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الاهمية النسبية لمكونات المحصول فى الفول البلدي المنزرع تحت خليط من الأسمدة الحيوية والعضوية فى الأراض المستصلحة حديثا

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الملخص العربي

أجريت تجربتان حقليتان فى تربة رملية ملحية القوام في قرية الأمل ، شمال سيناء ، مصر ، على زراعة محصول الفول البلدي صنف (النوبارية ١) ، خلال موسمي الشتوي ٢٠١٠ و ٢٠١١. لدراسة تقييم الاستخدام الاقتصادي للأسمدة العضوية والحيوية مع سماد اليوريا (٦٠ ، ٤٥ ، ٣٠ كجم نيتروجين لكل فدان) على خصوبة التربة المالحة والمستصلحة حديثا و إنتاجية الفول البلدي. تم تلقيح بذور الفول بالسماد الحيوي والمثبتة للنتروجين – التكافلية البكتيريا من *leguminosarum* الريزوبيم) وأضيف السماد العضوي بمعدل (٥ ميجا جرام للفدان) متحدين معا او غير متحدين مع الأسمدة المعدنية والحيوية.

وكانت النتائج المتحصل عليها كالتالي :

أن الأسمدة الحيوية والتسميد العضوي متحدين مع السماد النتروجينى أدت إلى زيادات واضحة في محصول المادة الجافة من قش الفول ومحصول البذور ، ووزن١٠٠ بذرة ، وارتفاع النبات (سم) وعدد الفروع .

أدى استخدام التسميد العضوي والحيوي متحدين مع التسميد النتروجينى المعدني إلى انخفاض غير معنوي في رقم الحموضة للتربة تحت الدراسة.

لوحظ انخفاض في نسبة الملوحة التربة باستخدام التسميد العضوي والحيوي متحدين مع التسميد النتتروجينى المعدني . وجد زيادة في العناصر الميسرة في التربة (النتروجين – الفوسفور – البوتاسيوم – الحديد – المنجنيز – الزنك) نتيجة استخدام التسميد العضوي والحيوي نتيجة انخفاض رقم حموضة التربة وكذلك لتحسين صفات التربة .

أشارت النتائج أن هناك ارتباط موجب و عالي المعنوية بين محصول البذور في الفول و طول النبات وعدد البذور في القرن ومتوسط المحصول الأخضر ووزن ١٠٠بذرة بينما أرتبطت صفة عدد أوراق النبات ارتباط سالب مع محصول بذور النبات ، واوضحت النتائج المتحصل عليها باستخدام طريقة الانحدار المتعدد المرحلى حيث كانت صفات محصول النبات الاخضر و وزن ١٠٠بذرة هى الاكثر اسهاما فى محصول الفول .

أظهرت نتائج تحليل العامل أن الصفات تحت الدراسة تجمعت في ٣ عوامل ساهمت بحوالي ٨١.٧٧ % فى التباين الكلى لصفة محصول البذور في الفول البلدي وقد تضمن العامل الأول صفات طول النبات وعدد الأفرع في النبات ووزن ١٠٠ بذرة وعدد البذور في النبات والقرن ومتوسط النبات الأخضر ويسهم هذا العامل بحوالي ٥٠.٧٢% من التباين الكلى وضم العامل الثاني عدد الأوراق في النبات ويسهم هذا العامل بحوالي ١٦.٥٨% من التباين الكلى وضم العامل الثالث عدد القرون الجافة في النبات ويسهم هذا العامل بحوالي ١٤.٤٧% من التباين الكلى . أوضحت نتائج تحليل العامل أن التحليل يتسع لدراسة مزيد من الصفات حيث أن الصفات تحت الدراسة فسرت ٨١.٧٧ فقط من التباين.

أوضحت النتائج أن أفضل معاملة هي استخدام التسميد الحيوي متحد مع ٣٠ كجم نتروجين لكل فدان حيث أنها أعطت أعلى ربح وأعلى عائد ربح لكل جنية مصروف ١.٤٦ جنية .

RELATIVE CONTRIBUTION FOR YIELD COMPONENTS OF FABA BEAN GROWN UNDER COMBINATION OF BIO- ORGANIC FERTILIZERS ON FERTILITY IN NEWLY RECLAIMED SOIL.

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ABSTRACT: *Two field experiments were carried out in sandy clay saline soil at El- Amal village, North Sinai, Egypt, cultivated with faba bean cv. (Nobaria 1), during the winter season of 2009/2010 and 2010/2011. The study aimed to investigate effect of bio-fertilizer and organic farm combination with different rates of mineral nitrogen fertilizer rates (60, 45 and 30 kg N fed^{-1}) on newly reclaimed saline soil fertility and faba bean productivity. Seeds were inoculated with bio- fertilizer containing the symbiotic N-Fixing bacteria of Rhizobium leguminosarum) and amendment of soil with organic farm, at a rate of (5 Mg fed^{-1}) combined with mineral nitrogen fertilizer rates.*

Results obtained revealed that bio- and organic fertilization combined with mineral N were increased significantly in dry matter yield/ fed 100-seed weight, plant height, No. of branches/plant and dry biomass kg/fed. Electrical conductivity (EC) showed decrease trend with the application of bio-fertilizer and compost combination with 45kg N fed^{-1} to the soil. The soil pH ranged from 8.10 to 7.97 in both seasons and did not vary significantly among the treatments. The soil content of available N, P and K were significantly increased by application of organic farm and bio-fertilizer combination with mineral N rates of 30 and 45 kg N fed^{-1} compared with the control. Similar significant and increase effect of for the studied treatments on the soil contents of DTPA- extractable micronutrients (Fe, Mn and Zn) in the soil. Seed yield of beans positively associated with plant height and number of seeds/pod and the average crop yield of green, 100 seed, while number of leaves associated with the status in the negative correlation with plant seeds of crop plants. The results of full model regression and stepwise multiple linear regression revealed that 90.5% (expressed as R^2) of the total variation in faba bean yield could be attributed to these aforementioned two traits. On the other hand factor analysis grouped the studied characters into 3 factors contributed at 81.77 in the total variation of seed yield. Economically, the beast treatment was bio-fertilizer + 30 kg N giving profit for each expense LE of 1.46.

