦٧.٥٠	١٦٠	١٠٠
المتوسط العام للإستفادة	**٧٠**	**٤٣.٧٥**	**٣٢**	**٢٠.٠٠**	**٥٨**	**٣٦.٢٥**	**١٦٠**	**١٠٠**

يتبين من الجدول السابق أن (٤٣.٧٥%)من الريفيات المبحوثات كانت درجة إستفادتهن من مكون أطباق يومية كبيرة ، مما يدل على حرص الريفيات المبحوثات على معرفة ما يتعلق بأصناف الأكل اليومية التي يقمن بإعدادها ، ونجد أيضا أن الأصناف اليومية الأخرى إشتملت على كل من : كفتة السيخ بنسبة تكرار (٢٠%) ، والكوسة بالبشاميل بنسبة تكرار (١٦.٨٧%) ، وعيش باللحمة بنسبة تكرار (١٢.٥%) والفراخ المشوية بنسبة تكرار(٩.٣٧ %) من الريفيات المبحوثات ، مما يدل على تعدد الأصناف المندرجة تحت هذا المكون .

ج- وصفات جدتي:

جدول رقم (٥) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من مكون وصفات جدتي

الإستفادة / وصفات جدتي	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
الكشري	٨٥	٥٣.٢٥	٣٣	٢٠.٥٠	٤٢	٢٦.٢٥	١٦٠	١٠٠
الفول النابت	٧١	٤٤.٥٠	٢٩	١٨.٠٠	٦٠	٣٧.٥٠	١٦٠	١٠٠
وصفات أخرى	٣٤	٢١.٢٥	٥	٣.٢٥	١٢١	٧٥.٥٠	١٦٠	١٠٠
المتوسط العام للإستفادة	**٦٣**	**٣٩.٥٠**	**٢٢**	**١٣.٧٥**	**٧٥**	**٤٦.٧٥**	**١٦٠**	**١٠٠**

جدول رقم (٦) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من مكون مكونات الوجبات المتكاملة

الإستفادة / مكونات الوجبات المتكاملة	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
بروتين	٩٧	٦٠.٥٠	٤٥	٢٨.٢٥	١٨	١١.٢٥	١٦٠	١٠٠
كربوهيدرات	٩٠	٥٦.٢٥	٥١	٣٢.٠٠	١٩	١١.٧٥	١٦٠	١٠٠
دهون	٨٦	٥٣.٧٥	٥١	٣٢.٠٠	٢٣	١٤.٢٠	١٦٠	١٠٠
فيتامينات	٨٦	٥٣.٧٥	٥٣	٣٣.٢٥	٢١	١٣.٠٠	١٦٠	١٠٠
المتوسط العام للإستفادة	**٩٠**	**٥٦.٢٥**	**٥٠**	**٣١.٢٥**	**٢٠**	**١٢.٥٠**	**١٦٠**	**١٠٠**

يتضح من الجدول السابق أن أكثر من نصف الريفيات المبحوثات (٥٦.٢٥%) يتمتعن بمستويات معرفية كبيرة ، مما يدل على معرفة الريفيات المبحوثات بضرورة تكوين وجبات متكاملة لأفراد أسرهن وأن تشتمل هذه الوجبات على المكونات الرئيسية المتمثلة في البروتين ، والكربوهيدرات ، والدهون ، والفيتامينات مع معرفتهم بهذه المكونات بنسب مختلفة كما في الجدول السابق .

هـ- طرق حفظ وتخزين الغذاء:

جدول رقم (٧) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من مكون طرق حفظ وتخزين الغذاء

الإستفادة / طرق حفظ وتخزين الغذاء	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
التجميد	١٢٨	٨٠.٠٠	٢٨	١٧.٥٠	١٠٠	٢.٥٠	١٦٠	١٠٠
طرق أخرى	٨	٥.٠٠	٠	٠.٠٠	١٠٠	٩٥.٠٠	١٦٠	١٠٠
المتوسط العام للإستفادة	**٦٨**	**٤٢.٥٠**	**١٤**	**٨.٧٥**	**١٠٠**	**٤٨.٧٥**	**١٦٠**	**١٠٠**

يظهر من الجدول السابق أن غالبية الريفيات المبحوثات (٨٠%) كانت معرفتهن كبيرة بطريقة التجميد ، في حين كانت معرفتهن منعدمة بنسبة (٩٥%) بالنسبة لطرق الحفظ والتخزين الأخرى ، حيث بلغت نسبة معرفتهن للطرق

الأخرى ٥% ، وتمثلت هذه الطرق في التمليح بنسبة تكرار (٢١.٨٧%) ، والمربات بنسبة تكرار (١٥%)، والتجفيف بنسبة تكرار (١٣.٧٥%) . كما يتضح أيضا أن ما يقرب من نصف الريفيات المبحوثات كانت متوسط إستفادتهن من هذا المكون منعدمة (٤٨.٧٥ %) مما يدل على ضرورة تفعيل هذا المكون حتى تتمكن الريفيات من تحصيل أقصى إستفادة ممكنة .

و- إنتاج الغذاء :

جدول رقم (٨) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من مكون إنتاج الغذاء

الإستفادة / إنتاج الغذاء	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
الحلويات	١٠٤	٦٥.٠٠	٣٩	٢٤.٥٠	١٧	١٠.٥٠	١٦٠	١٠٠
أصناف أخرى	٥٠	٣١.٢٥	١٠	٦.٢٥	١٠٠	٦٢.٥٠	١٦٠	١٠٠
المتوسط العام للإستفادة	**٧٧**	**٤٨.٢٥**	**٢٤**	**١٥.٠٠**	**٥٩**	**٣٦.٧٥**	**١٦٠**	**١٠٠**

يتضح من الجدول السابق أن ما يقرب من نصف المبحوثات (٤٨.٢٥ %) تتمتعن بإستفادة معرفة كبيرة فيما يتعلق بمكونات إنتاج الغذاء ، مما قد يدل على حرص المبحوثات على معرفة متضمنات هذا المكون وإستفادتهن منه ، كما أن الأصناف الأخرى تمثلت في المخبوزات بنسبة تكرار (٢٦.٨٧%)، والطحينة بنسبة تكرار (١٥.٦٢%) ، والتونة بنسبة تكرار (١٠.٦٢%) .

