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HOW FAR SEAWEED CAN BE INCLUDED IN THE ORGANIC FARMING PROGRAMS ?

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ABSTRACT

A two field experiments were conducted at Mansoura University Agric. Research Station, Dakahlia governorate, Egypt in two successive summer seasons of 2005 and 2006 to study, if the seaweed can be included in the organic farming program or not?. Also, to compare different organic fertilizer sources that are used in organic farming programs either alone or in combination on the growth and yield of the common bean crop. Data revealed that seaweed has a considerable amount of macro and micro nutrients, in the same time it is very poor in the heavy metals (Cd and Pb). Data revealed also that, poultry manure is better than the town refuse compost or F.Y.M. So, the combination of (poultry manure plus seaweed) is more proper to use in the organic farming program because it (a- easy in application b- gives the plant its complete requirements of nutrients c- has a very less heavy metals (Cd and Pb) .

Keywords: Common bean, Phaseolus vulgaris, organic fertilizers, seaweed, organic farming, heavy metals .

INTRODUCTION

Organic farming area increases day by day all over the world. That is because it considers a mean to suppress more diseases and illness. Seaweed materials consider as a pollutant materials to some extent and sea tourism handicap. Fortunately, seaweed contains appreciable quantities of naturally nutrients, hormones, amino acids and vitamins (Kusima, 1989; Crouch and Van Standen, 1991). So, these research goals include a question that say: to any extent can use these materials in the organic farming?.

Using seaweed (*Ascophyllum nodosum*) in organic farming has been commercially available (Abetz, 1980). The seaweed extract realize better results in improving vegetable production (Warman *et al.*, 1993). Blunden and Wildgoose (1977) found that foliar application of aqueous seaweed suspension on vegetable plants increased stem height and total yield. Temple and Bomke (1989) applied seaweed on beans; they found an increase in dry weight of leaves. Blunden *et al.* (1988) applied the seaweed suspension on spinach and onion, Lung (1996) and Hamed (1989) applied it on pepper, Lopez-Mosquera and Pazoas (1997) on potatoes, Cassan *et al.* (1994) on spinach, Türemis *et al.* (1998) on strawbeary, Tartoura and El-Saei (2001) on pea plants. All of them found better results .

On other hand, Awad (1994) mentioned that the importance of organic matter to Egyptian agriculture comes directly next to water importance. Seddik and Ali (2004) showed that addition of vermiculite or bentonite with poultry manure (P.M) to sandy soil gave better results. Soliman *et al.* (1991); El-Gizy (1994) , Fayed (1998), Nour (2004) all of them found better results of poultry manure (P.M) application on vegetable crops comparing with F.Y.M. El-Bassiony (2003) on *Phaseolus vulgaris*, Kabeel *et al.* (2006) on snap bean (under polyethylene tunnels) all of them realize better results comparing with mineral fertilizers .

Concerning to F.Y.M, El-Gizy (1994), Kotb (1994), Shahin (1996) on pea plants, the first, found significantly increase in plant height, the second, found significantly increase in shoot dry weight, the third, found better results in net assimilation rate comparing with the control. Soubeih (2005) using F.Y.M at a rate of 30 m^3/fed. He found significantly increase in all vegetative characters comparing with poultry manure (P.M) at a rate of 10 m^3/fed..

Concerning with town refuse compost (T.R.C) Aal *et al.* (2003) found that T.R.C has a good effect on organic matter content, CEC and hydrolic conductivity of soil. Beavis (2004) found that T.R.C reduced the soil acidity. Tadana and Furuhata (2004) found that T.R.C has a considerable role in plant nutrition .

The aim of this study is to know, how far the seaweed and the cheep organic manures (P.M, F.Y.M and T.R.C) to include in organic farming programs instead of manufactured N, P, K fertilizers .

MATERIALS AND METHODS

A two field experiments were conducted in two successive summer growing seasons of 2005 and 2006 at the Experimental Farm of the Faculty of Agric., Mansoura Univ., Egypt. The seeds of common bean (*Phaseolus vulgaris* L.), cv. Bronco, were planted on March 15^{th} in the first season and on March 18^{th} in the second one. Seeds were sown in hills, 20 cm apart, on one side of the ridge. Thinning took place after complete germination, two plants in each hill. The plot area was 12.60 m^2 which consisted of 6 ridges, 3.0 m in length and 0.70 m in width, leaving a guard row between the experimental units .