Key word: *Saline soil, Bio-fertilizer, Organic farm, Faba bean productivity, Correlation, Stepwise and Factor analysis.*

INTRODUCTION

Saline soils vary greatly in the composition of salts. The dominant salts in coastal saline soils are chlorides, mainly sodium chloride.

Broad bean (Vicia faba, L.) is considered one of the most important food legume crops in Egypt. So, it is a great importance to improve production through increasing the area of broad bean or by increasing the productivity yield/fed. Bio-fertilizers play a significant role in improving soil fertility by fixing atmospheric nitrogen, both, in association with plant roots and without it, solubilise insoluble soil growth substances in the soil. They are in fact being promoted to harvest the naturally available, biological system of nutrient mobilization (Venkatashwarlu, 2008). Bio- fertilizers play an important role in enhancing crop productivity through nitrogen fixation, phosphate solubilization, plant hormone productivity, and designed to improve soil fertility as well as, evaluate the effect of manuring on broad bean growth and properties. Nasef *et al*. (2004) found that application of compost manure improved physical, chemical and biological properties of the soil and hence increased its

productivity. El- Sebaey, (2006) reported that ammonia nitrogen as well as values of available phosphorus and potassium concentration significantly increased in the soil and organic manure application increased available P and K in soil rhizosphere. Salama (2006) reported that inoculating broad bean plants with biofertilizer led to increased dry weight, grain yield, N, P and K content in grains and straw and nitrogenase activity compared with uninoculated control treatment of broad bean plants. El-Demerdash (1994) found that half of the recommended rate of added inorganic N- fertilizer can be saved by seed inoculation with symbiotic N_2- fixers. El-Sebaey, (2006) found that addition of compost manure (50 kg N /fed) and inoculation gave higher records of N, P and K uptake than the full dose of inorganic or organic N – fertilizer (100kg N /fed) application. Singh *et al*. (2002) stated that application of 10 t FYM/ha gave considerable grain yield with saving around 25 – 50 % of chemical nitrogen. Kushwha (1994) reported that application of N up to 50.4 kg N/fed significantly increased pods and seed weight/plant. El-Quesni *et al* (2010) found that the microbein or compost treatments gave the highest growth parameters, carbohydrates content, and N, P and K percentages. The interaction effects between bio-fertilizer microbien or compost and salinity levels showed a markedly decrease on Na percentage and proline concentration of shoots and increased all growth parameters , as well as N, P and K percentages increased at low level of salinity, similar trend was obtained for the uptake of concerned nutrients as previously mentioned for their concentrations. Sheraz *et al* (2010) found that Bio-fertilizers being essential components of organic farming play vital role in maintaining long term soil fertility and sustainability by fixing atmospheric dinitrogen , mobilizing fixed macro and micro nutrients or convert insoluble P in the soil into forms available to plants, there by increases their efficiency and availability.

Yield is the final product of several characters. The determination of most important characters influencing yield may be useful in the breeding programmers. Correlation, stepwise multiple linear regression and factor analysis are statistical techniques applied successfully to identify the relative contribution of some independent variables on a dependent variable .factor analysis is a type of multivariate analysis that reduces a large number of correlated variables to a small number of main factors. (Hung *et al*., 1983; Sindhu *et al.*, 1985 and Ashmawy *et al.*, 1998) used factor analysis in faba been, experiment, respectively.

The study was carried out to study and evaluate the individual and combined effects of mineral nitrogen, bio- and organic fertilizers and its economical efficiency on soil fertility and faba bean plant growth under salts soil conditions.

MATERIALS AND METHODS

During the two consecutive winter seasons of 2010 and 2011, two field experiments were carried out on the farm of El- Amal village at Sahl El-Tena. The El-Tina plain lies in the North-Western Mediterranean coast of Sinai, between 32^{o}_ 350 and 32^{o}_ 450 E and 31^{o}_ 000 and 31^{o}_ 250 N, Kaiser (2009). The objective of this investigation was to study the effect of fertilization cattle farm and Rhizobium inoculation with mineral nitrogen fertilizer, on soil fertility and faba bean plants, cv. Nobaria 1 productivity under sandy clay saline soil. Before planting and also after plant harvesting surface soil sample (0- 30 cm) of the used soil were collected , air-dried , ground good mixed sieved through a 2mm size and analyzed for some physical and chemical properties recorded in Table (1) using the methods described by Black *et al* (1965) , Cotton *et al* (1982) and Page *et al* (1982) . The experiment was carried out in randomized complete blocks design with 3 replicates. Each experiment included 7 treatments represent all possible combinations of mineral N fertilizer level 60 kg N/ fed as control treatment and 45and 30 kg N/fed. Urea 46 % N was used as mineral nitrogen fertilizer source. Seed inoculation treatment using bio- fertilizer containing the symbiotic N- Fixing bacteria of *Rhizobium leguminosarum*) which provided by the Soil

