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EFFECT OF ORGANIC AND BIOFERTILIZERS ON GROWTH, YIELD AND CHEMICAL COMPOSITION OF *Oenothera biennis* L.

BY

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ABSTRACT

A field experiment was carried out during two successive seasons (2004/2005 and 2005/2006) to investigate the effect of organic and biofertilizers on growth, yield and chemical composition of *Oenothera biennis*. Three concentrations from each of Biogeine, Phosphorine and Potassiumag (30, 40 and 50 gm/3m^2)and cattle manure at 10m^3/fed./season were used in addition to untreated plants as a control. Generally, all concentrations of biofertilizers increased growth parameters and chemical composition as compared to untreated plants. So, the best response was resulted from the highest concentration of biofertilizers (50gm/3m^2). The yields of seeds, and fixed oil were increased, also the chemical composition showed the highest values with application of the highest concentration of biofertilizers.

INTRODUCTION

Oenothera biennis L. (Evening primrose) belongs to family Onagraceae. Its an edible and medicinal plant and has a long history of use as alternative medicine. Simpson (1994) reported that some *Oenothera* species the grown as an oil seed crop and to provide drugs for the pharmaceutical industry. Srivastava *et al* (1998) reviewed various constituents isolated from *Oenothera* species. These include steriods, terpenoids, fatty acids, flavonoids, tannins, mucilage, resin, bitter principle and potassium salts.

Some evidences reported that. *Oenothera biennis* L., plant has some medicinal effects as Brown (1995) who reported that, *Oenothera biennis* seed oil has a positive effect on the uterine muscles nervous system and metabolism, he added that the oil relieves pain and inflammation. Sayonava *et al.,*(1997) mentioned that, gamma linolenic acid (GLA 18.3) is a component of the seed oils of *Oenothera biennis* L. has widely used as a dietary supplement and for treatment of various medical conditions.

Seeds of *Oenothera biennis* L. are a rich source of oil. Some Annual –report (1987) stated that the percentage of *Oenothera biennis* seed oil ranged from 15.9 to 26.6% and the percentage of gamma linolenic acid ranged from 9.6 to 12.7%.

However, Hulan *et al.* (1987) mentioned that seeds of *Oenothera biennis* L. contained 21 –34 % lipids and seed oil is a rich source of linolenic acid. On the other hand, Grignac (1988) reported that seed yield of *Oenothera biennis* L. approx 1.5 –2.0 t/ha, containing 20% total oil and 8.9 % gamma linolenic acid. Simpsom *et al.* (1993)

found that seeds of evening primrose (*Oenothera* spp) contain 17 –25 % oil, which 7 – 10 % is gamma linolenic acid.

Therefore, *Oenothera biennis* L.plants could be considered one of the oil crop, which could has a pharmaceutical use. Consequently, some attention must be added as some horticultural treatments which could affect its productivity without any side effects.

Application of biofertilizers to horticultural crops had drown the attention of research workers and had become in the last few decades a positive alternative to chemical fertilizers. Biofertilizers are reasonably safer to the environment and human compared to chemical fertilizers.

MATERIALS AND METHODS

A field experiment was carried out in the Experimental Farm of Faculty of Agriculture in Moshtohor, Benha University, for two successive seasons (2004/2005 and 2005/2006) to investigate the response of Evening primrose or (*Oenothera beinnis* L.) to the treating by biofertilizations at different concentrations. The Evening primrose (*Oenothera beinnis* L.) seeds were obtained from the Farm of Faculty of Agriculture, Moshtohor, Benha University. Seeds were germinated in pots at the end of October to the end of November and were transplanted in experimental plots of clay soil, the area of each plot was $3m^2$ containing 12 plants (the soil analysis is present in Table -A). Treatments began after one month from transplanting and were repeated every 3 weeks in the two seasons. The plants were treated with biofertilizers at rates of 30,40 and $50gm/3m^2$.

Table (A): The physical and chemical properties of the soil.

Physical properties		Chemical properties	
Clay	59.68%	**PH**	8.50
Silt	24.03%	**Available N**	29.82 ppm
Fine sand	18.32%	**Available P_2O_5**	114 ppm
Coarse sand	3.37%	**Available K_2O**	189 ppm
Soil texture	Clay soil	**B**	59.22 ppm
		Fe	33.07 ppm
		Mg	8.142 ppm
		Mn	7.24 ppm

The chemical properties of the soil were determined using the method of Chapman and Pratt (1978).

The cattle manure was obtained from the Animals Production Department, Faculty of Agriculture, Benha Univ. Moshtohor.

Oenothera plants received [cattle manure (CM)] at the rate of 10 m^3 / fed / season (710 cm^3 / plot/ season) .