ز- معلومات غذائية :

جدول رقم (٩) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من مكون معلومات غذائية

الإستفادة / معلومات غذائية	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
السمنة	٨٧	٥٤.٢٥	٤٦	٢٨.٧٥	٢٧	١٧.٠٠	١٦٠	١٠٠
النحافة	٨١	٥٠.٥٠	٤٦	٢٨.٧٥	٣٣	٢٠.٧٥	١٦٠	١٠٠
المتوسط العام للإستفادة	**٨٤**	**٥٢.٥٠**	**٤٦**	**٢٨.٧٥**	**٣٠**	**١٨.٧٥**	**١٦٠**	**١٠٠**

يتضح من الجدول السابق أن أكثر من نصف الريفيات المبحوثات (٥٢.٥٠) يتمتعن بإستفادة كبيرة من مكون المعلومات الغذائية ، مما يدل على أن الريفيات المبحوثات يحرصن على معرفة كل ما يتعلق بالسمنة والنحافة لتتمكن من الحفاظ على صحتهن ، وبالتالي يستطعن القيام بمهامهن الأسرية بنشاط وحيوية .

٢- صحة المرأة:

ويتضمن هذا المحور مكونين رئيسيين هما : المعرفة بوسائل تنظيم الأسرة ، ونشرات لصحة المرأة كما يلي :

١- المعرفة بوسائل تنظيم الأسرة :

جدول رقم (١٠) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من مكون المعرفة بوسائل تنظيم الأسرة

الإستفادة / وسائل تنظيم الأسرة	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
اللولب	٨٨	٥٥.٠٠	٥٠	٣١.٢٥	٢٢	١٣.٧٥	١٦٠	١٠٠
الحقن	٧٦	٤٧.٥٠	٤٦	٢٨.٢٥	٣٨	٢٣.٧٥	١٦٠	١٠٠
الحبوب	٥٥	٣٤.٠٠	٣٩	٢٤.٥٠	٦٦	٤١.٠٠	١٦٠	١٠٠
المتوسط العام للإستفادة	**٧٣**	**٤٥.٥٠**	**٤٥**	**٢٨.٢٥**	**٤٢**	**٢٦.٢٥**	**١٦٠**	**١٠٠**

يتضح من الجدول السابق أن ما يقرب من نصف الريفيات المبحوثات (٤٥.٥ %)كانت إستفادتهن كبيرة من مكون المعرفة بوسائل تنظيم الأسرة ، ، مما قد يدل على أن الريفيات يقبلن على معرفة الوسائل التي تساعدهن على تنظيم أسرهن ، وبالتالي زيادة الإهتمام بتربية أولادهن وتوفير إحتياجاتهم بسهولة دون كثرة الأعباء عليهن .

٢- نشرات لصحة المرأة:

جدول رقم (١١) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من مكون نشرات لصحة المرأة

الإستفادة / نشرات لصحة المرأة	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
الزواج المبكر	٧٤	٤٦.٢٥	٤٠	٢٥.٠٠	٤٦	٢٨.٧٥	١٦٠	١٠٠
تغذية الحوامل	١٠٠	٦٢.٥٠	٣٨	٢٣.٧٥	٢٢	١٣.٧٥	١٦٠	١٠٠
التغذية في مرحلة الشباب (المراهقة)	٨٨	٥٥.٠٠	٤٣	٢٦.٧٥	٢٩	١٨.٢٥	١٦٠	١٠٠
تغذية المرضعات	٩٥	٥٩.٥٠	٣٦	٢٢.٥٠	٢٩	١٨.٠٠	١٦٠	١٠٠
المتوسط العام للإستفادة	**٨٩**	**٥٥.٥٠**	**٣٩**	**٢٤.٥٠**	**٣٢**	**٢٠.٠٠**	**١٦٠**	**١٠٠**

يتضح من الجدول السابق أن أكثر من نصف الريفيات المبحوثات(٥٥.٥%) كانت إستفادتهن المعرفية كبيرة من مكون نشرات لصحة المرأة حيث بلغت نسبتهن ، مما يدل على أهمية المعلومات المتضمنة بهذا المكون بالنسبة لهن ، حيث أن هذه المعلومات تساعدهن على الإهتمام بصحتهن في المراحل العمرية المختلفة وبالتالي التمتع بصحة جيدة .

٣- صحة الطفل:

أوضحت النتائج البحثية فيما يتعلق بمحور صحة الطفل أنه يتضمن أربعة مكونات فرعية تمثلت فيما يلي :

١- أمراض الطفل :

أوضحت النتائج البحثية فيما يتعلق بمكون أمراض الطفل أنه يوجد العديد من الأمراض المتعلقة بالطفل وأن الإستفادة المعرفية لهذه الأمراض كانت كبيرة بنسبة (٤٩.٥%) ، وجزئية بنسبة (٣٦%) ، ومنعدمة بنسبة(١٤.٥%) ، جدول رقم (١٢) . كما أوضحت النتائج البحثية أن أمراض الطفل تمثلت في نزلات البرد بنسبة تكرار(٥٨.٢٥%) ، والنزلات المعوية بنسبة تكرار (٥٦.٧٥%) ، والحمي بنسبة تكرار(٤٢.٥%) ، والسعال بنسبة تكرار(٢٦.٧٥%) ، والأمراض الجلدية بنسبة تكرار(٢٠.٧٥%) ، والحساسية والصدر بنسبة تكرار(١٠.٧٥%) من إجمالي الريفيات المبحوثات .