The studied factors were two (seaweed and organic fertilizers). The experimental design was split plot system in Randomized Complete Blocks with 4 replicate. The seaweed occupies the sub plots and organic fertilizers occupies the main plots .

Analysis of the experimental field is summarized in Table (1), the seaweed in Table (2) and the organic fertilizers are in Table (3). The levels of seaweed were: with (400 gm dry seaweed per fed.) and without. This seaweed amount was added as foliar application through three times, it was after the first three irrigations. The organic fertilizers were poultry manure (P.M), F.Y.M. and town refuse compost (T.R.C) comparing with the control (mineralic N, P, K) according to the recommended dose (40 kg/fed.-N, 32 kg/fed. P_2O_5 and 50 kg/fed. K_2O) .

Addition of NPK:

In the control NPK were taken from urea (46.5 % N), superphosphate (48 % P_2O_5) and K-sulphate (50 % K_2O) .The aamounts of NPK were equal to the recommended dose. In the other treatments the N dose was exactly the same of control, whereas, P and K were very near to the control, so, the NPK dose became as following :

1-In the treatment of P.M: was taken from 4 m^3 / fed P.M plus 400 gm/ fed seaweed.
2- In the treatment of F.Y.M: was taken from 12 m^3 / fed F.Y.M plus 400 gm/ fed seaweed .
3- In the treatment of T. R.C: like in F.Y.M
4- In the treatment of combination : the N dose calculated depending on the total N percent in the source .The addition of organic fertilizers and P were during plowing , whereas, N and K were divided into two equal parts, the first was added directly after thinning (before the second irrigation) and the other part was before the next irrigation . The other agricultural practices were done as common in this area .

Table (1): Analysis of the experimental field .

O.M %	$CaCO_3$ %	Total sand %	Silt %	Clay %	Texture class	E.C (soil paste) dS/m	pH (soil paste)	S.p
1.22	3.51	16.50	14.00	69.50	Clay	0.35	7.7	90.86

Table 1: continue

Total N %	Available (ppm)		Total (ppm)					
	NH_4^+	NO_3^-	Fe	Mn	Zn	Cu	Cd	Pb
0.06	30.15	125.11	145.50	30.11	85.31	35.16	1.50	13.05

Table (2): Chemical analysis of the important parameters of the seaweed* suspension .

O.M	Total (%)			Total (ppm)					
%	N	P	K	Fe	Mn	Zn	Cu	Cd	Pb
13.00	0.33	0.30	4.00	44.00	2.00	15.55	9.00	0.01	0.02

* The source is CENTIC manufactory (6- Zakarrya Rezk – El-Zamalik, Cairo). The raw material is hand collected seaweed (mainly brown algae, *Ascophyllum nodossum*). The container has a 400 gm dry solid state in 1000 cm^3 H_2O and applied as 1 litre to fed.

Table (3): chemical analysis of the important parameters of the poultry manure (P.M.), F.Y.M. and town refuse compost (T.R.C) .

Organic fertilizer	Total (%)			Total (ppm)						O.M %	C/N ratio	pH (soil paste)	E.C (soil paste) dS/m
	N	P	K	Fe	Mn	Zn	Cu	Cd	Pb				
P.M.	3.11	1.20	2.55	1506	185	225	61	0.01	0.03	45.50	13.45:1	7.70	0.80
F.Y.M.	1.10	0.55	2.25	1750	299	95	125	0.71	0.55	30.05	16.55:1	8.50	0.60
T.R.C.	1.11	1.20	0.85	3850	525	828	223	0.35	7.51	55.51	18.53:1	7.90	0.75

Determination of plant growth parameters:

Plant Growth:

Growth characters expressed as plant height, No. of branches, No. of leaves, total fresh weight/plant, leaf area/plant and total dry weight were measured after 45 days from planting date. Plant leaf area was determined according to Koller (1972) formula as :

$$\text{Plant leaf area (cm}^2) = \frac{\text{Dry weight of leaves}}{\text{Dry weight of 20 disks}} \times \text{Leaf area of disks in cm}^2$$

Total yield and its components:

The cv. of the studied plant is Bronco. This cv. is used mainly to produce green pods (not seeds) . The following parameters were recorded:

Total green pod yield: it was determined as total number of pods and weight of pods /plot and converted to tons/fed..

