

COMPARATIVE STUDY FOR USING ORGANIC MANURE AS INDIVIDUAL AND / OR MIXING IT WITH CHEMICAL FERTILIZER AND THEIR EFFECTS ON THE PRODUCTIVITY OF *Vicia faba* PLANTS.

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ABSTRACT

Two field experiments were carried out during the seasons of 2001 and 2002 to study the effect of using organic manure (Recycling the agricultural residues) as individually and/or as mixed with chemical fertilizer (NPK); The important results are as following:

Using organic manure as Nile compost (Recycling the agricultural residues) at rates between 2-3 tons/fed. which equal 40-60 nitrogen units caused an enhancement in *Vicia faba* growth. Also the obtained data reveals that, organic fertilizer as alone or mixed with the chemical fertilizer gave a superiority in total pods yield and its components if compared with using chemical nitrogen fertilizer alone.

The nutritional values expressed as the content of protein, N, P, K, Fe, Mn, Zn and Cu, the statistical analysis of the obtained data indicated no great effect of using nitrogen fertilizer as individually and/or as mixed with chemical fertilizer.

INTRODUCTION

Broad bean (*Vicia faba*, L.) is one of the most important vegetable crops in Egypt. Most of the new reclaimed soils in Egypt do not offer the best conditions to growing vegetables, because most of them contain low amounts of organic matter. So that organic manures such as farmyard, chicken, compost, town waste and green manure can be used successfully as organic manure to improve the chemical and physical properties of the soil, reducing pH, etc., increasing soil organic matter content and offer the nutrient elements for growing vegetable plants. (Warman, 1990; Abo-El-Defan, 1990; Abo-Hussein, 1995; Harbi *et al.*, 1996 and Saad, 1999). On the other side, one of the most important factors affecting the productivity of vegetables is NPK fertilizers (El-Desuki *et al.*, 2000). Nitrogen, phosphorus and potassium are major essential elements required for physiological mechanisms of plant growth. Mixing organic with inorganic fertilizers had a great effect on the plant productivity, where, the balanced nutrient composition of the compound fertilizer is a key factor deciding the effectiveness of the mineral fertilizer in promoting the vegetative growth and yield of bean plants (Hamail *et al.*, 1996). The effect of N, P and K as a mixture on the physiological processes of common bean plants, chemical composition, yield and its quality were studied by several investigators (Abou-El Magd *et al.*, 1992; Sharma and Room, 1993; Al-Afife, *et al.*, 1995; Hamail *et al.*, 1996; Nassar *et al.*, 2001, and Ahmed, 2003).

MATERIAL AND METHODS

Two field experiments were carried out at the Experimental Station of the National Research Centre, at Shalakan, (Kalubia Governorate) during the two successive seasons of 2001 and 2002 to investigate the productivity of *Vicia faba* plants as affected by organic manure as individual or mixed with chemical nitrogen fertilizer.

Table (1) presented the physical and chemical properties of the experimental soil and Table (2) showed the chemical analysis of the used organic manure (Nile compost).

Table (1) : Chemical analysis of the experimental soil (2001 and 2002 seasons).

Chemical analysis	2001	2002
Available K (mg/100 g soil)	0.61	0.58
Available P (mg/100 g soil)	5.72	4.82
Total nitrogen (mg/100 g soil)	128.04	151.82
Cl (meq/L.)	1.82	1.65
CO ₃ (meq/L.)	4.34	5.13
Na ₂ CO ₃ (meq/L.)	3.65	3.82
CaCO ₃ (meq/L.)	1.76	1.65
Organic matter (%)	1.82	1.86
SO ₄ (ppm)	76.03	95.41
E.C. (mmhos/cm/25°C)	2.48	2.36
pH	7.52	7.70

Broad bean seeds cv. Koprosey was planted in November 7 and 10 of 2001 and 2002 in the two growing seasons, respectively.

The experimental design used in the two growing seasons was complete randomized blocks with three replicates.

The chemical nitrogen fertilizer was added as ammonium sulfate (20.6 % N) in two equal portions, 30 days after sowing and 3 weeks later, but the organic manure, (Nile compost) were added during preparing the soil for plantation. The different rates of chemical and organic nitrogen fertilizers are as following:

Organic nitrogen units / fed.	0	20	40	60	30	20	40
Chemical nitrogen units / fed.	60	0	0	0	30	40	20

Each experimental plot consisted of three rows, each of 6 m in length and 80 cm wide and two plants per hill spaced 20 cm apart on one side of the rows. Farmers agricultural and magement practices of growing broad bean plants were used. The plot area was 14.4 cm.

Table (2) : The chemical analysis of the used organic manure.