Microbiology Unit at Soils, Water and Environment Res. Inst. Agric. Res. Center Giza, Egypt. The seeds were coated with the gum media carrying the bacteria strain on the same day of sowing (700 g inoculants /20kg seeds). The inoculated grain plots received a liquid bacteria strain (5 l fed^{-1} mixed with 200 l water) which replaced three times after 23, 46 and 68 days of planting according to Shaban and Omar (2006) .Calcium super-phosphate (15.5% P_2O_5) was added in a rate of 31.0 kg P_2O_5 /fed during soil preparation. The used organic fertilizer cattle farm was added at rate of (5 Mg fed^{-1}), and mixed with the soil at 25 days prior to planting. The used cattle farm was chemical, analyzed for its some chemical properties and the content of some macro- and micronutrients according o the methods described by Cottenie *et al* (1982) and Page *et al* (1982). The obtained data were recorded in Table (2) .Potassium sulphate (48 % K_2O) at the rate of 100 kg K_2O/fed was added in two equal split doses before sowing and after 45 days from sowing. Sowing was carried out 29 October 2009 and 20 October 2010 and harvest carried out 12 May 2010 and 5 May 2011. Two to three of seeds were sown in hole with 5 cm depth. The distance between each two holes was 15 cm. After 21 day of sown, the plant of each hole were thinned to one plant. At harvesting stage the plants of the other three replicates were harvested. Each fresh and dry plant sample was separated into shoot, Number of pods per plant, plant height, yield and yield components and weight of 100 seeds.

Statistical analysis.

Simple correlation: a matrix of simple correlation coefficients between faba bean yield and each of its components(plant height (cm), branch number/plant, number of leaves/plant, number of seed/pod , number of seed/plant, average seed weight(g)/plant and 100seed weight (g) was computed as applied by Steel and Torrie (1980). Data were statically anlyize according to Sndecor and Cochran (1981) and least significant different tested LSD at 5 % of significance was calculated to detected significant difference.

Stepwise multiple liner regression: stepwise regression were applied as described by Draper and Smith (1981) to determine variables that accounted for the majority of total faba bean yield variability. To avoid the lack of fit of both full model regression and stepwise multiple linear regressions as a result of multicollinearity phenomenon (the strong association among faba bean yield components), the level of multicollinearity was estimated using a common measure namely: variance inflation factor (VIF) as suggested by Hair *et al* (1992). Large VIF values (above 10) reported high co linearity.

Factor analysis: was applied according to Cattell (1965) to reduce a large number of correlated variables to a much smaller number of independent clusters of variables called factors. After the loading of the first factor was calculated, the process was repeated on the residuals maturation, as applied by Kaiser (1958).* The purpose of rotation was to rebuilding the larger loadings in each factor and to suppress the minor loading coefficient so as to improve the opportunity of achieving meaningful biological interpretation of each factor.

Table (1) Physical-chemical properties of used soil.

Particulars size distribution (%)				Texture Classes	O.M (%)	$CaCO_3$ (%)
C.sand	Fin sand	Silt	Clay			
23.4	61.6	10.8	4.2	Sandy loam	0.52	10.9

		Cations (meq/l)				Anions (meq/l)			
pH (1:2.5)	EC (dS/m)	Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}	CO^{-}_{3}	HCO^{-}_{3}	Cl-	SO^{-2}_{4}
8.40	8.22	6.46	9.72	65	0.83	nil	7.30	45	29.71

Macroelements ($mgkg^{-1}$)			Microelements ($mgkg^{-1}$)		
N	P	K	Fe	Mn	Zn

35	2.4	278	2.7	4.2	0.69

Table (2) Chemical analysis of organic Cattle and compost

EC dSm^{-1}	pH	N	P	K	Fe	Mn	Zn	C/N	O.M
		(%)			(mg kg^{-1})			(%)	
4.82	7.32	2.37	0.85	2.41	224	98	123	21.42	31.44

RESULTS AND DISCUSSION

Effect of the treatments studied.

Soil pH: Data presented in Table (3) show that the soil pH ranged from 8.10 to 7.97 in both seasons and was not significantly affected by the studied treatments. Also, pH decreased as affected by organic farm and bio-fertilizer combined with mineral N rates. The production of organic acids (amino acid, glycine, cystein and humic acid) during mineralization (amminization and ammonification) of organic materials by heterotrophy and nitrification by autotrophy would have caused this decrease in soil pH. These results were in agreement with Sarwar *et al* (2008) who reported that application of compost alone and in combination with chemical fertilizer reduced significantly the soil pH compared to the control as well as chemical fertilizer after harvesting rice and wheat. Shaban and omar (2006) found that the application of different mineral nitrogen fertilizer with bio-fertilizer led to Dehydrogenase activity and production of µ moles of H_2 in the rhizosphere of maize root media had a positive effect on increasing the hydrogen moles which react in root zone to form hydrocarbon acid led to decrease soil pH. The high activity of Dehydrogenase enzyme and the released carbon dioxide in the rhizosphere cause the formation of carbonic acids decreasing pH of the root zone.

Soil salinity (ECe):

Organic farm and bio-fertilizer combination with mineral nitrogen fertilizer levels significantly affected soil EC that ranged from 7 to 4.36 dSm^{-1} and from 7.50 to 3.74 dSm^{-1} in the first and second seasons, respectively, presented in Table (3). Electrical conductivity showed decrease trend with the application of bio-fertilizer and organic farm combination of 45kg N fed^{-1}. These results could be related to the influence of bio-fertilizer on the total porosity, and improving soil aggregation and possible moving soil soluble salt with irrigation water. These results are in agreement with those found by Shaban and Manal (2009). Application of bio and organic fertilizer combined with different mineral nitrogen mineral fertilizer levels led to a decrease in soil salinity because bio-fertilizer and organic farm could improve the soil properties.