The chemical analysis of the organic fertilizers (Cattle manure- (CM) (Table, B) was made according to Jackson (1967).

Table (B): The chemical characteristics of the organic fertilizers (CM) applied to *Oenothera beinnis* L.

Fertilizer characteristics	Seasons	
	2004	2005
Weight of 1 m^3 (kg/m^3)	493	470
Moisture content(%)	9.40	9.10
Organic matter%	62.98	62.24
Organic carbon%	31.68	36.10
N%	1.88	1.83
C: N ratio	17.4: 1	19.7: 1
NO_3 – N(ppm)	173.90	206.8
NH_3 – N(ppm)	49.40	63.60
P%	0.29	0.60
K%	1.18	1.12
Fe (ppm)	1865.50	2690.9
Zn (ppm)	192.60	179.80
Cu (ppm)	44.3	43.2
Mn (ppm)	90.80	159.20

Bacteria fertilizers (Biogene, Phosphorine and Potassiumag) were obtained from the General Organization for Agricultural Equalization Fund (GOAEF), Ministry of Agriculture, Egypt.They are efficient strains in peat moss growth media containing $28\text{-}32\times10^8$ cells /100 g peat moss.

The organic fertilizer was analyzed in Training Center Research of Agricultural

Residues (T C R A R)-Agric. Research Center Moshtohor, Tukh, Qalyoubia .

The active bacteria in Biogeine(nitrogin fixation) is *Azotobacter sp* and in Phosphorine was *Bacillus megatherium* (phosphorus solublization), while in Potassiumag (potassium valublization) was active in it *Bacillus sp.* Three concentrations 30, 40 and 50 gm/plot biofertilizers were mixted with enough quantity of sand and were added around the plants after 1 month from transplanting and repeated every 3 weeks. The following treatments were applied:

1. control
2. [Cattle manure (CM)] at rate of 10 m^3 / fed / season (710 cm^3 / plot/ season)
3. 30 g/plot Biogeine = N1
4. 40g/plot Biogeine= N2
5. 50g/plot Biogeine=N3
6. 30g/plot Phosphorine =P1
7. 40g/plot Phosphorine =P2
8. 50g Phosphorine= P3
9. 30g/plot Potassiumag=K1
10. 40g/plot Potassiumag= K2
11. 50g/plot Potassiumag= K3
12. N1 + P1 + K1
13. N2 +P2 + K2
14. N3 +P3 +K3

The experiment was designed, as a complete randomized blocks as described by Snedecor and Cochran (1982). The treatments were replicated three times in plots, each plot was 3 m^2, and contained 13 plants between then 60cm . All plants were fertilized every season with ammonium nitrate (33% N) 200 kg/fed. in two doses at after about 30 days from transplanting and second one after the first about one month. Calcium super phosphate at 200 kg/fed. was added during preparing of the soil.

Data on plant height (cm), fresh and dry weight of leaves (g/plant), fresh weight of flower(g), number of capsules (g) and fresh and dry weight of capsules(g), and yield of seeds (g / plant) and per capsule (g) for each treatment were recorded. Data were subjected to statistical analysis according to Sndecor and Cochran (1982). Using L.S.D. method for comparing between maens of treatments.

Chemical analysis:

Plant samples were analyzed to determine the total carbohydrates in the dried seeds using the method described by Herbert *et al* (1971). Nitrogen, phosphorus and potassium contents were determined in seeds by the methods of Piper, (1947). Protein content and fixed oil of seeds were determined adopting to the method of A.O.A.C (1995). Fixed oil was extracted from seeds by using Soxhlet apparatus The oil percentage was determined. G.L.C analysis of fixed oil was carried our after methylation in the laboratory of M.A.P.R. Dokki according to Kinsella, (1966).

RESULTS AND DISCUSSION

1- Vegetative parameters:-

Data in Table (1) indicated that, plant height, leaf number, leaves number, branches number, fresh & dry weight of leaves, fresh and dry weight of stems of *Oenothera biennis* at vegetative stage were significantly increased with the application of biofertilizers (Biogeine, Phosphorine and Potassiumag) at 30, 40 and 50 gm/plot as compared to control plants in both seasons. Increasing the concentration of biofertilizers from 30 to 40 or 50 gm/plot insignificantly increased these parameters in most cases. However, increasing biofertilizers concentration up to 50gm significantly promoted oenothera growth and produced the highest values of these parameters. Moreover, it was also found that, Biogeine was more effective for stimulating *Oenothera biennis* growth than the other biofertilizers as 50gm of Biogeine and the mixture (N3+P3+K3) produced the maximum response in this respect. These increments might be attributed to the effect of biofertilizers on increasing levels of nutrients in the treated plants which could be interpreted due to cell elongation and cell division. Also, these results may be due to the physiological roles of N, P and K . These results are in agreement with the findings of Harridy *et al.* (1998) on roselle and Attia and Saad (2001) on *Catharanthus roseus* .