Character	Nile compost
Weight of cubic meter (kg)	400
Moisture %	30
pH	7
EC (mmhos)	5
Organic carbon %	41
Organic Matter %	70
Total nitrogen %	2
C/N ratio	1:17
Total phosphorous %	0.6
Total potassium %	0.6
Iron mg/kg	7900
Manganese mg/kg	190
Copper mg/kg	20
Zinc mg/kg	4.75

Plant samples (5 plants) were taken randomly, at 75 days after sowing from each plot and the following data were recorded: Plant height (cm), number of branches and leaves per plant, fresh and dry weight of branches, leaves and whole plant as g/plant. Yield of each plot (green pods and dry seeds) was weighted and counted as ton/Fed.

Samples of 20 pods were taken from each experimental plot and the pod length and diameter, average weight of pod /plant, number of pods /plant, number of seeds /pod, weight of seeds /plant and weight of 100 seeds (g) were recorded. The chemical analysis, i.e. N, P and K in dry seed were determined according to the methods of Pregl (1945) , Troug and Mayer (1939) and Brown and Lilleland (1946), respectively. But Fe, Mg, Mn, Zn and Cu concentration, were determined using flame ionization atomic absorption, spectrometer Model 1100B of Perkin Elemer and according to the method of Chapman and Pratl (1978). The protein percentage in seeds were accounted by multiplying nitrogen content by 6.25.

The data were statistically analyzed according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Plant growth:

Table (3) show clearly that broad bean plants which received of the chemical nitrogen fertilizer at rates of 60 % kgs. /fed. resulted the tallest *Vicia faba* plants which carried the largest leaves and branches number and the heaviest fresh and dry weight of whole plants and its different organs. The previous results were true in the two experimental seasons with excpetion fresh and dry weight of whole plants and its different parts of 2nd season which recorded their highest values with that plants which supplied the organic manure (Nile compost) at medium rate (2 ton /fed. i.e. equal 40 Kg. N/Fed.).

Table (3): Effect of organic and chemical nitrogen fertilizers at different levels on the plant growth characters of *Vicia faba* during the two seasons of 2001 and 2002.

Nitrogen treatments/kgs./fed. Organic Chemicals	Plant height (cm)	Number of		Fresh wt.g./plant			Dry wt.,g./plant		
		Branch	Leaves	Branch	Leaves	Total	Branch	Leaves	Total
2001									
20	88.33	8.00	54.50	165.00	192.67	357.67	100.00	54.55	154.55
40	89.33	7.00	59.00	199.33	244.00	443.33	103.33	62.98	166.32
60	90.67	7.67	57.80	199.67	252.33	452.00	106.33	60.23	166.57
0	110.67	11.33	72.60	312.00	313.33	625.33	119.00	106.51	225.51
30	98.00	8.67	67.00	174.67	269.00	443.67	107.00	74.12	181.12
20	104.00	9.00	60.50	210.00	300.33	510.00	113.00	75.89	188.89
40	109.00	10.67	70.50	271.67	307.33	579.00	118.33	93.70	212.04
L.S.D.at 5%	7.14	2.44	6.56	30.28	54.67	67.07	N.S.	22.81	14.91
2002									
20	97.00	7.00	65.11	250.11	232.91	483.02	98.23	126.03	224.27
40	90.33	8.67	70.00	278.73	271.94	550.67	150.30	128.44	278.74
60	88.33	8.67	70.80	254.25	234.21	488.46	58.04	113.1	171.55
0	107.67	10.00	73.11	244.92	258.50	503.42	92.76	123.57	216.34
30	98.33	7.67	69.00	222.93	236.40	459.33	53.24	121.70	174.94
20	106.67	8.00	61.11	237.38	238.21	475.59	101.38	120.97	222.34
40	107.00	9.00	72.33	239.77	250.80	490.57	91.78	117.62	209.40
L.S.D.at 5%	1.76	N.S.	5.81	9.54	21.16	27.0	11.03	N.S.	14.27

As a general, the obtained data reveals also that, addition the mixture of organic and chemical nitrogen at rate of 40, and 20 Kg. N/Fed. respectively resulted in a superiority in plant growth character, but the statistical analysis of the obtained data indicated no great variation to be enough to reach the 5% of significant level. These findings were true in both experiments with the most studied growth parameters.

It could be concluded that, using organic manure as Nile compost (Recycling the agricultural Residues) at rates between 2-3 tons /Fed. which equal 40-60 nitrogen units caused an enhancement in *Vicia faba* plant growth. Also, when mixed 2 tons of organic manure with 20 unit of chemical nitrogen the growth characters value recorded nearly equal or a few less values than that plants received the highest level of chemical nitrogen (60 unit/fed.).