Tran *et al* (2004) who found organic manure and bio-fertilizer play an important and key role because they possesses many desirable soil properties and exerts beneficial effect on soil physical, chemical and biological characteristics and increase of organic matter.

On the other hand, the concentration of cations and anions in soil paste extracts of the studied experiments of nitrogen fertilizer alone and combination with bio-fertilizer and organic are presented in Table (3). The data obtained reveal that the soluble ion contents in surface layer during the two seasons for Ca^{+2}, Mg^{+2}, Na^{+}, K^{+}, HCO^{-}_{3}, Cl^{-} and SO^{-2}_{4}, ion ranged between 8.57 – 9.79 ; 7.92- 3.92; 56 – 29 ; 1.20 – 1.35 , 5.41- 3.59; 38.67- 24.00 and 29.61- 16.15 meq/l, respectively . From data in Table (3) showed that the effect of organic farm and bio-fertilizer combination with mineral N rates on Na^{+} content in soil was decrease while increase of K^{+} and Ca^{++} during two seasons planting . The attributed the reduction in Na+ of soil treated with other treatments due to the release of organic acids causing mobilization of native Ca^{++}. These finding are in agreement with these reported by Ahmed (2007) found that reduction in soil Na^{+} may be related to residual organic compound of chicken manure that directly or

indirectly increase the Ca^{++} , whereas decrease the Na^{+} ions in solution extract . The soil organic matter (%) as affected by all

Table 3

the possible combination of the used amendments study , results revealed that soil organic matter percentage ranged between 0.59 to 0.73 % in first season and 0.63 to 0.75 % in second season. The corresponding relative increase mean values of O.M content in soil as affected by Bio-fertilizer ,organic farm , and organic + bio-fertilizer combination with mineral N fertilizer were 6.77 – 13.55 and 25.54 % in first season , while the mean values in second season were 3.17 , 15.87 and 17.46% , respectively. These results are confirmed by Aal, *et al* (2003) they found that application of organic farm increased organic matter content in soil. Shaban (2005) mentions that high soil organic mater is correlated with the occurrence of active organic acids. These organic acids provided a substantial modification of soil physical and chemical properties. On the other hand, the data presented in Table (3) reveal that the $CaCO_3$ contents of soil treated with all treatments application were significantly decreased during two season planting which confirms the hypothesis of solubilizing calcium from $CaCO_3$ by soluble CO_2 in the soil by applying irrigation during faba bean planting when the organic matter content in the soil. Maximum decrease of 8.41 % in $CaCO_3$ content of 0-30 cm soil depth was observed when soil treated with organic farm combined with 45 kg N fed^{-1} in first season. Similarly, in case of organic farm + bio-fertilizer + 30 kg N fed^{-1} applied plots the decrease in $CaCO_3$ content was 8.03 % in second season. The corresponding relative decrease mean values $CaCO_3$ as soil affected by bio-fertilizer ; organic farm and bio-fertilizer + organic farm combination with mineral N fertilizer were 2.23, 14.01 and 12.13 % in first season and 6.15, 12.41 and 12.95in second season respectively , compared by control (mineral N fertilizer). These results are agreement by Muhammad (2001) reported that the application of compost combination with chemical fertilizer led to decrease values of Na^+ while Ca^{++} + Mg^{++} increase due to reaction of organic acids wit $CaCO_3$. However a part of these would have also precipitated with carbonates and bicarbonates (HCO_3) present in the soil.

Available macronutrients in the studied soil.

Data in Table (4) show that the contents (mg kg^{-1}) of available N, P and K contents in the soil were significantly affected by application of organic farm and bio-fertilizer combination with mineral N fertilizer rates of 30 and 45 kg N fed^{-1} compared with the control treatment. The highest values of N, P and K were 84.34, 6.74 and 443 mg kg^{-1} for in the first season and 83.00, 6.74 and 441 mg kg^{-1} for second season in soil treated by organic farm combination with 45 kg N fed^{-1}. The corresponding relative increase mean values of N, P and K contents in soil as affected by bio- fertilizer , organic farm and organic farm + bio-fertilizer combined with mineral N rates (30 and 45kg N fed^{-1}) were 13.65, 17.78 and 12.35 % in first season 8.55 , 14.57 and 10.05 % in second season for N. Also, 14.98, 20.22 and 23.03 in first season 14.35, 25.89 and 25.42 in second season for P and 8.37 , 8.12 and 7.36 % in first season and 6.37 , 7.37 and 3.87 % in second season for K content in soil after faba bean harvest.

These results are similar to those obtained by Rashed (2006) reported that biological N fertilization increased the soil content of available N, P and K by the lowest or even without mineral N fertilization. Also, Khaled *et al* (2011) they reported that the N, P and K contents of available in soil treated with compost combination with mineral N doses was significant compared with control.

Available micronutrients in the soil.