Total dry seed yield: it was determined as total number of pods and weight of seed /plot, and converted to tons/fed. as well as weight of 100 seeds .

.**Chemical constituents:**

When the plants (also seaweeds) were collected , it were digested as described in Jackson (1967) using a modified Kjeldahl procedure .The soil or organic fertilizers were also digested according to Jackson (1967) by another Kjeldahl modification (proper for soil and organic fertilizers) . Available nitrogen (NH_4^+ and NO_3^-) extracted using K_2SO_4 1% then, NO_3^- determined colorimetrically , Singh (1988) and (NH_4^+ and NO_3) reduced using devarda's alloy (Kjeldahl) as in Jackson (1967). Phosphorous was determined (colorimetrically) as described in Jackson (1967). Potassium was determined using a flame photometer as described in Jackson (1967). Fe, Mn, Zn, Cd and Pb were determined as described in Page *et al.* (1982) using an atomic absorption spectrophotometer. Soil moisture was determined according to Wright (1939) . EC was determined according to Richards(1954). The other determinations were determined as described in Piper (1947), Jackson (1958), Black (1965), Black *et al.* (1965), and Page *et al.* (1982) .

Statistical analysis:

All data were statistically analyzed according to the procedure outlined by Snedecor and Cochran (1967). The treatment means were compared using LSD according to Gomez and Gomez (1984) .

RESULTS AND DISCUSSION

Plant growth:

Single effect of the studied treatments:

Data in Table (4) show the results of the vegetative characters of the common bean. Regarding to poultry manure (P.M), it is statistically better than the control in the most measured parameters. This may be due to that the available N, P, K in P.M is lesser than the control, but, the available N, P, K in P.M is dissolved day by day in parallel with the plant growth, beside that, the P.M has micronutrients and some biological promoters at the time when the control does not has. P.M also consider as organic substrate in the soil, it has a positive effect on the soil physical properties. P.M as in Table (3) has a narrow C/N ratio (13.45:1), this ratio stimulate the microorganisms to analyze the P.M faster than the other studied organic fertilizers (may be completely analysis) especially the pH of the P.M is the same pH of the soil 7.7 not more. This result in harmony with that obtained by Kabeel *et al.* (2006) .

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Table (4): Effect of seaweed and organic fertilizer on the vegetative parameters of common bean plants (45 days from planting date) .

Treatments \ Parameters	Plant height (cm)		No. of branches		No. of leaves		Total fresh weight/plant (g)		Leaf area (cm^2)		Total dry weight/plant (g)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Organic fertilizers												
Mineralic NPK (100%) (Control)	38.49	38.00	22.83	22.85	41.50	4.35	238.17	240.11	3559.15	3550.30	37.50	37.45
P.M (100%)	39.17	39.10	23.33	23.31	43.33	43.03	241.60	240.00	3500.11	3540.25	39.66	38.95
T.R.C (100%)	34.00	34.11	20.00	20.02	39.33	39.25	196.15	191.15	3359.25	3360.11	33.71	33.75
F.Y.M (100%)	32.11	32.25	19.50	19.45	36.11	32.00	188.83	185.80	3310.83	3310.80	30.18	30.25
P.M (50%)+ T.R.C (50%)	37.25	36.95	19.33	19.45	36.00	36.05	186.50	185.81	3016.73	3011.25	28.88	28.50
P.M (50%)+ F.Y.M (50%)	35.23	35.00	17.83	17.50	34.81	43.75	166.17	165.11	2914.11	2915.32	25.56	25.11
P.M (33.3%)+ T.R.C (33.3%)+ F.Y.M (33.3%)	33.17	33.25	15.17	15.11	33.61	33.65	156.25	155.13	2815.26	2814.00	23.19	23.00
L.S.D (0.05)	0.75	0.74	0.71	0.70	0.85	0.84	8.25	8.30	75.15	76.00	1.55	1.48
Seaweed												
With	37.21	37.11	20.51	20.25	37.63	37.65	209.25	211.11	3325.40	3333.60	32.79	32.77
Without	30.98	31.25	17.35	17.40	33.15	33.11	185.00	195.11	3307.44	3300.52	25.96	26.95
F.Test	*	*	*	*	*	*	*	*	*	*	*	*

Table(5):Effect of interaction (seaweed x organic fertilizer) on the vegetative parameters of common bean plants (45 days from planting date) .