2-Flowering parameters:-

Data in Table (2) showed that, spraying *Oenothera biennis* with biofertilizers at different concentration significantly increased number of flowers, flowers fresh & dry weight, capsules number, fresh and dry weight of capsules over untreated plants in both seasons. Increasing Phosphorine up to 50gm or the mixture of

N3+P3+K3 increased the values in this concern as compared to the other concentrations of any treatment in both seasons. Increasing the concentrations of Phosphorine to 50 gm increased all of these parameters in both seasons, but N3+P3+K3 produce the maximum values as compared with any treatment or any concentration. These results are in agreement with the findings of Abdou and El-Sayed (2002) on caraway, Agamy (2004) on sweet fennel, Toaima. (2005) on *Achillea millefolium*, L. and Abd- Allah (2006) on *Tanacetum vulgare* .

Seeds yield:-

Data presented in Table (2) showed significant increase in the seeds yield (g/plant, g/capsule and kg/fed.) of *Oenothera* plants after treating with biofertilizers and organic manure over the untreated plants. Generally, increasing the concentration of biofertilizers resulted in gradual increments in the yield of seeds. The maximum value was found with the highest concentration of Potassiumag (50 gm/plot). From the above results, it could be concluded that, application of biofertilizers at the high levels especially Phosphorine (P3) increased the flowering parameters as a result of increasing vegetative growth due to applying Biogeine and Potassiumag as led to increase seeds yield. These results are in agreement with those of Abdou and El-Sayed (2002) on caraway, Agamy (2004) on sweet fennel plants, Toaima. (2005) on *Achillea millefolium*, L. and Abd-Allah (2006) on *Tanacetum vulgare* plants.

4- Total carbohydrates (%):-

The different concentrations of plant extracts showed increase in the total carbohydrates % in the seeds of *Oenothera biennis* in both seasons. (Table, 3). Further more, concentration of biofertilizers up to 50 gm/plot realized the favorable response for the accumulation of carbohydrate in both seasons. In this concern, Attia and Saad (2001),on *Catharanthus roseus* plants, Khater (2001) on caraway plants and Abdou (2003) on *Chrysanthemum morifolium* attained similar results.

5- Protein and nitrogen (%):-

Using the treatments of biofertilizers at different concentrations led to increase the total protein % in the seeds in both seasons as compared to the untreated plants (Table, 3). The high concentration of biofertilizers gave the highest total protein. Also, increasing the concentration of biofertilizers and the mixture of N3+P3+K3 increased the nitrogen % to maximum values in both seasons. In other words, production of the protein was parallel with nitrogen biosynthesis are in *Oenothera* plants as a result of biofertilizers application. These results in agreement with those of Hasaouna *et al.* (1994) on alfalfa, Aboud (2000) on *Cassia obovata and* Khalil and EL-Aref (2001) on wheat .

6- Phosphorus %:

Phosphorus % increased as result of treating with biofertilizers in comparison with untreated plants (Table, 3). The phosphorus % increased with increasing the concentration of biofertilizers. The best treatment in this concern was with P3 and the mixture of N3+P+K3 at in both seasons.

Table (1): Effect of Biofertilizers on vegetative growth of *Oenothera biennis.*

Treatments	Plant height		Branch number		Leaves number		Leaves F.W		Leaves D.W		Stem F.W		StemD.W	
	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S
Control	112.67	115.67	2.00	2.02	104.50	106.00	83.33	88.33	20.83	22.33	80.00	80.00	18.50	18.11
Biogen(30g)(N1)	132.67	134.67	8.00	7.67	130.33	132.64	125.33	128.00	25.50	27.00	140.21	142.30	28.00	29.01
Biogen(40g)(N2)	134.70	137.67	8.00	8.33	137.50	139.90	128.00	132.00	26.63	28.64	145.32	148.37	29.60	31.32
Biogen(50g)(N3)	138.33	138.33	9.00	9.50	145.65	148.50	137.00	140.00	28.40	31.33	160.65	153.60	32.21	32.50
Phosphorin (30g)(P1)	129.00	132.00	6.00	6.33	112.50	115.23	102.50	110.00	21.40	25.23	132.00	138.50	26.40	27.85
Phosphorin (40g)(P2)	131.00	134.00	7.00	7.33	120.00	125.33	111.33	118.30	23.69	27.67	136.00	139.60	27.20	29.60
Phosphorin (50g)(P3)	133.33	136.00	8.00	8.50	127.00	129.33	118.60	121.67	25.60	30.00	140.30	140.25	28.60	30.20
Potassiumag(30g)(K1)	120.50	119.67	4.67	4.00	108.33	108.33	92.33	94.00	21.50	22.67	128.00	133.50	25.60	27.35
Potassiumag(40g)(K2)	123.33	122.67	6.67	3.67	119.50	121.67	101.30	105.00	23.00	24.67	134.00	136.67	26.80	28.60
Potassiumag(50g)(K3)	128.67	126.00	7.00	6.00	125.33	126.67	115.32	117.33	25.00	27.36	137.45	140.20	27.40	30.50
N1+P1+K1	135.67	136.00	7.00	6.85	145.67	148.30	145.30	150.20	29.68	30.50	145.30	155.60	29.00	32.60
N2+P2+K2	138.00	139.00	8.50	8.80	148.33	152.45	151.50	154.00	32.82	34.25	156.80	158.49	31.20	33.54
N3+P3+K3	141.33	142.33	10.33	10.50	158.42	162.26	160.00	159.60	35.60	35.00	167.89	164.00	33.40	33.00
Organic	136.00	138.33	9.67	9.00	145.67	145.00	142.00	143.00	28.50	29.80	155.00	158.66	31.00	32.60
L.S.D at 0.05%	11.79	18.11	5.33	5.51	25.80	24.90	40.05	39.04	4.88	4.19	58.30	55.27	9.91	10.33