The application of organic farm and bio-fertilizer combination with mineral N at the rates influenced significantly increase with respect to the content (mg kg^{-1}) DTPA-extractable micronutrients (Fe, Mn and Zn), as recorded in Table (4). Meanwhile, increase in the soil content of available micronutrients, (Fe, Mn and Zn) due to application of bio-fertilizer and organic farm combination with mineral nitrogen fertilizers compared with control. Theses results are in

agreement with those of Magdi *et al* **(2011).** The highest contents of micronutrients (Fe, Mn and Zn) as a result of adding organic

Table 4

farm combination with 45kg N fed^{-1} of mineral nitrogen fertilizers were 8.75, 4.26 and 1.63 mg kg^{-1}. Applied different treatments showed significant increases in Fe, Mn and Zn available in soil compared with control treatment. Khaled *et al* (2009) reported that relative increases of those nutrients in the soil of the experimental plot unit by adding chicken manure and bio-fertilizer in combination with mineral N-fertilizer at rates (25– 50 and 100 kg N fed^{-1}) were significantly increased compared to control . Application of organic farm and bio-fertilizers resulted in decreasing soil pH and increased available content of Fe, Mn and Zn. It is worthy to mention that the contents of the studied available micronutrients, in general, lay within the sufficient limits of Fe, Mn and Zn in the critical limits identical division for the others (FAO, 1992). The distribution pattern of available (Fe, Mn and Zn, mg/kg soil), may be due to the increase of soil organic matter in surface layers, as reported by (El-Sheikh 2003).

Effect of fertilization on yield and related characters:

Results presented in Table (5) showed the effect of bio-fertilizer and organic farm combination with mineral N fertilization at different rates on faba bean in the two growing seasons. These data) show that the treatments of bio- and organic farm fertilization resulted in clear increases in dry matter yield of faba bean shoots, seed yield, weight of 100 seed, plant height (cm), dry biomass kg /fed and branch number/plant. In general, the application of 45 kg N/fed combined with organic farm gave the significant increases in these traits. The data also, show that the investigated characters significantly increased due to increasing mineral nitrogen from 30 to 45 kg/fed in combination with bio-fertilizer and organic farm in both seasons. These results are confirmed with those obtained by Gomaa *et al* (2010) who indicated that the majority of bio-organic fertilization treatments produced high dry weight comparable to that obtained by the control. Moreover, the farmyard manure treatment companied with Azotobacter or Azotobacter + Rhodotorula, induced significant increase of the obtained yield compared to either of the positive control or the other treatments. The possibility of exploring the *Rhizobium* symbiosis and organic farm led to improve the productivity of saline soil conditions. On the other hand, the results demonstrated clearly that using bio-fertilizer *Rhizobium* and organic farm combination with mineral N fertilization had a positive effect on all growth characters under study. These results reflected the activity of microorganism to reduce salinity and simultaneously improving characterization of soil structure (increasing drainable porosity and aggregate stability) and consequently enhanced leaching process through irrigation fractions. Shaban and Omar (2006) and Ahmed *et al* (2011) found that bio-fertilizers applications have greater impact on organic agriculture and also on the control of environmental pollution, soil health improvement and reduction in input use. So, we recommend using a mixture of selected effective microorganisms active in nitrogen fixation, hormonal production and enzyme production in combination with organic cattle and bio-fertilizer combined with mineral N fertilizer in a cumulative manner in agriculture production.

Simple correlation analysis.

Matrix of simple correlation coefficients among plant seed yield of faba bean and its components is shown in Table (6). The results revealed that there was a highly significant positive correlation between seed yield/ plant and each of number of seeds/ plant ($r= 0.925^{**}$ %) average of fresh green pods/ plant (0.884^{**} %), 100-eed weight. (0.829^{**} %), branch number/plant (0.771^{**}%), plant height (0.694^{**} %) and number of seeds/ pod (0.630^{**} %). According, by faba been breeder should exploit the previous characters when planning breeding program to improve the pro ductility of faba bean crop. However, insignificant associations were observed between faba bean yield and each of number of dry pod/plant and number of leaves/plant indicating that these traits may be independent in their gene expression under the present study. The faba bean breeder must take in account the interrelationships among .Similar results

were reported by many investigators who studied the relationship between seed yield/plant and its components in faba been (Hung *et al*., 1983; Sindhu *et al.*, 1985 and Ashmawy *et al.*, 1998|).

Table 5

Table (6): Matrix of simple correlation coefficients among seed yield/plant of faba bean and its components over both 2010/09 and 2011/10 seasons.

Characters	Plant height	No. of branch /plant	No. of leaves/ plant	No. of dry pods/ plant	Seed no./pod	No. of seed/ plant	100-seed(g)	Avg. fresh green/ pod	Seed yield/plant
Plant height (cm)	1	0.720**	0.13	-0.77	0.443	0.691**	0.455	0.655**	0.694**
No. of branches/ plant		1	0.202	-0.102	0.442	0.815**	0.417	0.710**	0.771**
No. of leaves/plant			1	-0.076	0.217	0.063	-0.342	-0.060	-0.139
No. of dry pods/plant				1	0.096	0.099	0.229	0.040	0.092
No. of seeds /pod					1	0.781**	0.359	0.578*	0.630**
No. of seeds/Plant						1	0.650*	0.774**	0.925**
100- seed wt. (g).							1	0.628**	0.829**
Avg. fresh green pod								1	0.884**

*and** significant at 0.05 and 0.01probability levels respectively.

Stepwise linear regression analysis.

This method was used to determine the more effective traits that mostly explain the variation of faba bean yield. Table (7) shows the partial regression coefficients as well as their significance for the accepted variables that significantly contributing to variation of faba bean yield. These variables were average fresh green/pod and 100 seed weight (g) . According to the results, 90.5% (expressed as R^2) of the total variation in faba bean yield could be attributed to these aforementioned two traits. The other five traits were not included in the model due to their very low relative contribution (R^2= 3.26%)

The prediction equation for faba bean yield was formulated as follows:

$Y= -33.6 + 4.467(x_1) +0.362(\mathbf{x_2})$.