Treatments \ Parameters		Plant height (cm)		No. of branches		No. of leaves		Total fresh weight/plant(g)		Leaf area (cm^2)		Total dry weight/plant(g)	
		1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Organic fertilizers	Seaweed												
Mineralic NPK (100%) (Control)	With	40.50	40.35	24.85	24.75	41.25	41.30	238.38	238.40	4622	4600.11	46.80	46.75
	Without	37.83	37.80	22.38	22.40	38.11	38.00	216.16	215.90	4517	4505.12	43.91	43.85
P.M (100%)	With	40.80	40.75	24.80	24.75	40.06	40.01	230.51	231.41	4415	4411.18	46.70	46.75
	Without	38.61	38.51	21.95	21.99	37.38	37.30	200.11	200.00	4116	4113.30	43.00	43.00
T.R.C (100%)	With	38.25	38.80	23.17	23.15	39.18	39.12	195.66	199.16	3822	3820.45	38.15	38.05
	Without	36.11	36.10	23.01	23.00	36.92	36.85	181.87	180.81	3717	3745.31	35.78	35.77
F.Y.M (100%)	With	35.20	35.11	23.00	23.00	38.17	38.15	180.71	180.75	3683	3680.62	35.11	35.29
	Without	34.83	34.50	22.91	23.75	35.585	35.10	175.50	175.13	3583	3580.00	32.25	32.22
P.M (50%)+ T.R.C (50%)	With	35.11	35.01	22.85	22.75	34.32	34.31	169.52	170.50	3444	3440.41	32.71	32.75
	Without	34.51	34.12	21.00	21.05	33.11	33.00	161.12	165.12	3361	3365.41	29.15	29.00
P.M (50%)+ F.Y.M (50%)	With	35.09	35.22	20.85	20.50	32.99	32.95	159.11	160.00	3152	3125.18	28.36	28.33
	Without	34.99	34.75	18.11	19.50	32.09	32.00	150.31	151.31	2814	2850.00	25.11	25.01
P.M(33.3%)+T.R.C(33.3%)+F.Y.M (33.3%)	With	34.55	34.40	17.21	17.00	31.55	31.52	148.12	149.11	2681	2695.11	24.71	24.75
	Without	32.11	33.50	16.85	16.99	30.61	31.00	144.05	145.25	2466	2470.25	21.33	21.40
L.S.D (0.05)		0.80	0.85	0.75	0.73	1.12	1.13	9.88	9.25	158.25	160.11	1.95	1.90

The other organic fertilizers (town refuse compost, T.R.C or F.Y.M or the organic fertilizer mixtures were come significantly after the poultry manure. They are orderd as: T.R.C, F.Y.M, (P.M 50% + T.R.C 50%), (P.M 50% + F.Y.M 50%), (P.M 33.3% + T.R.C 33.3% + F.Y.M 33.3) respectively. This arrangements is in parallel with its content of macro and micronutrients (Table 3). Regarding to seaweed: the treatment (with seaweed) is better than without in all measured parameters. It is due to that the seaweed has a considerable amount of nutrients, hormones, amino acids and vitamins (Kusima, 1989) .

Interaction (seaweed x organic fertilizers):

Data in Table (5) show effect of the interaction (seaweed x organic fertilizer). Data in this table show that effect of interaction on all the measured vegetative parameters is better than the effect of any organic fertilizer alone. This may be due to the effect of the seaweed. The seaweed (according to Kusima (1989) in Japan has appreciable quantities of naturally nutrients, hormones, amino acids and vitamins .

This previous materials stimulate the plant to appear more response over above the effect of any of the studied factor alone, so this interaction consider positive interaction. In addition, the treatments that receive P.M (either alone or with seaweed) still has superiority in its effect on the vegetative parameters (Kabeel *et al.*, 2006) have got the same trend .

Yield and its components:

Single effect of the studied treatments:

Regarding to total green pod yield in Table (6), this parameter go in the same direction that achieved in Table (5). Where, the P.M realize better results than the control, also, than the other organic fertilizer sources. Regarding to the other parameters in Table (6), it also go in the same direction of the parameter of total green yield. The reason of this trend may be that (as mentioned in Table, 5). P.M is the best source of this study because it has the best pH 7.7 (F.Y.M=8.5, T.R.C=7.9) and P.M has the best C/N ratio, 13.45: 1 (F.Y.M=16.55:1, T.R.C=18.58:1), all these reasons give P.M chance to realize the plant requirement in time that the plant need.