٢- تطعيمات الطفل :

أوضحت النتائج البحثية فيما يتعلق بمكون تطعيمات الطفل أنه توجد العديد من التطعيمات والتي يأخذها الطفل في مراحل نموه الأولى وأن معرفة الريفيات بهذه التطعيمات كانت كبيرة بنسبة(٥٥ %) ، وجزئية بنسبة(٢٦.٧٥%) ، ومنعدمة بنسبة(١٨.٢٥%) ، جدول رقم (١٢) . كما أوضحت النتائج البحثية أن التطعيمات التي عرفتها المبحوثات تمثلت فيما يلي : شلل الأطفال بنسبة تكرار(٨٧.٥%) ، والحصبة بنسبة تكرا ر (٦٦.٢٥ %) ،والدرن بنسبة تكرار(٤٦.٢٥%) ، والجدري بنسبة تكرار(١٦.٢٥%) ، والتيتانوس بنسبة تكرار(١٣.٧٥%) ، والإلتهاب الكبدي بنسبة تكرار (١٠.٧٥%) من إجمالي الريفيات المبحوثات .

٣- العناية بالطفل:

أظهرت النتائج البحثية فيما يتعلق بمكون العناية بالطفل أنه تعددت طرق العناية بالطفل ، حيث بلغت نسبة الإستفادة الكبيرة (٤٣%) و الجزئية(٣٤.٥%) ، والمنعدمة (٢٢.٥%) من هذا المكون ، جدول رقم (١٢) . كما

أوضحت النتائج البحثية أن أوجه العناية بالطفل تمثلت فيما يلي : نظافة المبلس بنسبة تكرار(٧٠.٧٥%)، والتغذية الجيدة المتكاملة بنسبة تكرار(٥١.٧٥%) ، والعناية بالصحة بنسبة تكرار (٣١.٢٥%) ، والإهتمام بالتعليم بنسبة تكرار (١٢.٥%) من إجمالي الريفيات المبحوثات .

٤- تغذية الطفل:

أبانت النتائج البحثية فيما يتعلق بمكون تغذية الطفل أنه تعددت طرق التغذية ، حيث بلغت نسبة الإستفادة الكبيرة من هذا المكون(٦٢.٥%) ، والجزئية بلغت(١٨%) ، والمنعدمة (١٩.٥%) ، جدول رقم (١٢) . كما أوضحت النتائج البحثية أن تغذية الطفل تضمنت مجموعة من المواد الغذائية تمثلت فيما يلي : البيض بنسبة تكرار (٥٨.٢٥%) ، واللبن بنسبة تكرار(٥٥.٥%) ، والفواكه بنسبة تكرار (٣٦.٧٥%) ، واللحوم والأسماك بنسبة تكرار(٣٣.٢٥ %) وشوربة الخضار بنسبة تكرار(٣٣.٧٥%) والعصير بنسبة تكرار(٢٦.٧٥%) ، هذا بالإضافة إلى إنتظام الوجبات والتنوع في الطعام بنسبة تكرار(١٩.٥%) من إجمالي الريفيات المبحوثات .

جدول رقم (١٢) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من محور صحة الطفل

الإستفادة / مكونات صحة الطفل	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
أمراض الطفل	٧٩	٤٩.٥٠	٥٨	٣٦.٠٠	٢٣	١٤.٥٠	١٦٠	١٠٠
تطعيمات الطفل	٨٨	٥٥.٠٠	٤٣	٢٦.٧٥	٢٩	١٨.٢٥	١٦٠	١٠٠
العناية بالطفل	٦٩	٤٣.٠٠	٥٥	٣٤.٥٠	٣٦	٢٢.٥	١٦٠	١٠٠
تغذية الطفل	١٠٠	٦٢.٥٠	٢٩	١٨.٠٠	٣١	١٩.٥٠	١٦٠	١٠٠
المتوسط العام للإستفادة	**٨٤**	**٥٢.٥٠**	**٤٦**	**٢٨.٧٥**	**٣٠**	**١٨.٧٥**	**١٦٠**	**١٠٠**

يتضح من الجدول السابق أن أكثر من نصف الريفيات المبحوثات(٥٢.٥%) يتمتعن بإستفادة معرفية كبيرة فيما يتعلق بمحور صحة الطفل ، مما يدل على حرص الريفيات المبحوثات على معرفة كل ما يتعلق بصحة أطفالهن حتى يحافظن عليها ويتمتع أطفالهن بصحة جيدة ، مما يزيد من بهجتهن وإصرارهن على تلبية احتياجاتهن المعرفية المتعلقة بأطفالهن .

٤- صحة الغذاء:

أوضحت النتائج البحثية فيما يتعلق بمحور صحة الغذاء أنه تناول العديد من النقاط تمثلت فيما يلي : أهمية الدهون وكانت نسبة الإستفادة الكبيرة (٥١.٢٥%) ، والجزئية (٣٣.٧٥%) ، والمنعدمة (١٥%) ، وأيضا أضرار الدهون بنسبة إستفادة كبيرة(٦٠%) ، وجزئية (٢٣.٧٥%)، ومنعدمة (١٦.٢٥%) ، و مصادر البروتين بنسبة إستفادة مرتفعة (٦٠.٥%) ، وجزئية (٢٣.٧٥%) ، ومنعدمة(١٥.٧٥%) ، هذا بالإضافة إلى أهمية البروتين حيث بلغت نسبة الإستفادة الكبيرة(٦١.٧٥%) ، والجزئية(٢٤.٥%) ، والمنعدمة(١٣.٧٥%) ، جدول رقم (١٣) .