Many investigators reported that, using organic manure as plant fertilizer is an excellent, where it contained N, P, K and other nutrients. Whereas, addition of organic matter improves soil structure, increased soil moisture holding capacity and water infiltration.(Abu-Hussein, 1995; Harbi et al.,1996; Saad, 1999; El-Dsuki et al.,2000; and Ahmed et al.,2003).Also, they added that the nitrogen compounds in manure are eventually converted to the available nitrate from Nitrate is soluble and is moved into the root zone with water, consequently that mechanism reflexed on growth characters of plant.

Pods yield :

Data presented in Table (4) shows clearly that, the heaviest pods yield of broad bean were recorded with that plants which received the mixture of organic + chemical nitrogen fertilizer at ratios of 2 : 1 respectively. The total dry seeds yield weighted 1.365 and 1.433 tons /Fed. respectively in 1st and 2nd seasons. On the contrary the lowest pods yield were associated with that plants which supplied only one ton of Nile compost (organic manure) without any addition. The statistical analysis of the obtained data reveals that the differences within different treatments were enough to be significant at 5% level.

Response of the total pods yield fractions, i.e. average number and weight of pods per plant to the different treatments of nitrogen fertilizer followed the same pattern of change like that which mentioned above. Also the average seeds number and weights per plant as well as the average weight of 100 seeds recorded their peaks with that plants applied its nitrogen fertilizer requirements as organic + chemical at ratio of 2 : 1 respectively. These findings were true in 1st season, but followed a little fluctuation in 2nd season.

Moreover, the data in Table (4) indicated that, organic treatments as alone or mixed with the chemical nitrogen fertilizer gave a superiority in total pods yield and its components if compared to using chemical nitrogen fertilizer alone. These were true, with exception that treatment of using one ton of compost /Fed. in both seasons.

Table (4): Effect of organic and chemical nitrogen fertilizers at different levels on the yield and its components of *Vicia faba* during the two seasons of 2001 and 2002.

Nitrogen treatments/kgs./fed. Organic Chemicals	Pod			Seeds			Dry seeds (ton/fed.) Yield	
	Length	Diameter	Average wt.,g./plant	No / plant	No / pod	Wt.,g./plant		Wt of 100 (g)
2001								
20	12.13	1.38	16.69	4.18	4.31	18.00	241.00	0.833
40	12.67	1.32	17.60	5.16	4.2	23.30	411.00	1.099
60	13.77	1.30	19.28	6.20	4.41	27.30	338.00	1.229
0	11.23	1.41	17.32	6.00	3.78	22.70	482.00	0.838
30	12.70	1.46	16.24	7.00	4.24	29.70	322.00	0.973
20	13.80	1.51	19.64	7.83	4.61	36.10	270.00	1.270
40	14.83	1.54	19.27	8.85	4.70	41.60	487.00	1.365
L.S.D. at 5%	0.53	0.15	0.68	N.S.	0.33	7.37	N.S.	0.131
2002								
20	13.13	1.78	12.32	4.17	4.44	18.0	292.00	0.932
40	13.13	1.81	11.06	5.57	4.45	22.90	316.00	1.003
60	13.00	1.78	12.36	5.13	4.94	25.30	374.00	1.347
0	12.30	1.81	12.60	8.47	4.90	37.40	227.00	1.006
30	12.17	1.77	14.27	8.63	5.00	43.00	246.00	1.176
20	12.30	1.81	14.64	8.50	4.74	40.30	249.00	1.345
40	13.40	1.77	14.28	8.40	5.02	43.90	476.00	1.433
L.S.D. at 5%	N.S.	N.S.	0.24	1.88	N.S.	7.41	8.87	0.164

It could be concluded that, *Vicia faba* plant is one of the leguminacea and its need of nitrogen fertilizer is little if compared with other vegetable crops. In the same time it is small known that releasing the nitrogen as like other minerals from organic manure is slowly, this means the amount of available nitrogen for plant absorption is only as the *Vicia faba* requirement. For this reason, when applied organic nitrogen as alone gave pods yield less than that treatments of mixed it with chemical nitrogen. Role of the chemical nitrogen in the mixture of organic + chemical is to promotion the activity of microorganisms which act the organic material to release the minerals. Many investigators studied the response of some many vegetable plant to the organic fertilizer and gave a result which supported the data written here (Hamail et al., 1996; Nassar et al., 2001 and Ahmed et al., 2003).

Chemical composition:

Table (5) clearly indicated that, the chemical composition of *Vicia faba* seeds tissues had no strong correlation with the different tratments of nitrogen fertilization. Whereas, the percentage of protein, N, K, P, Fe, Mn, Zn, and Cu, all of them recorded no significant values in 1st season as affected by nitrogen fertilizer treatments. Also, the contents of Fe, Mg, Zn and Cu in 2nd season followed the same pattern of change which mentioned before. The concentration of protein, N, and P in 2nd experiment affected significantly by the nitrogen fertilizer treatments.