Response of yield and its components to the interaction (seaweed x organic fertilizer) .Regarding to total green yield in Table (7), this parameter in case with seaweed is better than without. Also, the other treatments (including the control) realize in case of with seaweed better results than without. Also, the other parameters go in the same direction. Seaweed may be is the reason of this trend, where, this material (as mentioned before) stimulate the plant to produce more units of yield and its components because this material, according to Kusima (1989) has appreciable quantities of naturally nutrients, hormones, amino acids and vitamins .

Chemical constituents:

Chemical composition of the green plant (45 days age):

Single effect of the studied treatments:

Concerning with the macronutrients in Table (8) in case of fertilizers, there are significant differences among it, but, the P.M does not differ significantly with the control (mineralic source). For example, in case of N%, it is in the control = 4.64 %, it is in the P.M = 4.60 (LSD = 0.1).

Table (6): Effect of seaweed and organic fertilizer on yield and its components of common bean plants .

Treatments \ Parameters	Total green yield Kg/fed.		No. of dry pods /plot		Total dry yield Kg/fed.		Weight of 100 dry seeds	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Organic fertilizers								
Mineralic NPK (100%) (Control)	1297	1377	1274.78	1274.75	1217.25	1210.10	33.78	33.70
P.M (100%)	1447	1529	1299.16	1299.00	1226.88	1220.09	37.05	36.44
T.R.C (100%)	1159	1158	1000.95	1000.95	1117.44	1115.33	34.07	34.00
F.Y.M (100%)	1100	1100	989.31	989.00	987.71	980.70	33.82	33.75
P.M (50%)+ T.R.C (50%)	1095	1090	950.11	951.11	925.32	920.35	31.48	31.50
P.M (50%)+ F.Y.M (50%)	1092	1090	896.12	890.00	881.44	881.50	31.17	31.00
P.M (33.3%)+ T.R.C (33.3%)+F.Y.M (33.3%)	1082	1080	878.38	875.33	840.73	845.70	31.00	31.90
L.S.D (0.05)	**25.50**	**28.40**	**51.25**	**50.11**	**75.11**	**76.25**	**0.41**	**0.40**
Seaweed								
With	1290	1370	1318.70	1315.00	11373.35	1175.88	33.15	33.01
Without	1200	1210	953.75	960.00	880.70	895.75	30.11	30.10
F.Test	*	*	*	*	*	*	*	*

Table (7): Effect of interaction (seaweed x organic fertilizer) on yield and its components of common bean plants .

Treatments \ Parameters		Total green yield Kg/fed.		No. of dry pods /plot		Total dry yield Kg/fed.		Weight of 100 dry seeds	
		1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Organic fertilizers	**Seaweed**								
Mineralic NPK (100%) (Control)	**With**	1390.25	1385.11	1608.38	1610.25	1276.25	1220.11	36.90	36.85
	Without	1300.25	1305.16	1313.17	1310.17	1217.69	1205.60	33.91	33.81
P.M (100%)	**With**	1495.35	1490.15	1800.25	1820.22	1287.11	1250.11	37.89	38.90
	Without	1410.33	1400.25	1311.88	1331.75	1200.28	1205.25	33.96	33.40
T.R.C (100%)	**With**	1195.16	1490.17	1641.55	1640.50	1151.17	1150.10	36.61	35.70
	Without	1185.66	1180.41	1051.12	1000.00	1041.88	1040.75	33.50	33.63
F.Y.M (100%)	**With**	1150.25	1145.41	1317.66	1320.06	1099.40	1090.40	36.50	36.50
	Without	1100.88	1115.25	1000.85	1000.75	1000.35	1000.00	33.45	33.40
P.M (50%)+ T.R.C (50%)	**With**	1100.16	1110.31	1000.95	1000.00	911.36	912.50	34.41	34.39
	Without	1090.32	1090.16	817.25	825.25	850.31	900.66	31.39	31.39
P.M (50%)+ F.Y.M (50%)	**With**	1095.41	1090.88	935.61	945.75	880.11	875.22	34.39	34.35
	Without	1000.26	1000.77	800.36	810.40	800.51	800.15	31.38	31.30
P.M(33.3%)+T.R.C(33.3%)+F.Y.M (33.3%)	**With**	1090.11	1080.10	811.81	820.25	850.48	855.50	34.35	34.31
	Without	1000.81	1020.16	798.22	799.40	800.48	850.25	31.30	31.20
L.S.D (0.05)		**26.40**	**30.50**	**99.36**	**100.44**	**85.05**	**80.36**	**0.43**	**0.42**