Table (2): Effect of Biofertilizers on flowers, capsules and seeds of *Oenothera biennis*

Treatments	Flowers number		Flowers F.W		Flowers D.W		Capsules number/ plant		Capsules F.W		Capsules D.w		Seeds weight / plant(gm)		Seeds weight / capsule		Seed yield / Fed.(kg)	
	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S
Control	92.67	80.00	10.33	10.50	2.20	2.50	195.00	198.00	90.33	97.33	36.33	39.33	23.50	25.33	0.12	0.13	394.80	425.60
Biogen(30g)(N1)	95.33	81.67	13.50	16.20	3.24	3.84	196.00	198.00	92.50	105.00	37.72	44.10	24.00	27.75	0.12	0.14	403.20	466.20
Biogen(40g)(N2)	96.50	83.33	14.40	18.26	3.60	4.50	198.00	200.00	95.63	112.30	40.85	48.16	26.00	30.75	0.13	0.15	436.80	516.60
Biogen(50g)(N3)	98.00	86.50	17.64	21.50	4.59	5.67	203.00	206.00	110.00	115.20	49.50	51.75	32.34	33.66	0.16	0.16	543.31	565.49
Phosphorin (30g)(P1)	112.00	99.20	22.40	19.80	5.28	4.56	212.00	210.00	129.67	117.00	54.18	49.14	34.02	30.87	0.16	0.15	571.54	518.62
Phosphorin (40g)(P2)	118.00	107.67	28.32	24.61	7.00	6.00	218.30	221.00	135.33	138.00	58.05	59.34	37.12	37.76	0.17	0.17	623.62	634.37
Phosphorin (50g)(P3)	125.60	120.33	32.50	30.00	8.64	8.10	222.54	228.00	138.52	139.35	62.10	62.55	40.92	40.92	0.18	0.18	687.46	687.46
Potassiumag(30g)(K1	96.00	83.00	19.20	16.60	4.56	3.84	220.14	232.50	140.25	145.00	58.80	60.90	36.54	38.37	0.17	0.17	613.87	644.62
Potassiumag(40g)(K2	98.50	87.00	22.52	19.14	5.50	4.75	226.58	236.50	145.36	148.69	62.35	63.64	39.68	40.32	0.18	0.17	666.62	677.38
Potassiumag(50g)(K3	100.00	87.30	25.30	21.75	6.75	5.67	230.00	239.00	149.78	152.25	67.05	68.40	44.22	44.88	0.19	0.19	742.90	753.98
N1+P1+K1	115.00	98.50	24.00	20.30	5.76	4.80	233.00	239.58	152.78	153.00	63.84	64.26	39.69	40.32	0.17	0.17	666.79	677.38
N2+P2+K2	121.00	114.00	27.83	25.08	6.85	6.25	238.00	241.00	155.00	155.25	66.65	67.00	42.24	42.88	0.18	0.18	709.63	720.38
N3+P3+K3	128.00	125.40	33.28	32.50	8.91	8.64	240.20	245.12	158.00	160.87	71.10	72.00	46.86	47.52	0.20	0.19	787.25	798.34
Organic	120.50	121.33	21.50	21.00	6.50	6.04	235.12	238.25	148.00	151.00	66.60	67.95	41.58	42.21	0.18	0.18	698.54	709.13
L.S.D at 0.05%	2.03	1.77	2.47	4.58	1.18	1.41	1.40	1.91	1.64	6.03	1.11	3.23	1.78	1.52				