On the other hand, the validity of the proposed model was established where the values of Variance Inflation factor (VIF) for the accepted variables were less than 10 indicating no effect of multicolinearity.

As mentioned before, the average fresh green/pod and 100 seed weight (g) were the most important variables according to stepwise analysis. Therefore, these two traits should be ranked the first in a breeding program for improving faba bean yield. The current results were in harmony with those obtained by Mohamed. (1992).

Factor analysis:

The factor analysis technique divided the eight faba bean yield components into three factors which all together explained 81.774% of the total variability in the dependence structure. The factor analysis was constructed by applying the principal component approach to establish the dependent relationship among faba bean yield components. Factor loadings that greater than 0.5 were considered important. A summary of the composition of variables of the eight extracted factors with loading are given in Table (8). Factor 1 included six variables which accounted for 50.717 of the total variability. The six variables were plant height, number of branches/plant, average fresh green/pod; number of seeds/plant and 100- seed weight. The sign of the loading values indicates the direction of the relationship between the factor and its related characters.

Table (7): Regression parameters of the accepted variables according to stepwise multiple linear regressions.

Reg .Parameters / Character	Regression coefficient (b)	Standard error(SE)	Probability level (P-value)	Variance inflation factor(VIF)
Avg fresh green pod (x_1)	4.467**	0.888	000	1.651
100 seed wt. (x_2)	0.362**	0.095	003	1.651
Intercept	-33.6			
Model sig.	000			
R^2	90.5			
Adjusted R^2	88.8			
R^2 of eliminated traits	3.26			

Table (8): Summary of factor loadings for eight characters of faba bean.

Variance	Loading	Communality (h^2)	Eigen values	% of variance	Suggested factor name
Factor 1					
Plant height	0.805	0.816			Plant growth factor
No. of branch/p	0.841	0.870			
Avg. fresh geen/pod	0.885	0.878	4.057	50.717	
Seed no. pod	0.728	0.727			
No. of seed/plant	0.958	0.953			leaves factor
100seed wt.	0.704	0.652			
Factor 2					pod factor
No. of leaves/p	0.857	0.948	1.327	16.583	
Factor 3					
No. of dry pod/p	0.803	0.939	1.158	14.474	
Cumulative variance				81.774	

-Bold and underline cells indicate to the highest values of factor loadings and variables
-Extractioon method; principle component analysis.
-Rotation method; varimax with Keiser normalization

The five variables had high communality with factor I; therefore, this factor may be called plant growth factor. Factor II was made up of number of leaves/plant. Because factor II concerned with leaves factor, it accounted for 16.583 % of the total variability in the dependent structure. In factor II, the variables had a high loading in the factor leaves factor.

Factor III was responsible for 14.474 % of the total variability in the dependence structure. It included one character whitely number of dry pods/plant it is called pod factor. These results are on line with those

reported by Gad El-Karim *et al (1990)*, Ashmawy *et al* (1998) and Habibi G. (2011)

Factor analysis procedure can be used successfully for analysis of large amounts of multivariate data, and should be applied more frequently in field of faba bean research. Using of factor analysis technique by plant breeders may be helpful in determining the nature and sequence of traits to be selected in breeding programmes.

Finally, it can be recommended from the previous results that the important traits overall statistical procedures of analysis were average fresh green pod and 100 seed weight. These characters will enable the breeders or agronomists to realize high income of faba been.

Economic analysis.

Data in Table (9) show that organic farm treatment +45 kg N was the best treament followed by bio-fertilizer treatment +45 kg N mineral fertilization, compared to the control (60 kg N nitrogen). Yield (grain or straw) was better in Egyptian Pounds was bio-fertilizer +30 kg N given return a profit for each expense LE gave a profit of 1.46, followed by bio + organic +30 kg N given return a profit for each LE 1.071 LE treatment, followed by 60 kg mineral N gave 0.032 pound.

Recommendation.

From the above mentioned results, it could be concluded that bio-fertilizer + 30 kg N /fed or compost application had decreased the hazard effect of saline water. In addition bio fertilizer combination with chemical fertilizers had a favorable effect on growth of faba bean. Adding organic farm cattle and inoculate on with bio-fertilizers increased significantly biomass yield, seed and straw yields during the two seasons compared to chemical fertilizer. The economically best treatment was bio-fertilizer combination with 30 kg N/fed which gave high profit. However, plant breeder would have to develop varieties, which respond to the integrated use of organic farm and bio-fertilizer inoculation to reduce the dose of mineral nitrogenous fertilizers needed.

Table 9

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الاهمية النسبية لمكونات المحصول فى الفول البلدي المنزرع تحت خليط من الأسمدة الحيوية والعضوية فى الأراض المستصلحة حديثا

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الملخص العربي

أجريت تجربتان حقليتان فى تربة رملية ملحية القوام في قرية الأمل ، شمال سيناء ، مصر ، على زراعة محصول الفول البلدي صنف (النوبارية ١) ، خلال موسمي الشتوي ٢٠١٠ و ٢٠١١. لدراسة تقييم الاستخدام الاقتصادي للأسمدة العضوية والحيوية مع سماد اليوريا (٦٠ ، ٤٥ ، ٣٠ كجم نيتروجين لكل فدان) على خصوبة التربة المالحة والمستصلحة حديثا و إنتاجية الفول البلدي. تم تلقيح بذور الفول بالسماد الحيوي والمثبتة للنتروجين – التكافلية البكتيريا من *leguminosarum* الريزوبيم) وأضيف السماد العضوي بمعدل (٥ ميجا جرام للفدان) متحدين معا او غير متحدين مع الأسمدة المعدنية والحيوية.