In case of phosphorous, it is in the control = 0.29%, and in the P.M = 0.28 (LSD = 0.02). In case of potassium, it gives the same behavior as in N % or P%. It meaning that the P.M (in case of macroelements) gives the plant its complete requirements as in the mineralic source. Many researches give very near results like Fawzy *et al.*, 2007. They found that P.M is better than the mineralic source or F.Y.M .

Concerning with the micronutrients in Table (8), the micronutrients (Fe, Mn, Zn, Cu) in case of organic sources, it are better than the mineralic source, because the used organic fertilizers as in Table (3) is very rich in microelements. The plant in the control absorbs its requirement (completely or approximately) from the soil itself .

Concerning with the heavy metals (Cd or Pb) in Table (8), it are in the organic sources is higher than in the control (mineralic source), but, it does not exceed the critical limit, where, the critical limit for Cd is 5ppm and for Pb is 30 ppm according to Alloway (1995) .

Concerning with seaweed suspension in Table (8) there is a significant difference between the treatments (with seaweed and without) in case of macro and micro elements. It is due to (as in Table, 2) that these materials have considerable amounts of macro and microelements. On the other hand, there is no significant differences between the treatments (with seaweed and without) in case of heavy metals, it is due to (as in Table, 2) that these materials are very poor in the heavy metals, so, these organic sources are more suitable to include it in the organic farming programs, these results in harmony with that obtained by El-Abbasy and El-Morsy (2002) .

Response of chemical composition of the green plant (45 days age) to the interaction (seaweed x organic fertilizer).

Concerning with the data in Table (9), the interaction gives significantly differences among all the studied treatments and this interaction gives a positive effect over above each single studied factor. Once again the poultry manure in case of macroelements plus seaweed realize very near result comparing with (the mineralic source plus seaweed). The heavy metals in Table (9) in all studied treatments are not exceeding the critical limit .

Response of chemical composition of the green pods:

Data in Table (10), in general, give the same trend as in Table (8) that belong to the vegetative plant part except that the recorded values in case of green pods is higher than that recorded in case of vegetative plant part (to some extent), for example, the N% for the control in case of green pods Table (10) is 4.90 %, but, it in the vegetative part (Table, 8) is 4.64 %. Also the P% in the control of Table, 10 (green pods) is 0.45 %, but in Table, 8 (vegetative part) is 0.29 %, the other recorded values give the same trend. This behavior may be due to that the green pods are the storage part of plant. Regarding to the heavy metals in Table (10), it gives significantly effect among the fertilizers, but, it in case of seaweed (with and without) the F. test is not significant. It is may be due to that the content of seaweed from the Cd and Pb is very less .

Response of chemical composition of the green pods to the interaction (seaweed x organic fertilizer):

The interaction among all the studied elements is significant, and this kind of interaction is positive, where, every studied factor (either fertilizer or seaweed) realize addition value to the other factor. For example, the N% in Table (10) in case of control (alone) is 4.95 %, but, it in case of interaction Table (11) (control plus seaweed) is 4.99 % .

Table (8): Effect of seaweed and organic fertilizer on the chemical composition of the green common bean plants (45 days from planting date) the data is the average of the two seasons .

Treatments \ Parameters	Macro elements (%)			Micro elements (ppm)				Heavy metals (ppm)	
	N	P	K	Fe	Mn	Zn	Cu	Cd	Pb
Organic fertilizers									
Mineralic NPK (100%) (Control)	4.64	0.29	4.95	10.80	6.00	6.08	3.00	0.01	0.03
P.M (100%)	4.60	0.28	4.90	300.15	30.11	30.81	15.19	0.35	0.75
T.R.C (100%)	3.85	0.27	4.82	285.11	28.19	27.62	14.25	0.85	4.55
F.Y.M (100%)	3.82	0.27	4.71	261.12	26.71	25.43	13.32	0.71	2.65
P.M (50%)+ T.R.C (50%)	3.80	0.26	4.63	245.15	26.50	25.54	12.41	0.52	1.75
P.M (50%)+ F.Y.M (50%)	3.80	0.26	4.52	240.00	22.60	22.16	12.30	0.45	1.23
P.M (33.3%)+ T.R.C (33.3%)+ F.Y.M (33.3%)	3.61	0.25	4.51	233.06	20.11	21.16	12.30	0.40	1.12
L.S.D (0.05)	0.10	0.02	0.09	35.01	3.85	3.09	0.13	0.05	0.07
Seaweed									
With	4.66	0.28	4.90	295.11	29.11	28.91	14.50	0.03	0.04
Without	4.06	0.21	4.41	280.16	28.00	26.01	12.33	0.01	0.03
F.Test	*	*	*	*	*	*	*	NS	NS