Table (3): Effect of Biofertilizers on carbohydrates, protein, N%, P%, and K% of *Oenothera biennis.*

Treatments	Total carbohy-drates in seeds		Protein in seeds		N% in seeds		P% in seeds		K% in seeds	
	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S	F.S	S.S
Control	11.11	11.85	9.62	10.21	1.54	1.78	0.99	0.77	0.80	1.04
Biogen(30g)(N1)	11.97	12.37	11.27	11.94	2.81	2.91	1.10	0.79	0.92	1.14
Biogen(40g)(N2)	14.23	13.59	11.65	12.79	2.87	3.05	1.19	0.99	1.06	1.28
Biogen(50g)(N3)	15.46	14.71	12.95	13.38	3.08	3.15	1.26	1.24	1.32	1.45
Phosphorin (30g)(P1)	13.12	13.67	12.80	14.56	2.06	2.33	2.18	2.19	1.11	1.12
Phosphorin (40g)(P2)	13.52	14.24	13.84	14.64	2.24	2.35	2.30	2.20	1.20	1.26
Phosphorin (50g)(P3)	14.70	15.75	13.94	15.01	2.99	2.41	2.47	2.47	1.81	1.87
Potassiumag(30g) (K1)	12.20	12.75	11.10	12.16	1.77	1.95	1.02	1.02	2.01	2.16
Potassiumag(40g) (K2)	12.76	13.40	11.25	12.90	1.81	2.06	1.09	1.16	2.14	2.41
Potassiumag(50g) (K3)	13.56	14.64	13.56	13.81	1.86	2.12	1.16	1.25	2.40	2.59
N1+P1+K1	13.49	13.91	13.77	13.47	2.88	2.99	2.14	2.04	1.96	2.19
N2+P2+K2	16.87	15.18	14.16	15.34	2.95	3.15	2.24	2.17	2.10	2.33
N3+P3+K3	19.13	16.36	16.51	17.96	3.17	3.24	2.84	2.86	2.88	2.81
Organic	11.63	12.37	10.07	11.70	2.62	1.88	1.05	1.13	1.85	2.08
L.S.D at 0.05%	0.52	0.02	0.02	0.02	0.01	0.02	0.02	0.26	0.02	0.02

F.S = First season S.S = Second season

7- Potassium %:-

Generally, all concentrations of potassiumag gradually increased the potassium % in the seeds of *Oenothera biennis* over untreated plants, The maximum value was recorded with treating plants with the high concentration of K and the N3+P+K3 (Table, 3). In this respect Harridy *et al.* (2001) on lemongrass, Khater (2001) on caraway Abd EL-Latif *et al.* (2002) on *Matricaria chamomilla*, Abdou (2003) on *Chrysanthemum morifolium*, Hamed (2004) on *Sallvia officinalis* and *Origanum syriacum and* Toaima (2005) on *Achillea millefolium*, L. attained similar results.

8-Fixed oil %:-

It is evident that, the percentage of total lipids increased with the application of phosphorine (P3) and mixture of N3+P+K3. Increasing the concentrations up to 50 gm/3m^2 of biofertilizers increased the accumulation of fixed oil in the seeds of *Oenothera biennis* more than with the other treatments in both seasons . The yield of fixed oil (per individual plant) showed the same trend as the percentage of fixed oil,

(Table, 4 and Figs. 1, 2 and 3) . Similar results were obtained by Abdel-Kader and Ghaly (2003) on coriander, Ghadban *et. al.,* (2003,b) on *Ricinus communis* L. and Salman (2004) on *Ocimum basilicum*

9- Fatty acids:-

GLC analysis of methylated fatty acid of *Oenothera biennis* in Table (5) indicated that in control plant, linolic acid was the main fatty acid and accounted by 49.65 %, oleic acid by 18.65 % then palmatic acid by 10.21% and Linolenic acid by 8.02 % of total fatty acids. The total saturated fatty acids accounted by 15.79 %, while, unsaturated one reached 76.32% from total fatty acids.

Application of biofertilization tended to increase the linolic acid, palmatic, oleic and linolenic acid contents. These fatty acids tended to increase with increasing biofertilizer concentrations up to 50 gm/plot. Saturated fatty acids decreased with N1,N2, N3, N1+P1+K1, N2+P2+K2 and N3+P3+K3, while, untreated fatty acids tended to increase as a result of application of biofertilization or organic manure to *Oenothera biennis.*

Table (4): Effect of Biofertilizers on oil%, oil yield/ plant and oil yield/ Fed. of *Oenothera biennis.*