جدول رقم (١٣) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من محور صحة الغذاء

الإستفادة / مكونات صحة الغذاء	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
أهمية الدهون	٨٢	٥١.٢٥	٥٤	٣٣.٧٥	٢٤	١٥.٠٠	١٦٠	١٠٠
أضرار الدهون	٩٦	٦٠.٠٠	٣٨	٢٣.٧٥	٢٦	١٦.٢٥	١٦٠	١٠٠
مصادر البروتين	٩٧	٦٠.٥٠	٣٨	٢٣.٧٥	٢٥	١٥.٧٥	١٦٠	١٠٠
أهمية البروتين	٩٩	٦١.٧٥	٣٩	٢٤.٥٠	٢٢	١٣.٧٥	١٦٠	١٠٠
المتوسط العام للإستفادة	**٩٣**	**٥٨.٢٥**	**٤٣**	**٢٦.٧٥**	**٢٤**	**١٥.٠٠**	**١٦٠**	**١٠٠**

يتضح من الجدول السابق أن أكثر من نصف الريفيات المبحوثات (٥٨.٢٥ %) تمتعن بإستفادة معرفية كبيرة من محور صحة الغذاء ، مما يدل على حرص الريفيات على معرفة ماهو مفيد وما هو ضار من العناصر الغذائية المختلفة وذلك لتجنب الأضرار والإستفادة من الفوائدعند تحضير الوجبات الغذائية .

٥- التغذية العلاجية :

أوضحت النتائج البحثية فيما يتعلق بمحور التغذية العلاجية أنه قد إشتمل على كيفية التغذية في حالة العديد من الأمراض منها : مرض الكبد ، حيث بلغت نسبة الإستفادة الكبيرة(٣٣%) ، والجزئية (٣٤.٥ %) ، والمنعدمة(٣٢.٥ %) ، وأيضا مرض السكر حيث بلغت نسبة الإستفادة الكبيرة(٤٣%) ، والجزئية(٣٢.٥ %)، والمنعدمة(٢٤.٥ %) ،كما تضمن أيضا مرض ضغط الدم وكانت نسبة الإستفادة الكبيرة(٣٨.٧٥ %) ، والجزئية (٣٧.٥%) ، والمنعدمة ٢٣.٧٥%) ،وأيضا الأنيميا حيث بلغت نسبة الإستفادة الكبيرة (٥٥.٥ %) ، والجزئية(٢٠%)، والمنعدمة(٢٤.٥ %)، هذا بالإضافة إلى تغذية كبار السن حيث بلغت نسبة الإستفادة الكبيرة(٤٣.٥%) والجزئية (٣١%) ، والمنعدمة (٢٥.٥ %) ، جدول رقم (١٤) ٠

جدول رقم (١٤) توزيع الريفيات المبحوثات وفقا لإستفادتهن المعرفية من محور التغذية العلاجية

الإستفادة / الأمراض	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
مرض الكبد	٥٣	٣٣.٠٠	٥٥	٣٤.٥٠	٥٢	٣٢.٥٠	١٦٠	١٠٠
مرض السكر	٦٩	٤٣.٠٠	٥٢	٣٢.٥٠	٣٩	٢٤.٥	١٦٠	١٠٠
ضغط الدم	٦٢	٣٨.٧٠	٦٩	٣٧.٥٠	٣٨	٢٣.٧٥	١٦٠	١٠٠
الأنيميا	٨٩	٥٥.٥٠	٣٢	٢٠.٠٠	٣٩	٢٤.٥٠	١٦٠	١٠٠
كبار السن	٦٩	٤٣.٥٠	٥٠	٣١.٠٠	٤١	٢٥.٥٠	١٦٠	١٠٠
المتوسط العام للإستفادة	**٦٨**	**٤٢.٥٠**	**٥٠**	**٣١.٢٥**	**٤٢**	**٢٦.٢٥**	**١٦٠**	**١٠٠**

يتضح من الجدول السابق أن(٤٢.٥ %)من الريفيات المبحوثات تتمتعن بإستفادة معرفية كبيرة من محور التغذية العلاجية ، مما قد يؤكد على أهمية هذا المحور ، حيث أن الريفيات يحرصن على معرفة كيف تتم التغذية في الحالات المرضية المختلفة ، مما يساعدهن على الحفاظ على صحتهن وصحة أفراد أسرهن .

٦- البيئة:

أوضحت النتائج البحثية فيما يتعلق بمحور البيئة أنه تضمن العديد من النقاط مثل : التخلص من القمامة ، حيث بلغت نسبة الإستفادة الكبيرة(٧٠.٧٥%) ، والجزئية (١٨.٧٥%) ، والمنعدمة(١٠.٥ %) ، وأيضا تجميع القمامة حيث بلغت نسبة الإستفادة الكبيرة (٦٧.٥%) والجزئية (٢١.٢٥%) ، والمنعدمة(١١.٢٥ %) ، وأيضا الإهتمام بنظافة المنزل حيث كان نسبة الإستفادة الكبيرة (٧٦.٢٥%) ، والجزئية (١٥.٧٥%) ، والمنعدمة (٨ %)، بالإضافة إلى عدم إلقاء القمامة في الترع والمصارف ، حيث بلغت نسبة الإستفادة الكبيرة(٧٠%) ، والجزئية(١٨.٢٥%) ، والمنعدمة (١١.٧٥ %) ، وأيضا كيفية القضاء على الحشرات المنزلية حيث بلغت نسبة الإستفادة الكبيرة (٧٢.٥ %) ، والجزئية (١٧.٥ %)، والمنعدمة (١٠%) ، وأيضا طرق الوقاية من أنفلونزا الطيور حيث بلغت نسبة الاستفادة الكبيرة(٦٩.٥ %) ، والجزئية (١٨%)، والمنعدمة(١٢.٥ %) ، وأخيراً المحافظة على البيئة من التلوث حيث بلغت نسبة الإستفادة الكبيرة (٦٣%) ، والجزئية(٢١.٢٥ %) ، والمنعدمة (١٥.٧٥ %) ، جدول رقم(١٥) .