وكانت النتائج المتحصل عليها كالتالي :

أن الأسمدة الحيوية والتسميد العضوي متحدين مع السماد النتروجينى أدت إلى زيادات واضحة في محصول المادة الجافة من قش الفول ومحصول البذور ، ووزن١٠٠ بذرة ، وارتفاع النبات (سم) وعدد الفروع .

أدى استخدام التسميد العضوي والحيوي متحدين مع التسميد النتروجينى المعدني إلى انخفاض غير معنوي في رقم الحموضة للتربة تحت الدراسة.

لوحظ انخفاض في نسبة الملوحة التربة باستخدام التسميد العضوي والحيوي متحدين مع التسميد النتتروجينى المعدني . وجد زيادة في العناصر الميسرة في التربة (النتروجين – الفوسفور– البوتاسيوم – الحديد – المنجنيز –

الزنك) نتيجة استخدام التسميد العضوي والحيوي نتيجة انخفاض رقم حموضة التربة وكذلك لتحسين صفات التربة .

أشارت النتائج أن هناك ارتباط موجب و عالي المعنوية بين محصول البذور في الفول و طول النبات وعدد البذور في القرن ومتوسط المحصول الأخضر ووزن ١٠٠بذرة بينما أرتبطت صفة عدد أوراق النبات ارتباط سالب مع محصول بذور النبات ، واوضحت النتائج المتحصل عليها باستخدام طريقة الانحدار المتعدد المرحلى حيث كانت صفات محصول النبات الاخضر و وزن ١٠٠بذرة هى الاكثر اسهاما فى محصول الفول .

أظهرت نتائج تحليل العامل أن الصفات تحت الدراسة تجمعت في ٣ عوامل ساهمت بحوالي ٨١.٧٧ % فى التباين الكلى لصفة محصول البذور في الفول البلدي وقد تضمن العامل الأول صفات طول النبات وعدد الأفرع في النبات ووزن ١٠٠ بذرة وعدد البذور في النبات والقرن ومتوسط النبات الأخضر ويسهم هذا العامل بحوالي ٥٠.٧٢% من التباين الكلى وضم العامل الثاني عدد الأوراق في النبات ويسهم هذا العامل بحوالي ١٦.٥٨% من التباين الكلى وضم العامل الثالث عدد القرون الجافة في النبات ويسهم هذا العامل بحوالي ١٤.٤٧% من التباين الكلى . أوضحت نتائج تحليل العامل أن التحليل يتسع لدراسة مزيد من الصفات حيث أن الصفات تحت الدراسة فسرت ٨١.٧٧ فقط من التباين.

أوضحت النتائج أن أفضل معاملة هي استخدام التسميد الحيوي متحد مع ٣٠ كجم نتروجين لكل فدان حيث أنها أعطت أعلى ربح وأعلى عائد ربح لكل جنية مصروف ١.٤٦ جنية .

Table (3): Soil properties after faba bean harvest as affected by combination of bio and organic fertilization compared to mineral nitrogen.

Treatments	Kg N/ fed	pH (1: 2.5)	EC (dSm^{-1})	Cations (meq/l)				Anions (meq/l)				O.M (%)	CaCO3 (%)
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO^{-}_3	HCO^{--}_3	Cl^{-}	SO^{--}_2		
Season 2010													
N-Mineral fertilizer	60	8.30	7.40	8.57	7.92	56	1.20	nil	5.41	38.67	29.61	0.59	9.81
Bio-fertilizer	45	8.10	5.17	9.45	3.99	37	1.25	nil	4.11	27.00	20.58	0.62	9.65
	30	8.24	6.32	9.21	4.92	48	1.21	nil	4.28	31.33	27.73	0.64	9.52
Organic Farm	45	8.06	5.30	9.53	3.97	38	1.30	nil	3.89	29.33	19.58	0.66	8.46
	30	8.08	5.10	9.67	4.10	33	1.32	nil	4.01	27.33	16.75	0.68	8.41
Bio-fert+ Organic	45	8.05	5.95	9.36	4.65	43	1.29	nil	4.22	30.67	23.41	0.71	8.65
	30	7.97	4.36	9.66	3.84	29	1.34	nil	3.64	22	18.20	0.73	8.60
LSD %5		0.123	0.232	0.273	0.177	8.962	0.123	nil	0.114	8.723	4.183	0.017	0.394
Season 2011													
N-Mineral fertilizer	60	8.27	7.46	8.63	7.97	57	1.21	nil	5.43	34.00	34.73	0.63	9.26
Bio-fertilizer	45	8.11	6.11	9.52	3.40	40	1.25	nil	4.10	26.00	24.70	0.64	9.21
	30	8.21	6.10	9.19	4.88	46	1.18	nil	4.22	33.00	23.72	0.67	8.17
Organic Farm	45	8.07	5.79	9.54	3.97	43	1.28	nil	3.91	31.04	23.56	0.69	8.12
	30	8.04	4.97	9.68	4.04	35	1.32	nil	4.07	27.10	18.28	0.72	8.13
Bio-fert+ Organic	45	8.00	5.85	9.32	4.56	43	1.29	nil	4.24	32.01	22.24	0.73	8.10
	30	7.97	3.74	9.79	3.92	29	1.35	nil	3.59	24.00	16.15	0.75	8.03
LSD % 5		0.14	1.47	0.28	1.53	10.20	0.08	nil	0.15	9.14	13.05	0.018	0.210

Table (4). Available macro and micronutrients content in soil after faba bean harvesting.