Treatments	Oil % in seeds		Oil yield /plant(gm)		Oil yield/Fed.(kg)	
	F.S	S.S	F.S	S.S	F.S	S.S
Control	6.71	7.05	1.58	1.78	26.50	29.99
Biogen(30g)(N1)	6.78	7.53	1.63	2.09	27.34	35.12
Biogen(40g)(N2)	7.99	8.88	2.08	2.73	34.90	45.87
Biogen(50g)(N3)	10.10	11.22	3.27	3.78	54.86	63.45
Phosphorin (30g)(P1)	7.59	8.44	2.58	2.61	43.40	43.77
Phosphorin (40g)(P2)	13.59	15.10	5.04	5.70	84.75	95.79
Phosphorin (50g)(P3)	15.78	17.53	6.46	7.17	108.48	120.53
Potassiumag(30g)(K1)	9.48	10.53	3.46	4.04	58.20	67.90
Potassiumag(40g)(K2)	13.23	14.70	5.25	5.93	88.19	99.57
Potassiumag(50g)(K3)	14.36	15.95	6.35	7.16	106.68	120.28
N1+P1+K1	15.91	16.66	6.31	6.72	106.09	112.85
N2+P2+K2	16.03	17.27	6.77	7.40	113.78	124.39
N3+P3+K3	17.57	19.53	8.23	9.28	138.34	155.89
Organic	12.94	14.38	5.38	6.07	90.41	101.99
L.S.D at 0.05%	0.05	0.05	0.05	0.29	0.21	4.52

F.S = First season S.S = Second season

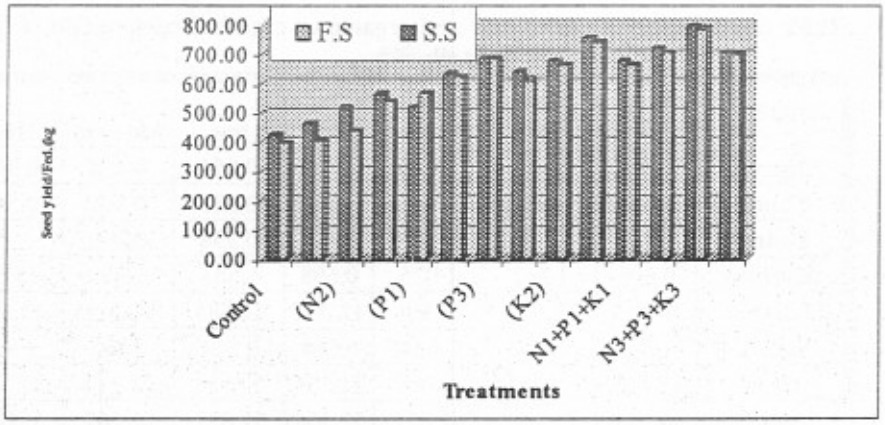

Fig.(1): Effect of cattle manure and biofertilization on seed yield/fed.