Table (9): Effect of the interaction (seaweed x organic fertilizer) on the chemical composition of the green common bean plants (45 days from planting date) the data is the average of the two seasons .

Treatments \ Parameters		Macro elements (%)			Micro elements (ppm)				Heavy metals (ppm)	
Organic fertilizers	Seaweed	N	P	K	Fe	Mn	Zn	Cu	Cd	Pb
Mineralic NPK (100%) (Control)	With	4.70	0.31	4.99	11.00	6.51	6.19	3.25	0.41	0.45
	Without	4.66	0.28	4.92	10.11	6.00	6.13	3.00	0.01	0.30
P.M (100%)	With	4.69	0.30	4.96	299.33	39.11	31.75	15.20	0.41	0.95
	Without	4.66	0.28	4.90	290.16	28.99	27.60	14.50	0.35	0.76
T.R.C (100%)	With	4.25	0.20	4.89	289.25	28.90	27.4	14.50	0.84	4.95
	Without	4.00	0.27	4.80	286.11	28.00	27.3	14.30	0.82	4.50
F.Y.M (100%)	With	3.95	0.28	4.79	275.25	27.11	26.50	14.00	0.80	3.05
	Without	3.90	0.26	4.71	270.11	26.90	26.21	13.81	0.75	2.85
P.M (50%)+ T.R.C (50%)	With	3.90	0.28	4.68	268.16	26.85	26.00	13.50	0.71	2.20
	Without	3.81	0.26	4.50	250.16	26.00	25.81	13.00	0.71	1.81
P.M (50%)+ F.Y.M (50%)	With	3.80	0.28	4.61	259.13	25.51	24.95	12.99	0.56	1.71
	Without	3.71	0.25	4.60	245.11	24.95	24.15	12.80	0.50	1.25
P.M(33.3%)+T.R.C(33.3%)+F.Y.M (33.3%)	With	3.70	0.29	4.60	250.95	23.75	23.00	12.80	0.45	1.25
	Without	3.60	0.26	4.50	238.95	21.00	22.95	12.60	0.41	1.14
L.S.D (0.05)		0.12	0.03	0.10	36.09	3.95	3.15	0.16	0.06	0.10

Table (10): Effect of seaweed and organic fertilizer on the chemical composition of the common bean green pods, the data is the average of the two seasons .

Treatments \ Parameters	Macro elements (%)			Micro elements (ppm)				Heavy metals (ppm)	
	N	P	K	Fe	Mn	Zn	Cu	Cd	Pb
Organic fertilizers									
Mineralic NPK (100%) (Control)	4.90	0.45	4.95	12.00	8.11	7.50	4.55	0.02	0.04
P.M (100%)	4.95	0.42	4.98	295.25	28.16	31.80	16.50	0.41	0.92
T.R.C (100%)	4.33	0.42	4.62	288.50	29.11	26.60	15.15	0.95	5.11
F.Y.M (100%)	4.33	0.41	4.50	240.00	26.77	26.18	13.50	0.75	2.81
P.M(50%)+ T.R.C (50%)	3.95	0.40	4.44	246.90	27.90	26.61	13.55	0.61	1.92
P.M(50%)+ F.Y.M (50%)	3.95	0.39	4.40	244.35	23.75	23.18	13.30	0.51	1.51
P.M(33.3%)+T.R.C (33.3%)+ F.Y.M (33.3%)	3.95	0.35	4.25	235.75	22.17	22.16	13.00	0.51	1.35
L.S.D (0.05)	0.08	0.04	0.35	35.01	3.89	3.10	0.18	0.01	0.31
Seaweed									
With	4.95	0.48	4.81	300.11	28.25	30.00	16.75	0.03	0.05
Without	4.90	0.46	4.75	208.50	26.17	28.60	13.25	0.02	0.04
F.Test	*	*	*	*	*	*	*	NS	NS

Table (11): Effect of the interaction (seaweed x organic fertilizer) on the chemical composition of the common bean green pods, the data is the average of the two seasons .

