J. Agric. Sci. Mansoura Univ., 25 (8): 5527 - 5532, 2000.

EFFICIENCY USE OF ALGIFERT BIOFERTILIZER ON CUCUMBER PRODUCTION AND SOME SANDY SOIL PROPERTIES

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ABSTRACT

A greenhouse experiment was conducted on a sandy soil in a randomize complete block design to study the effect of different addition methods and rates of algifert (as biofertilizer) on cucumber production and some soil properties.

The obtained data showed a pronounced increase in EC values than control. However, ESP decreased especially with soil together with foliar application. While pH values were not affected; OM and available N, P and K in the studied soil in all treatments of algifert were more than control.

With respect to cucumber plant growth and yield, it was found that soil and foliar application increased, plant dry weight, N, P, K content in cucumber leaves and fruit yield significantly. Foliar and soil application (Treatment F) gave the highest plant growth and yield followed by C (0.1% foliar application) and D (0.2% foliar application) ones. The improvement of physical and chemical properties of the investigated sandy soil with algifert additions was the main factor to increase the plant growth and yield of cucumber.

Key words: Greenhouse, Algifert, cucumber, sandy soil.

INTRODUCTION

To achieve reliable strategies for eco-compatible agricultural systems in Egypt, maximizing utilization of natural agricultural resources; emphathizing the importance of organic farming and minimizing consumption of inorganic fertilizers and enhancing environment control measures, a field experiment was conducted to study the effect of algifert biofertilizer application on cucumber yield and soil properties.

Seaweed extracts, being a biological product, are applied either foliar or soil application to increase crop production and improve fruit commercial quality. Foliar application of seaweed extracts on potatoes led to a significant increase in tuber yield by 13% over the control (Blunder and Wildgoose, 1977). The seaweed treatments tended to increase the P content in cucumber leaves 8.9 against 7.4 g. kg^{-1} in control (Nelson and Van Staden, 1984). Featonby Smith and Van Staden (1987 a) reported that barley grain yield grown on a sandy loam soil was increased by about half using seaweed in foliar or soil drench form. In general, the application of seaweed extracts has many beneficial effects on plants which led to an increase in seed germination, nutrient uptake and crop yield (Abetz, 1980).

Therefore, the present investigation was conducted to elucidate the effect of algifert fertilization on greenhouse cucumber production and some sandy soil properties.

MATERIALS AND METHODS

A greenhouse experiment was conducted at Cairo /Belbies desert was in Sekem company to study the effect of different addition methods and application rates of algifert on cucumber production and soil characteristics. The analysis of algifert is found in Table (1 a,b) according to Algea Producter A/S: P.O.Box 68, N.3401, Norway.

Some mechanical and chemical properties of the studied soil were analyzed according to Black et al. (1982) and presented in Table (2).

Table (1): Algifert analysis.

Algifert is a natural plant growth stimulant made by alkaline hydrolysis of Norwegian Seaweed, (Ascophyllum nodsum), and designed for foliar application.

a- General characteristics of Algifert

Colour	Dark brown to black.
Physical appearance	Flaky powder.
Particle size	Min. 90 % passes through a 2 mm sieves.
Odour	Characteristic for processed seaweed.
Bulk density	500 - 900 $kg.m^{-3}$ (0.5 – 0.9 $gm.cm^{-3}$).
Solubility	100 % in a 50% water solution at 20 °C.
Stability	Stable at normal temperatures and light conditions.
EC	0.5 –0.6 dS m^{-1}
PH	9 – 10 in a 250 g\e water solution.
Storage stability	Very stable under house conditions which reflect the normal storage condition of the product in the original container.
Toxicity	Non- toxic / biodegradable.
Compatibility	Compatible with most commonly used sprays.

The different addition methods and application rates of algifert were as follows:

B = 0.2 % Soil application.

C = 0.1 % Foliar application.

D = 0.2 % Foliar application.

E = 0.3 % Foliar application.

F = 0.2 % + 0.1 (soil and foliar application).

G = 0.2% + 0.2 (soil and foliar application).

H = 0.2% + 0.3 (soil and foliar application).

b- Typical analysis of Algifert:

Dry matter		95 %	
Moisture		5 %	
Organic matter		52.5 %	
Inorganic matter		47.5 %	
Essential major elements (Macro-nutrients)		Essential major elements (Micro-nutrients)	
N	1.25 %	Fe	125.0 ppm
P	0.04 %	Zn	55.0 ppm
K	11.00 %	Mn	8.5 ppm
Ca	0.75 %	Cu	3.5 ppm
Mg	0.70 %	B	60.0 ppm
S	6.00 %	Mo	3.0 ppm

The analysis of algifert according to algae producter A/S: P.O. Box 68, N. 3401. Norway.