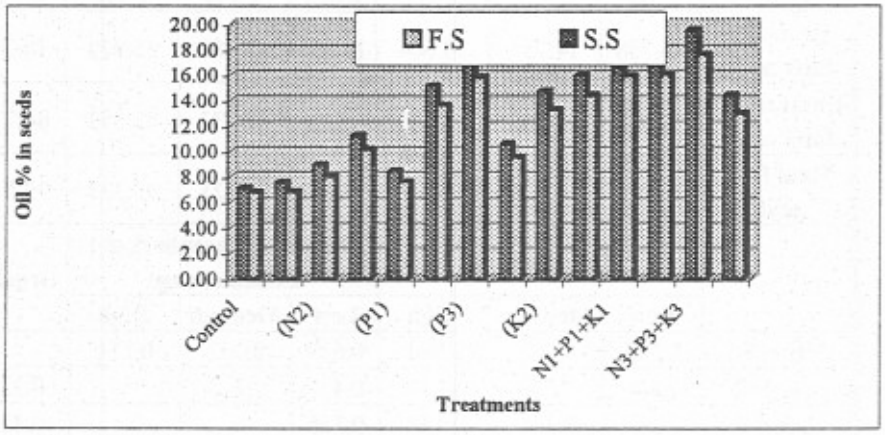

Fig.(2): Effect of cattle manure and biofertilizers on oil%

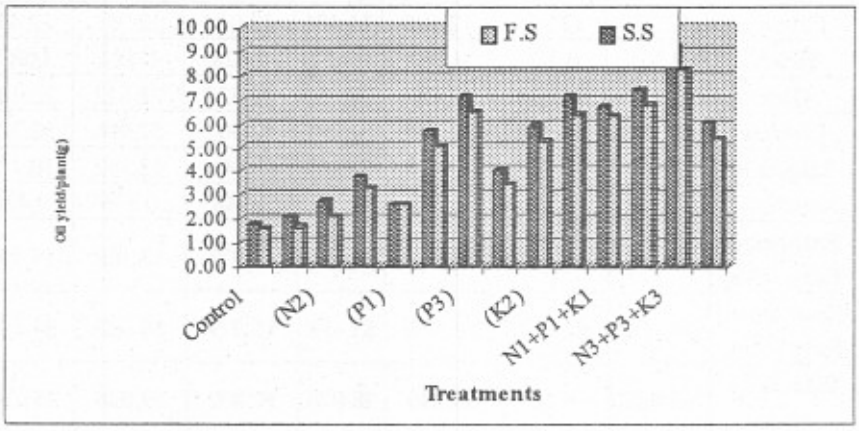

Fig.(3) Effect of cattle manure and biofertilizers on oil yield /fed.

Table (5): Effect of bio fertilizers and organic on chemical composition of fixed oil in *Oenothera biennis* oil:

Component	Control	N			P		
		low	Medium	High	low	Medium	High
Caprylic	1.254	0.361	0.215	-	0.954	0.498	0.468
Capric	1.383	-	-	-	0.652	0.461	0.349
Lauric	1.032	-	-	-	0.398	0.260	-
Myristic	0.894	1.247	1.025	0.698	1.581	1.365	1.095
Palmitic	10.213	11.325	11.698	12.351	11.685	12.021	12.524
Stearic	0.214	0.864	0.654	0.584	0.264	0.105	-
Oleic	18.652	19.257	20.054	21.574	20.834	21.112	21.549
Linoleic	49.651	51.369	51.857	52.364	51.032	51.142	52.084
Linolenic	8.021	9.541	10.005	11.298	10.367	11.098	11.138
Arachidic	0.798	0.957	1.012	0.873	1.354	1.262	0.309
Saturated fatty acids	15.788	14.754	14.604	14.506	16.888	15.972	14.745
Unsaturated fatty acids	76.324	80.167	81.916	85.236	82.233	83.352	84.771
Total fatty acids	92.112	94.921	96.52	99.742	99.121	99.324	99.516
	Potassiumage			Biogene + Phosphorine + Potassiumage			Organic
	Low	Medium	High	Low	Medium	High	
Caprylic	1.584	1.982	1.384	0.679	0.352	0.211	-
Capric	0.564	0.658	0.257	0.456	0.125	-	0.325
Lauric	0.365	0.335	0.128	0.355	-	-	0.439
Myristic	-	-	0.354	-	-	-	0.563
Palmitic	12.257	12.365	12.685	11.486	12.024	12.051	12.431
Stearic	0.365	0.586	0.489	0.657	0.824	0.524	0.967
Oleic	18.954	19.684	20.587	20.354	21.322	21.612	22.187
Linoleic	50.698	51.658	52.361	51.981	52.601	52.908	52.321
Linolenic	9.954	10.365	10.638	11.163	12.006	12.142	10.125
Arachidic	1.245	1.562	0.365	0.945	0.548	0.376	0.428
Saturated fatty acids	16.38	17.488	15.662	14.578	13.873	13.162	15.153
Unsaturated fatty acids	79.606	81.707	83.586	83.498	85.929	86.662	84.633
Total fatty acids	95.986	99.195	99.248	98.076	99.802	99.824	99.786