Table (5): Effect of organic and chemical nitrogen fertilizers at different levels on the chemical elements of *Vicia faba* seeds during the two seasons of 2001 and 2002.

Nitrogen treatments/kgs./fed.		%					ppm			
Organic	Chemicals	N	Protein	P	K	Fe	Mg	Mn	Zn	Cu
2001										
20	0	4.59	28.67	0.63	2.31	8.25	2.79	0.228	0.212	0.209
40	0	4.76	29.75	0.66	2.61	8.19	2.81	0.232	0.215	0.205
60	0	4.81	30.04	0.64	2.14	7.93	2.79	0.223	0.212	0.210
0	60	4.81	30.06	0.64	2.35	9.18	2.81	0.236	0.216	0.212
30	30	4.70	29.35	0.66	2.31	8.61	2.76	0.222	0.213	0.206
20	40	4.82	30.1	0.66	2.59	8.39	2.82	0.22	0.218	0.211
40	20	4.88	30.48	0.66	2.23	8.63	2.76	0.214	0.213	0.222
L.S.D. at 5%		N.S.	N.S.	0.03	0.14	0.36	N.S.	N.S.	0.003	N.S.
2002										
20	0	4.66	29.13	0.67	2.29	8.54	2.64	0.213	0.222	0.213
40	0	4.86	30.38	0.69	2.67	8.09	2.82	0.218	0.216	0.215
60	0	4.51	28.21	0.55	2.08	7.55	2.69	0.215	0.209	0.216
0	60	4.55	28.44	0.62	2.37	8.99	2.75	0.240	0.222	0.215
30	30	4.58	28.65	0.62	2.31	8.36	2.78	0.216	0.224	0.211
20	40	4.71	29.46	0.66	2.54	8.71	2.83	0.208	0.223	0.210
40	20	4.33	27.08	0.54	2.04	7.12	2.73	0.217	0.187	0.217
L.S.D. at 5%		0.09	0.55	0.02	0.07	0.75	0.03	0.011	0.013	0.004

In spite of the no significant response of some elements of the chemical composition of *Vicia faba* seeds, but the obtained data reveals that, addition organic manure (Nile compost) as individually and /or mixed with chemical nitrogen fertilizer for broad bean plants caused an enhancement for rooting system to absorb the minerals which release from decomposition the organic manure, hence reflexed on the content of other elements in plant tissues.

Generally, the highest non significant values of N, protein, Mg, Mn and Cu in 1st season were recorded with that plants received the mixture of compost + chemical at ratios of 2 :1 respectively. But in 2nd season, the obtained data indicated that, the highest content of most studied chemical composition parameters were found in tissues of *Vicia faba* seeds of that plants applied organic manure as alone at rate of 2 tons /Fed.

Many investigators reported that, the chemical composition of seeds of beans had no significant response to the organic or inorganic fertilization (Faiyad *et al.*,1991; Soliman *et al.*,1991; Salman *et al.*,2000; and Ahmed *et al.*,2003).

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دراسة مقارنة لإستعمال السماد العضوى منفرداً أو مخلوطاً مع الأسمدة المعدنية وتأثير ذلك على إنتاجية نبات الفول الرومى
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اجريت تجربتان حقليتان فى موسمى ٢٠٠١ ، ٢٠٠٢ لدراسة تأثير السماد العضوى الناتج من تدوير المخلفات النباتية (كمبوست النيل) كسماد عضوى منفرد أو مخلوط مع السماد الكيماوى (NPK) بنسبة مختلفة على انتاجية محصول الفول الرومى وتضمنت أهم النتائج على الآتى :-

- استعمال السماد العضوى الناتج من اعادة تدوير المخلفات النباتية بمعدل ما بين ٢-٣ طن/فدان (حوالى ٤٠-٦٠ وحدة ازوت/فدان) اعطى افضل نمو خضرى معبراً عنه بطول النبات وعدد الاوراق والوزن الغض والجاف للنبات والاجزاء المختلفة
- استخدام السماد العضوى منفرداً أو مخلوط مع السماد المعدنى اعطى قيم عالية لمحصول القرون (طن/فدان) وكذلك مكوناته المختلفة (أبعاد القرون ومتوسط وزن القرن وعدد القرون/نبات وعدد البذور/قرن ومتوسط وزن البذور/نبات وكذلك متوسط وزن ١٠٠ بذرة).
- اوضحت النتائج أن محتوى بذور الفول الرومى من العناصر الغذائية التى درست لم يتأثر تأثيراً كبيراً باستعمال السماد العضوى فى التسميد منفرداً أو مخلوط مع السماد الكيماوى.