جدول رقم (١٥) توزيع الريفيات المبحوثات وفقاً لإستفادتهن المعرفية من محور البيئة

الإستفادة / المكونات	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
التخلص من القمامة المنزلية	١١٣	٧٠.٧٥	٣٠	١٨.٧٥	١٧	١٠.٥	١٦٠	١٠٠
تجميع القمامة	١٠٨	٦٧.٥	٣٤	٢١.٢٥	١٨	١١.٢٥	١٦٠	١٠٠
الإهتمام بنظافة المنزل	١٢٢	٧٦.٢٥	٢٥	١٥.٧٥	١٣	٨.٠٠	١٦٠	١٠٠
عدم إلقاء القمامة في الترع والمصارف	١١٢	٧٠.٠٠	٢٩	١٨.٢٥	١٩	١١.٧٥	١٦٠	١٠٠
كيفية القضاء على الحشرات المنزلية	١١٦	٧٢.٥٠	٢٨	١٧.٥	١٦	١٠.٠٠	١٦٠	١٠٠
طرق الوقاية من انفلونزا الطيور	١١١	٦٩.٥٠	٢٩	١٨.٠٠	٢٠	١٢.٥	١٦٠	١٠٠
المحافظة على البيئة من التلوث	١٠١	٦٣.٠٠	٣٤	٢١.٢٥	٢٥	١٥.٧٥	١٦٠	١٠٠
المتوسط العام للإستفادة	**١١٢**	**٧٠.٠٠**	**٣٠**	**١٨.٧٥**	**١٨**	**١١.٢٥**	١٦٠	١٠٠

يتضح من الجدول السابق أن غالبية الريفيات المبحوثات (٧٠%) تتمتعن بمستويات معرفية كبيرة وذلك فيما يتعلق بمحور البيئة ، مما يدل على حرصهن على معرفة كل ما يتعلق بالجوانب البيئية المختلفة وذلك للحفاظ على بيئة صحية و آمنه لهن ولأسرهن ، مما قد ينعكس أثره على مستوياتهن الصحية وذلك من خلال المعلومات التي تقدمها لهن شبكة إتصال التنمية الريفية والزراعية(رادكون) ، مما يدل على أهمية شبكة إتصال التنمية الريفية والزراعية(رادكون) في تزويدهن بالمعلومات التي يحتجن إليها .

ثانياً : الإستفادة المعرفية فيما يتعلق بالمجال الإقتصادي :

وينطوى هذا المجال على محور رئيسي يتمثل في المشروعات الصغيرة التي يمكن أن تسهم في تحسين دخل الريفيات المبحوثات وبالتالي النهوض بمستوياتهن المعيشية ، وذلك كما يلي :

المشروعات الصغيرة :

أوضحت النتائج البحثية فيما يتعلق بمحور المشروعات الصغيرة ، أن شبكة إتصال التنمية الريفية والزراعية (رادكون) تضمنت عدد من المشروعات الصغيرة تمثلت في : التفصيل ، حيث كانت نسبة الإستفادة الكبيرة (٢٨.٥%) ، والجزئية (٣١.٢٥%) ، والمنعدمة(٤٠.٥ %) ، وأيضاً إنتاج البيض البلدي ، حيث بلغت نسبة الإستفادة الكبيرة(٥٩.٥%) ، والجزئية(٢٣.٧٥%) ، والمنعدمة (١٦.٧٥ %) ، وأيضاً إنتاج الجبن القريش بنسبة إستفادة كبيرة (٥٥%)، جزئية (٢٧.٥%) ، ومنعدمة(١٧.٥ %) ، هذا بالإضافة إلى تربية البط المسكوفي بنسبة إستفادة كبيرة(٤٠%)، وجزئية (٤١.٧٥%) ، ومنعدمة(١٨.٢٥%) ، وأيضاً تربية الماعز بنسبة إستفادة كبيرة (٣٥%) ، وجزئية (٤٥ %) ، ومنعدمة (٢٠%) ، و تربية الأرانب بنسبة إستفادة كبيرة (٢٩.٥ %) ، وجزئية (٣٥%) ، ومنعدمة (٣٥.٥%) ، وأيضاً تربية السمان بنسبة إستفادة كبيرة(١١.٢٥%) وجزئية(٢٨.٧٥ %) ، ومنعدمة (٦٠ %) ، و تحصين الكتاكيت بنسبة إستفادة كبيرة (١٨.٧٥%)، جزئية (٣٠%) ، ومنعدمة(٥١.٢٥%) ، وأيضاً تربية نحل العسل بنسبة إستفادة كبيرة (٢٥%) ، وجزئية (٢٣.٢٥%) ، ومنعدمة(٥١.٧٥%) ، وأيضاً عيش الغراب بنسبة إستفادة كبيرة(١٥.٥%) ، وجزئية(٢٧ %) ، ومنعدمة(٥٧.٥%)، وأخيراً الصابون السائل ، حيث بلغت نسبة الإستفادة الكبيرة(٥٨.٢٥ %)، والجزئية (٢٠%) ، والمنعدمة(٢١.٢٥%) ، جدول رقم (١٦) .

جدول رقم (١٦) توزيع الريفيات المبحوثات وفقاً للإستفادة المعرفية من محورالمشروعات الصغيرة