Table (2): Mechanical and chemical analysis of the studied soil.

Mechanical analysis		Chemical analysis	
Coarse sand	86.55	EC (dSm^{-1})	0.39
Fine sand	7.45	pH (1:2.5 Soil:water susp.)	7.85
Silt	2.00	ESP	8.05
Clay	4.00	Available N (ppm)	31.76
O.M	0.68	Available P (ppm)	10.26
$CaCO_3$	2.58	Available K (ppm)	395.15
Texture	sandy		

A randomized complete block design was used. Cucumber seeds were sown on 29th October, 1998. All agricultural practices as recommended under greenhouse conditions were followed. At maturity, cucumber fruit weights were recorded and statistically analyzed according to Snedecor and Cochran (1969). After harvest, soil samples were taken from each plot for chemical and physical analyses (Black et al 1982). N, P and K nutrients were determined in cucumber leaves according to Piper (1950) after 60 days from sowing.

RESULTS AND DISCUSSION

1. Effect of algifert application on soil properties:

1. a. The effect on soil salinity, pH and ESP:

Data in Table (3) show a slight increase in EC values with algifert soil application either alone or together with foliar additions. These results may be attributed to the salt effect of algifert component.

Regarding soil pH, its values were not affected by the different treatments of algifert.

With respect to the effect of algifert addition on exchangeable sodium percentage (ESP), data in Table (2) indicate that a decrease in ESP values of the treatments having soil addition together with low and medium concentrations of foliar application (F and G treatments) compared with control. However other treatments had a slight effect on ESP values.

1.b. the effect on organic matter content.

It is clear from Table (3) that OM values increased by different treatments of algifert as compared with the control, where the values increased from 0.82 to 0.90, 1.55, 1.42, 1.42, 1.95, 1.73 and 1.95 % at B, C, D, E, F, G and H treatments, respectively. The results showed that foliar treatments either alone or together with soil addition gave the higher values increases. These results may be due to the effect of algifert on increases the dry matter of cucumber plant, in addition to the biochemical effect of this fertilizer. These results are in accordance with those of Abetz (1980).

1.c.The effect on available N, P and K:

Results in Table (3) revealed that the available N, P and K were generally increased by all treatments of algifert. Foliar treatments either alone or together with soil addition gave the higher values. The maximum value was obtained by F treatment for available N, while the H treatment gave the maximum value for P and K.

It could be said that the algifert foliar spray either alone or together with soil application reflects on improving soil nutrient content, that leads to increase the availability of those nutrients to cucumber. These results are in agreement with those obtained by Nelson and Van Staden (1984). From the previous results, it is suggested that algifert biofertilizer addition had a good effect on improving soil physical and chemical properties of the experimental soil.

Table (3): Soil properties as affected by different algifert treatments.

Algifert treatments	EC ($dS\ m^{-1}$)	PH 1:2.5 (Soil: water)	ESP	OM (%)	Available (ppm)		
					N	P	K
A	0.36	7.80	8.05	0.82	32.14	10.50	417.40
B	0.39	7.72	7.95	0.90	32.49	10.90	440.05
C	0.35	7.80	8.00	1.55	37.95	11.25	500.10
D	0.35	7.80	8.00	1.42	38.14	11.65	495.66
E	0.40	7.75	7.90	1.42	36.40	11.25	488.72
F	0.40	7.60	6.25	1.95	39.50	12.23	506.38
G	0.40	7.75	6.25	1.73	33.80	11.28	435.15
H	0.40	7.82	7.10	1.95	36.10	13.05	509.45

Where:

A = Control
B = 0.2 % Soil application.
C = 0.1 % Foliar application.
D = 0.2 % Foliar application.
E = 0.3 % Foliar application.
F = 0.2 % + 0.1 (soil and foliar application).
G = 0.2% + 0.2 (soil and foliar application).
H = 0.2% + 0.3 (soil and foliar application).

2- Effect of algifert application on cucumber plant growth and fruit yield.