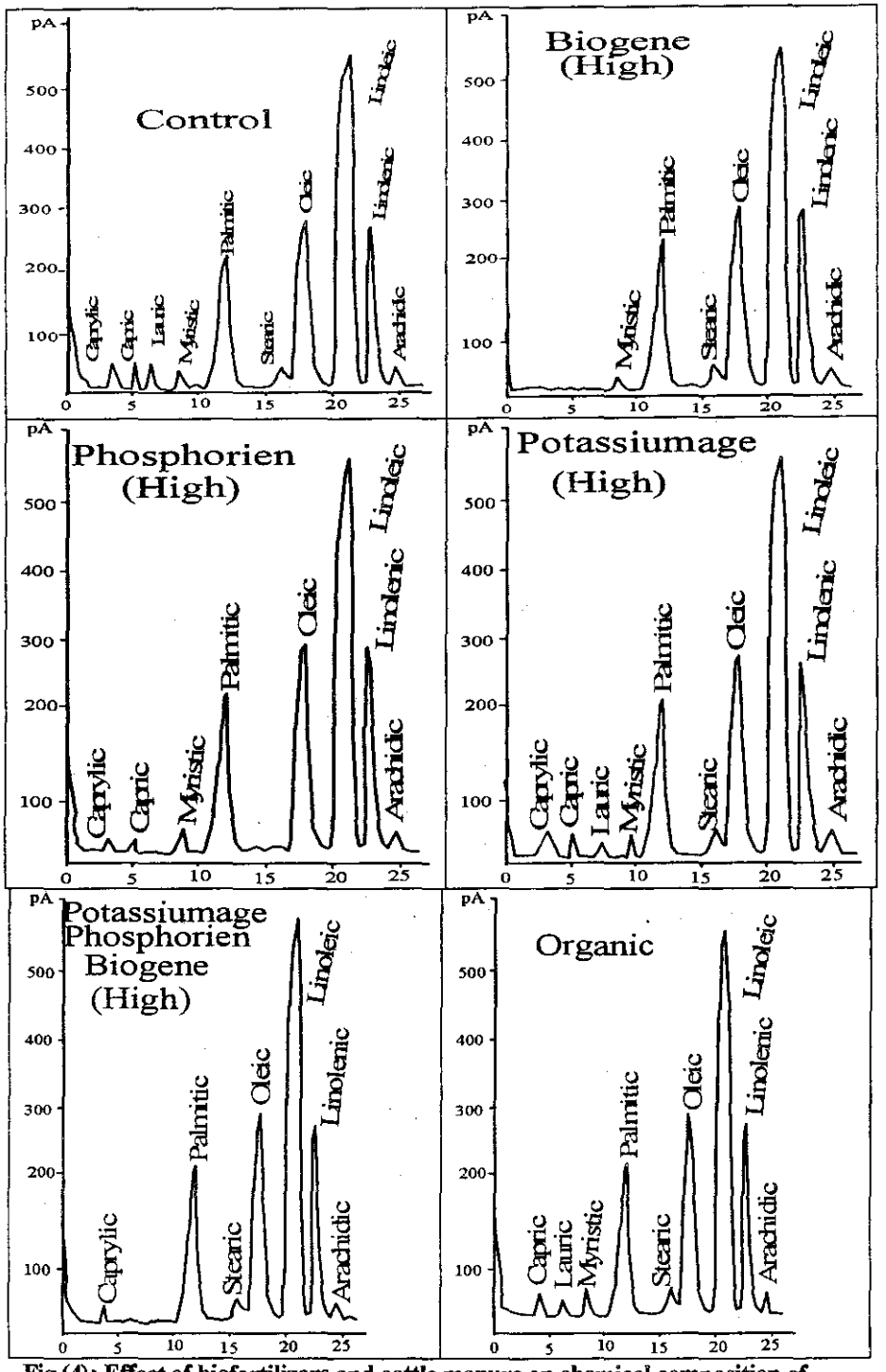

Fig.(4): Effect of biofertilizers and cattle manure on chemical composition of fixed oil in *Oenothera biennis* oil.

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تأثير التسميد الحيوي والعضوي على النمو والمحصول والمكونات الكيماوية على نبات الأونيثرا

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** مركز البحوث الزراعية- معهد بحوث البساتين – قسم النباتات الطبية والعطرية

أجرى هذا البحث بمزرعة كلية الزراعة – بمشتهر – جامعة بنها خلال موسمين ٢٠٠٤ /٢٠٠٥ – ٢٠٠٥ /٢٠٠٦ لدراسة تأثير إضافة الأسمدة الحيوية والعضوية على نمو ومحصول البذرة ومكونات الزيت الثابت من أحماض دهنية لنبات الاونثرا.

وقد تم دراسة تأثير البيوجين كمثبت للنيتروجين و الفوسفورين كمذيب للفوسفور والبوتاسيوماج كميسر للبوتاسيوم وكان ذلك بثلاث تركيزات (٣٠ و ٤٠ و ٥٠ جم/حوض) كما استخدم التسميد العضوى معدل ١٠م^3 سماد ماشية/ للفدان / موسم. وقد أوضحت النتائج ما يلي:

ادت المعاملة بالبيوجين الى زيادة جميع القياسات الخضرية والمعاملة بالفوسفورين الى زيادة جميع القياسات الزهرية وكذلك المعاملة بالبوتاسيوماج الى زيادة محصول البذرة ومكوناتها من الزيت الثابت بالاضافة لزيادة مكوناتها من البروتين والكربوهيدرات وكذلك ال N P K . كما ان استخدام التركيزات المرتفعة من الأسمدة الحيوية (٥٠جم/ حوض) قد أدى الى الحصول على أعلى ازهار وكبسولات وبذرة وزيت ثابت.وادى استخدام الخليط منهم الى زيادة النمو الخضرى حيث اعلى ارتفاع للنبات وعدد اوراق ولكن أعطى التركيز الاعلى من المخلوط ($N_3+P_3+K_3$) احسن النتائج. كما اوضح التحليل الكروماتوجرافى وجود زيادة الزيت الثابت بالمعاملة بالاسمدة الحيوية اعلى من الكنترول بالنسبة للأحماض المشبعة والغير مشبعة.