الإستفادة / المشروعات	كبيرة		جزئية		منعدمة		المجموع	%
	العدد	%	العدد	%	العدد	%		
التفصيل	٤٥	٢٨.٣٥	٥٠	٣١.٢٥	٦	٤٠.٥٠	١٦٠	١٠٠
إنتاج البيض البلدي	٩٥	٥٩.٥٠	٣٨	٢٣.٧٥	٢٧	١٦.٧٥	١٦٠	١٠٠
إنتاج الجبن القريش	٨٨	٥٥.٠٠	٤٤	٢٧.٥	٢٨	١٧.٥٠	١٦٠	١٠٠
تربية البط المسكوفي	٦٤	٤٠.٠٠	٦٧	٤١.٧٥	٢٩	١٨.٢٥	١٦٠	١٠٠
تربية الماعز	٥٦	٣٥.٠٠	٧٢	٤٥.٠٠	٣٢	٢٠.٠٠	١٦٠	١٠٠
تربية الأرانب	٤٧	٢٩.٥٠	٥٦	٣٥.٠٠	٥٧	٣٥.٥٠	١٦٠	١٠٠
تربية السمان	١٨	١١.٢٥	٤٦	٢٨.٧٥	٩٦	٦٠.٠٠	١٦٠	١٠٠
تحصين الكتاكيت	٣٠	١٨.٧٥	٤٨	٣٠.٠٠	٨٢	٥١.٢٥	١٦٠	١٠٠
تربية نحل العسل	٤٠	٢٥.٠٠	٣٧	٢٣.٢٥	٨٣	٥١.٧٥	١٦٠	١٠٠
عيش الغراب	٢٥	١٥.٥٠	٤٣	٢٧.٠٠	٩٢	٤٧.٥٠	١٦٠	١٠٠
الصابون السائل	٩٣	٥٨.٢٥	٣٣	٢٠.٥٠	٣٤	٢١.٢٥	١٦٠	١٠٠
مشروعات أخرى	٢١	١٣.٠٠	٥	٣.٥٠	١٣٤	٨٣.٧٥	١٦٠	١٠٠
المتوسط العام للإستفادة	**٥٠**	**٣١.٢٥**	**٤٥**	**٢٨.٢٥**	**٦٥**	**٤٠.٥**	**١٦٠**	**١٠٠**

يتضح من الجدول السابق أن أكثر من نصف الريفيات المبحوثات (٥٩ %) تتمتعن بإستفادة معرفية كبيرة وجزئية من محور المشروعات الصغيرة ، كما أن أكثر من ثلث المبحوثات أيضاً لا يستفدن من هذا المحور، مما يدل على ضرورة التركيز على هذا المحور من قبل القائمين على العمل على شبكة إتصال التنمية الريفية والزراعية (رادكون) ، مما قد يكون له أثر على مساعدة الريفيات على النهوض بمستوياتهن الدخلية والمعيشية . كما يتضح من الجدول أيضاً أن أكثر المشروعات إستفادة معرفية لدى الريفيات تمثلت في : إنتاج البيض البلدي ، والصابون السائل وإنتاج الجبن القريش ، وذلك بالنسبة التالية لكل منهم على الترتيب (٥٩.٥ %) ، و (٥٨.٢٥ %) ، و (٥٥ %) .

كما يتبين أيضاً أن هناك عدد من المشروعات كانت إستفادة المبحوثات منها منعدمة وتمثلت في : تربية السمان ، وعيش الغراب ، والمنحل ، وتحصين الكتاكيت ، وذلك بالنسب التالية لكل منهم على الترتيب (٦٠%) ، و (٥٧.٥ %) ، و (٥١.٧٥%) ، و (٥١.٢٥ %) ، مما يدل على ضرورة توعية الريفيات بالفائدة التي سوف تعود عليهن من مثل هذه المشروعات نظراً للعائد المجزي الذى سوف يعود عليهن منها . كما أظهرت النتائج أيضاً وجود عدد من المشروعات الصغيرة الأخرى تمثلت في : المشغولات اليدوية بنسبة تكرار (١١.٢٥%) ، و تربية الأوز بنسبة تكرار (١٠%)، وعمل ملايات السرير بنسبة تكرار (٨%) .

يتضح من العرض السابق للنتائج المتعلقة بالإستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) ، أنه فيما يتعلق بالمجال الإجتماعي كانت درجات الإستفادة المعرفية كبيرة لغالبية محاور ومكونات هذا المجال ، مما يدل على أهمية هذه المحاور للريفيات المبحوثات وحرصهن على معرفة كل ما يمكن أن يساعدهن على أداء وظائفهن الأسرية ، كما إتضح أنه فيما يتعلق بالمجال الإقتصادي كانت الإستفادة منخفضة نسبياً مقارنة بالمجال الإجتماعي ، وقد يرجع ذلك إلى أن المجال الإقتصادي يحتاج إلى جانب مادي يتمثل في رأس مال المشروع بالإضافة إلى المكان والجهد ، ويوضح الجدول رقم (٣٤) تلخيصاً لمستوى الإستفادة المعرفية من المجالات المتضمنة بأنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون).

جدول رقم (١٧) توزيع الريفيات المبحوثات وفقاً للمتوسط العام لمستوى الإستفادة المعرفية من المجالات المتضمنة بأنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون)

الإستفادة / المجالات التنموية	كبيرة		جزئية		منعدمة	
	العدد	%	العدد	%	العدد	%
أولا: المجال الإجتماعي :						
١- الغذاء والتغذية	٧٤	٤٦.٠٠	٣١	١٩.٥٠	٥٥	٣٤.٥٠
٢- صحة المرأة	٨١	٥٠.٠٠	٤٢	٢٦.٠٠	٣٧	٢٣.٢٥
٣- صحة الطفل	٨٤	٥٢.٥٠	٤٦	٢٨.٧٥	٣٠	١٨.٧٥
٤- صحة الغذاء	٩٣	٥٨.٢٥	٤٣	٢٦.٧٥	٢٤	١٥.٠٠
٥- التغذية العلاجية	٦٨	٤٢.٥٠	٥٠	٣١.٢٥	٤٢	٢٦.٢٥
٦- البيئـة	١١٢	٧٠.٠٠	٣٠	١٨.٧٥	١٨	١١.٢٥
ثانيا: المجال الاقتصادي:						
- المشروعات الصغيرة	٥٠	٣١.٢٥	٤٥	٢٨.٢٥	٦٥	٤٠.٥٠
المتوسط العام للإستفادة	**٧٨**	**٤٨.٧٥**	**٣٨**	**٢٣.٧٥**	**٤٤**	**٢٧.٥**