2.a. Effect on plant dry weight and leaves content from N, P and K:

Data in Table (4) indicate that all treatments increased cucumber plant dry weight and leaves content from N, P and K. the maximum dry weight was obtained by F treatment followed by G and H, while B, C, d and E treatments have a reverse effect on dry weight.

Table (4): Effect of algifert application on plant dry weight and leaves content from (N, P, K) of cucumber.

Algifert treatments	Plant dry weight (g)	Leaves content (%)		
		N	P	K
A	45.5	1.50	0.77	2.55
B	51.2	1.90	0.81	2.83
C	64.1	1.68	0.95	3.33
D	68.6	1.75	0.89	3.50
E	67.0	1.80	0.88	3.50
F	82.8	1.95	0.93	3.75
G	75.3	1.78	0.91	3.65
H	74.1	1.80	0.92	2.68

The effect on N, P and K content in cucumber leaves gave the same trend. It was clear that the foliar spray of algifert combined with soil addition more effective than other treatments.

2.b. Effect on cucumber fruit yield

Data presented in Table (5) reveal that except H treatment, other algifert treatments increased cucumber fruit yield significantly. Treatment (F) owned the highest fruit yield. In general, fruit weight as affected by various algifert applications (soil and/or foliar) could be arranged in the following descending order. F> C> D> E> G> B where the average values were 11.4, 10.32, 9.03, 8.94, 8.76 and 8.15 kg/plant, respectively, compared with the control (6 kg/plant). These relative increases in fruit yield were as much as 90, 72, 50.0, 49, 76 and 35.8 % over control, respectively. This descending trend is in harmony with those found in case of some pervious soil properties and either DW or plant contents of N, P and K.

On the other hand, further algifert biofertilizer (H treatment) had no effect on yield of cucumber.

Similar results were obtained by Featonby Smith and Van Staden (1978a), Abetz (1980) and Nelson and Van Staden (1984) who reported that barley grain yield grown on sandy loam soil was increased by about half with seaweed addition in foliar or soil drench form.

Table (5): Effect of algifert application on cucumber yield production (kg/plant).

Treatments	Replication			M
	R_1	R_2	R_3	
A	6.35	5.85	5.80	6.00
B	8.10	7.95	8.25	8.15
C	10.57	10.00	10.40	10.32
D	9.00	9.15	8.94	9.03
E	8.65	8.90	9.27	8.94
F	11.55	10.95	11.70	11.40
G	8.80	8.40	9.08	8.76
H	4.85	5.15	5.20	6.07
L.S.D (0.05)	0.44			
L.S.D (0.01)	0.62			

It could be concluded that the foliar spray of algifert as a biofertilizer together with soil addition is more effective on cucumber production than its foliar or soil addition alone- the recommended rate for this study in order to increase cucumber production is 0.2% soil + 0.1% foliar treatment especially if the soil properties was taken into consideration.

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كفاءة إستخدام السماد الحيوى (Algifert) على إنتاج الخيار وبعض خواص التربة الرملية.

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أقيمت تجربة صوبة فى أرض رملية فى مزرعة فى طريق مصر- بلبيس الصحراوى فى قطاعات تامة العشوائية لدراسة تأثير طريقة ومعدل إضافة سماد حيوى Algifert على إنتاجية نبات الخيار وكذلك تأثيره على بعض الخواص الطبيعية والكيماوية للأرض.

أظهرت النتائج المتحصل عليها زيادة طفيفة فى الأملاح الذائبة بالتربة ومع ذلك فإن النسبة المئوية للصوديوم المتبادل قد نقصت بالمعاملة إلى رشت ورقيا بالـ Algifert مع إضافتة بالتربة (معاملات F, G, H) بينما لم يتأثر pH التربة سواء بالاضافات الأرضية أو الورقية. لوحظ أن المادة العضوية وكذلك صلاحية امتصاص العناصر (النتروجين، الفوسفور والبوتاسيوم) قد زادت فى جميع المعاملات عن الكنترول.

وفيما يتعلق بالمحصول وجد أن جميع المعاملات أظهرت زيادة فى المادة الجافة للنباتات عن الكنترول وكذلك محتوى الأوراق من عناصر النتروجين والفوسفور والبوتاسيوم، ولقد انعكس ذلك على محصول الثمار حيث زاد معنويا فى جميع المعاملات ، ولقد أعطت المعاملة (0.2% إضافة أرضية + 0.1% رش ورقى) أعلى القيم من حيث الوزن الجاف للنبات ومحتوى الأوراق من العناصر ومحصول الثمار.