Treatments \ Parameters		Macroelements (%)			Microelements (ppm)				Heavy metals (ppm)	
Organic fertilizers	Seaweed	N	P	K	Fe	Mn	Zn	Cu	Cd	Pb
Mineralic NPK (100%) (Control)	With	4.99	0.46	4.99	12.25	8.18	8.00	4.83	0.04	0.05
	Without	4.92	0.45	4.96	12.00	7.85	7.90	4.60	0.02	0.04
P.M (100%)	With	4.95	0.45	4.98	298.11	28.21	35.71	17.25	0.81	1.00
	Without	4.91	0.44	4.98	295.33	28.15	31.20	16.50	0.42	0.93
T.R.C (100%)	With	4.38	0.43	4.93	290.85	29.95	28.11	16.95	1.20	5.25
	Without	4.30	0.42	4.71	288.11	29.35	28.00	16.50	0.96	5.10
F.Y.M (100%)	With	4.50	0.42	4.85	281.06	26.35	28.95	14.43	0.77	3.00
	Without	4.30	0.41	4.65	275.13	26.17	28.00	14.00	0.66	2.83
P.M (50%)+ T.R.C (50%)	With	4.28	0.40	4.80	275.35	28.35	28.50	14.11	0.62	2.10
	Without	3.99	0.39	441	260.77	28.00	27.85	14.00	0.58	1.98
P.M (50%)+ F.Y.M (50%)	With	4.28	0.40	4.71	265.85	23.88	23.51	13.95	0.50	1.58
	Without	3.95	0.38	4.50	264.70	23.80	23.25	13.50	0.48	1.55
P.M(33.3%)+T.R.C(33.3%)+F.Y.M (33.3%)	With	4.00	0.38	4.75	231.99	23.41	22.44	13.95	0.56	1.38
	Without	3.95	0.36	4.35	231.95	22.95	22.00	13.06	0.49	1.36
L.S.D (0.05)		0.09	0.05	0.38	36.11	4.11	3.21	0.17	0.05	0.41

Concerning with heavy metals in Table (11), although the green pods are the storage member in the plant, the accumulated amount for Cd or Pb are not exceed the critical limit according to Alloway (1995) .

CONCLUSION

The obtained data revealed that the combined treatment (P.M + seaweed) gives the plant all its requirements from macro and micro elements. In the same time the produced plant does not exceed the critical limit of the heavy metals Cd and Pb, so, the seaweed is proper material to include in organic farming programs .

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إلى أى مدى يمكن استخدام الطحالب البحرية فى برامج الزراعة العضوية ؟

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أجريت تجربتان حقليتان بالمزرعة البحثية لكلية الزراعة-جامعة المنصورة- محافظة الدقهلية- مصر، لدراسة امكانية الأعتماد على الطحالب البحرية فى برامج الزراعة العضوية من عدمه. كما كان من اهداف البحث عمل مقارنة بين الأسمدة العضوية الشهيرة الاستخدام فى برامج الزراعة العضوية من ناحية كفاءتها فى تغدية نبات الفاصوليا صنف برونكو المستخدم اساسا فى انتاج القرون الخضراء .

أظهرت النتائج ان مستخلص الطحالب البحرية يحتوى على كمية مناسبة من العناصر الكبرى والصغرى والهرمونات والاحماض الامينية والفيتامينات وفى نفس الوقت فقيرة فى ال heavy metal (Cd and Pb) المدروسة .

كما اظهرت النتائج ان سماد الدواجن أكفأ من سماد قمامة المدن وأكفأ من سماد ال F.Y.M . انتهت الدراسة الى ان المعاملة التى اخذت (سماد دواجن 4 متر مكعب للفدان + الطحالب البحرية 400جم/ ف) مناسبة جدا للاستخدام فى برامج الزراعة العضوية للاسباب الاتية:

ا- سهولة التطبيق

ب- أعطت النبات احتياجاته كاملة

ج- محتواها من ال heavy metal (Cd and Pb) لم يتجاوز حد السماح.