ن = ١٦٠

يتضح من الجدول السابق أن أكثر المحاور إستفادة بالنسبة للريفيات المبحوثات ، تمثلت فى البيئة بنسبة (٧٠%) ، وصحة الغذاء بنسبة (٥٨.٢٥ %) ،وصحة الطفل (٥٢.٥ %) ، وصحة المرأة بنسبة (٥٠.٥%) ، مما يؤكد على أهمية هذه المحاور بالنسبة للريفيات ، وبالتالي ضرورة تفعيلها وتعضيدها بالطرق الإرشادية التقليدية من ندوات ومحاضرات وبرامج تليفزيونية تركز على هذه الجوانب ، كما إتضح أيضاً وجود عدد من المحاور كانت نسبة الإستفادة المعرفية منها دون المستوى المنشود تمثلت فى : المشروعات الصغيرة الأخرى (٣١.٢٥%) ، والتغذيةالعلاجية (٤٢.٥%) ، لذلك لابد من العمل على تفعيل شبكة إتصال التنمية الريفية والزراعية (رادكون) مع التركيز على هذه الجوانب وتفعيل متضمناتها و تعضيدها حتى تتمكن الريفيات من الحصول على أقصى إستفادة معرفية ممكنة .

ثالثا: العلاقات الإرتباطية والإنحدارية المتعددة بين مستوى الإستفادة المعرفية للريفيات المبحوثات وبين المتغيرات المستقلة المدروسة:

تشير البيانات الموضحة بالجدول رقم (١٨) إلى وجود وجود علاقة إرتباطية موجبة مغزوية بين مستوى الإستفادة المعرفية للريفيات المبحوثات وكل من المتغيرات التالية : الحالة التعليمية ، والإنفتاح الإنتقالي ، وتعدد مصادر المعلومات ، وإمتلاك الأسرة لجهاز الحاسب الآلي ومستوى الإستفادة منه ، والمستوى الطموحي ، والتجددية ، ومستوى التعرض للشبكة ، والمعرفة بأنظمة الشبكة ، والرضا عن الشبكة ، والمستوى التقييمي لخصائص محتوى الشبكة .

وتبين أيضاً عدم وجود علاقة إرتباطية مغزوية بين مستوى الاستفادة المعرفية للريفيات المبحوثات وكل من المتغيرات التالية (السن ، والحالة الإجتماعية ، والتجددية ، والحيازة الأرضية المزرعية عند أي من المستويين الإحتماليين .

جدول رقم (١٨) قيم معاملات الارتباط البسيط بين مستوى الإستفادة المعرفية من متضمنات أنظمة الشبكة والمتغيرات المستقبلية المدروسة

المتغيرات	معامل الارتباط	المتغيرات	معامل الارتباط
السن	- ٠.٠٦٦	التجددية	٠.١٩٨ **
الحالة التعليمية	٠.٢٨٥ *	الحيازة الأرضية المزرعية	٠.٠٢٣
الحالة الإجتماعية كا^{2}	١.٦٤١	القيادية	٠.٠٦٣
الإنفتاح الإنتقالي	٠.٣٢٢ *	مستوى التعرض للشبكة	٠.٢٨٦ *
تعدد مصادر المعلومات	٠.٣١٠ *	المعرفة بأنظمة الشبكة	٠.٥٢٥ *
إمتلاك الأسرة لجهاز الحاسب الآلي ومستوى الإستفادة منها	٠.٣٢٥ *	الرضا عن الشبكة	٠.٦٤٨ *
المستوى الطموحي	٠.٢٥٣ *	المستوى التقييمي لخصائص محتوى الشبكة	٠.٦١٠ *

* مستوى الدلالة الإحصائية (٠.٠١) كا^{2} = ٤

** مستوى الدلالة الإحصائية (٠.٠٥)

تحقيق الفرض البحثي الأول : في ضوء نتائج التحليل الإرتباطي البسيط فإنه يرفض الفرض الإحصائي في صورته الصفرية وتقبل الفرض الأصلي بعد تعديله في صورته التالية "توجد علاقة إرتباطية بين مستوى الاستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة الاتصال (رادكون) والمتغيرات التالية : الحالة التعليمية ،والإنفتاح الإنتقالي ، وتعدد مصادر المعلومات ، وإمتلاك الأسرة لجهاز الحاسب الآلي ومستوى الإستفادة منه ، والمستوى الطموحي ،والتجددية ،ومستوى التعرض للشبكة ، والمعرفة بأنظمة الشبكة ، والرضا عن الشبكة ، والمستوى التقييمي لخصائص محتوى الشبكة .

العلاقة الإنحدارية الخطية المتعددة بين متغيرات الدراسة :

في ضوء العلاقات الإرتباطية اتجهت الدراسة إلى تقدير تأثير المتغيرات المستقلة على التباين الحادث في مستوى الإستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) وقد توصلت البيانات الواردة بجدول (١٩) إلى معنونة هذا النموذج إستناداً إلى قيمة (ف) حيث بلغت هذه القيمة ٤٥.٦٤٥ وهي قيمة مغزوية عند المستوى الإحتمالي (٠.٠١) .

جدول رقم (١٩) العلاقة الإنحدارية الخطية بين مستوى الإستفادة المعرفية من متضمنات أنظمة شبكة إتصال التنمية الريفية والزراعية (رادكون) وبعض المتغيرات المستقلة

المتغيرات	معامل الانحدار الجزئي	قيمة T	معامل الانحدار الجزئي القياس	الترتيب التأثيري
الرضا عن الشبكة	٢.١٥٥	٥.٣٠٩ **	٠.٤٠٥	الأول
تعدد مصادر المعلومات	٣.٩١٠	٤.٣٢٠ **	٠.٢٣٣	الثاني
المعرفة بأنظمة الشبكة	٣٤٧٢	٣.٣٦٣ **	٠.٢٠٢	الثالث
المستوى التقييمي لخصائص محتوى الشبكة	١.٨١٧	٢.٨١٧ **	٠.٢١٤	الرابع
التجددية	١.٤٠٢	٢.١٥٨ *	٠.١١٢	الخامس

R2 = ٠.٥٨٤ F = ٤٥.٦٤٥ **

* مستوى الدلالة الإحصائية (٠.٠١) ** مستوى الدلالة الإحصائية (٠.٠٥)

وتشير البيانات الواردة بالجدول إلى أن المتغيرات المستقلة الخمس وهي : متغير تعدد مصادر المعلومات ، ومتغير التجديدية ، ومتغير المعرفة بأنظمة الشبكة ، ومتغير الرضا عن الشبكة ،و متغير المستوى التقييمي لخصائص محتوى الشبكة ، مجتمعة تفسر حوالي ٥٨% من التباين الحادث في مستوى الإستفادة المعرفية للريفيات المبحوثات وهي نسبة كبيرة تشير إلى إسهام المتغيرات المدروسة إسهامًا قوياً في تفسير التباين في مستوى الإستفادة المعرفية لمتضمنات أنظمة الشبكة .