Treatment	Kg N/ fed	Macronutrients (mg/kg)			Micronutrients (mg/kg)		
		N	P	K	Fe	Mn	Zn
Season 2010							
N-Mineral fertilizer	60	64.67	5.34	394	5.82	3.78	1.35
Bio-fertilizer	45	75.33	6.30	422	7.10	3.94	1.49
	30	71.67	5.98	432	6.26	3.88	1.42
Organic Farm	45	84.34	6.74	443	8.75	3.86	1.63
	30	68.00	6.10	419	6.85	4.00	1.45
Bio-fert+ Organic	45	67.66	6.70	424	8.24	4.26	1.46
	30	77.67	6.44	422	7.83	3.83	1.50
LSD % 5		9.243	0.189	ns	0.149	0.181	0.051
Season 2011							
N-Mineral fertilizer	60	66.33	5.33	400	5.81	3.69	1.37
Bio-fertilizer	45	72.33	6.26	421	7.02	3.92	1.48
	30	71.67	5.93	430	6.22	3.96	1.43
Organic Farm	45	83.00	6.74	441	8.67	3.86	1.65
	30	69.00	6.68	418	7.55	4.02	1.45
Bio-fert+ Organic	45	70.00	6.73	422	7.52	4.23	1.63
	30	76.00	6.64	409	7.21	3.86	1.51
LSD % 5		7.80	0.23	12.06	1.05	0.14	0.07

Table (5): Faba bean yield and its related characters as affected by bio, organic and mineral nitrogen fertilization.

Treatments	Kg N/fed	Plant height (cm)	Branch number/ plant	No. of leaves /plant	Dry Biomass /fed(kg)	No of fresh green /plant	Avg. fresh green/ pod	Fresh green yield /plant (g)	Fresh green yield /fed (kg)	No. of dry pod/ plant	Seed .No. / pod	Seed. No/ plant	Avg. Seed Wt. (g)/ plant	100 seed Wt. (g)	Yield seed /fed (kg)
	First season														
N-Mineral fertilizer	60	57.42	3.71	75.92	1982	20.92	9.94	208	3378	19.50	2.69	51.45	36.23	70.62	805
Bio-fertilizer	45	95.17	4.85	81.25	2063	22.92	10.41	238	5247	21.42	2.54	54.55	40.67	74.71	902
	30	82.25	4.25	74.00	1737	20.91	8.51	178	3926	18.58	2.63	49.22	28.07	56.74	623
Organic Farm	45	95.67	5.17	90.17	2196	22.91	11.23	258	5672	22.00	3.00	65.97	47.39	87.37	1053
	30	73.75	2.79	70.67	1693	17.00	7.86	134	2944	15.58	2.64	41.08	23.67	57.64	426
Bio-fert+ Organic	45	66.33	2.58	66.83	1527	15.45	8.01	123	2704	13.87	2.13	29.43	16.07	54.97	359
	30	77.75	2.92	81.67	1888	20.41	9.03	184	4059	19.23	2.80	54.17	37.85	87.35	841
LSD. %5		28.38	0.64	4.08	49.10	2.07	1.59	41.80	1910.7	2.18	0.33	9.08	5.06	5.37	153.86
Second season															
N-Mineral fertilizer	60	85.00	3.67	76.17	2032	20.33	11.67	228	5002	18.88	2.96	52.71	39.52	71.02	878
Bio-fertilizer	45	95.50	4.83	80.10	2094	23.50	11.16	262	5758	21.75	2.97	64.38	41.59	64.67	924
	30	74.25	4.38	73.75	1793	21.33	9.27	198	4352	18.50	2.98	54.70	28.54	52.34	634
Organic Farm	45	90.83	5.00	89.25	2118	24.33	10.51	255	5612	23.75	3.13	74.17	46.99	76.88	1044
	30	75.33	2.74	71.75	1775	16.83	8.97	151	3314	15.33	3.00	45.94	25.44	58.81	565
Bio-fert+ Organic	45	69.33	2.54	67.33	1560	16.17	7.51	122	2574	14.50	2.67	38.61	19.66	50.94	436
	30	76.33	3.39	81.75	1927	19.92	9.72	193	4256	18.42	2.87	56.05	36.38	76.88	815
LSD. %5		10.23	0.42	5.42	112.40	1.74	1.14	19.01	417.83	1.58	0.77	6.45	2.27	5.66	50.66

Table (9): Economic analysis for the cost of fertilizers used in faba bean experiments over both seasons of the study.

Treatments	Rate of N (kg fed^{-1})	Bio-mass product	Cost total straw (ton)	Cost of straw yield	Yield seed (ardab/fed)	Cost of productivity (fed)	Cost of total production	Variable cost	Cost rent (fed) (pound)	Total cost (pound)	Benefit cost ratio
Mineral	60	1.17	228	265.734	5.428	5428	5693.23	2243	1276	3519	2174.23
Bio-fertilizer	45	1.16	228	265.050	5.870	5870	6135.05	2243	1276	3519	2616.05
	30	1.14	228	259.122	4.055	4055	4314.12	2160	1276	3436	878.12
Organic farm	45	1.11	228	252.738	6.765	6765	7017.24	2910	1276	4186	2831.24
	30	1.24	228	282.378	3.201	3201	3483.38	2835	1276	4111	-627.62
Bio+ organic	45	1.15	228	261.288	2.565	2565	2825.79	2985	1276	4261	-1435.21
	30	1.09	228	249.204	5.342	5342	5591.20	2910	1276	4186	1405.20