تحقيق الفرض البحثي الثاني : في ضوء نتائج التحليل الإنحداري الجزئي القياسي فإنه يرفض الفرض الإحصائي في صورته الصفرية وتقبل الفرض الأصلي بعد تعديله في صورته التالية "بتأثير مستوى الاستفادة المعرفية للريفيات المبحوثات من متضمنات أنظمة شبكة الاتصال (رادكون) بصورة مجتمعة معنوية لكل من المتغيرات التالية : تعدد مصادر المعلومات ، التجددية ، والمعرفة بأنظمة الشبكة ، والرضا عن الشبكة ، والمستوى التقييمي لخصائص محتوى الشبكة .

رابعاً : المشكلات التي تواجه الريفيات المبحوثات عند الإتصال بشبكة إتصال التنمية الريفية والزراعية (رادكون) والحلول المقترحة من وجهة نظرهن :

أوضحت النتائج البحثية أن أبرز المشكلات التي ذكرتها المبحوثات تمثلت في سقوط الشبكة وذكرتها (٣١.٧٥%) من المبحوثات ، وعطل الكمبيوتر(٢٢.٥%) من المبحوثات ، وأن المعلومات على الشبكة قليلة وغير مناسبة لحجم الأنظمة والموضوعات المطروحة عليها (١٦.٢٥%) من المبحوثات ، في حين تمثلت أبرز الحلول المقترحة من وجهة نظرهن في : حل مشكلات الشبكة وتدعيم الانترنت وذكرتها (٣١.٧٥%) من المبحوثات ،وصيانة وإصلاح الكمبيوتر وذكرتها (٢٢.٥%) من المبحوثات ، وزيادة المعلومات على الأنظمة وذكرتها (١٦.٢٥%) من المبحوثات .

التوصيات

إستخلاصاً لما آلت إليه نتائج هذا البحث فإنها توصي بما يلي :

١- إنشاء صندوق لدعم فعالية تكنولوجيا الإتصال والمعلومات فى المجال الزراعي (لأنه بات ضروريا إستخدامها فى العمل الإرشادي الزراعي) وذلك لضمان تطوير وإستمرار نظم الإرشاد الزراعي الإلكتروني وعدم توقفها بتوقف التمويل الخارجي .

٢- تحديث الحاسبات الآلية وملحقاتها بالمراكز الإرشادية الزراعية مع توفير أجهزة لاب توب حتى يمكن حملها والنزول بها إلى القرى البعيدة حتى يتمكن سكان هذه القرى من التعرض بسهولة للمعلومات المحملة على شبكات الإتصال والإستفادة منها .

٣- توفير الحوافز المادية والمعنوية للقائمين بالعمل الإرشادي بالمراكز الإرشادية .

٤- دعم نظام الإرشاد الإلكتروني الزراعي من خلال توفير أجهزة الحاسب الآلي بالمديريات والإدارات الزراعية وتفعيل الشبكات الإلكترونية الزراعية وإمتداد مظلتها على مستوى الجمهورية .

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Level of Knowledge Benefit of Rural Women from Included of Rural and Agricultural Development Communication Network (RADCON) in Some Villages of El-Behera Governorate

Abo Zaid Mohamed Mohamed El –Habbal. Gamal Hussen Bekheit Amer. Souzan Ibrahim El- Sayed El –Sharbatly and Hanan Nageib Ali Tahawy
Faculty of Agriculture . Saba Bacha . Alexandria University.
*Agriculture Extension and Rural Development Research Inistitute .ARC .

ABSTRACT: The study aimed to determine the level of knowledge benefit of rural women from included Rural and Agriculture Development Communication Net work (RADCON). A questionnaire through personal interview was to collect data for this study from 160 respondent . statistical methods for analyzing research data including : mean , standard deviation , simple coloration coefficient , analysis of variance. Important findings could be summarized as follows **.**

1- Knowledge benefit level was about (16.25%)of included RADCON was low , and (66.75%) has moderate level , while (17%) had high level .
2- The results showed that there was significant relationship between level of knowledge benefit and each of the following variables : educational status ,ambition level , the openness transitional ,the innovativeness , sources of information , owning the computer and level of benefit of it. the level of keeping on contact with RADCON , the knowledge about the Net work system of RADCON , satisfaction with RADCON , and evaluation level for the characteristics of the Net work content .
3- The results showed that multiple sources of information , the innovativeness , the knowledge about the Net work system of RADCON and satisfaction with RADCON, and evaluation level for the characteristics of the Net work content as independent variables have explained the variance in the knowledge benefit for the respondent of the included of RADCON .
4- The problems facing the respondents in the time of using RADCON and how to solve them according to their view : the Net work doesn't work as usually the computer is breakdown .

هيئة التحرير

جامعة الإسكندرية

كلية الزراعة – سابا باشا

مجلـة

الجديد في البحوث الزراعية

المجلد العشرون – العدد الأول – مارس ٢٠١٥

ISSN 1110 – 5585/1996

تصدرها و تحررها: كلية الزراعة – سابا باشا

جامعة الإسكندرية

ص . ب: ٢١٥٣١ بولكلى – الإسكندرية

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