RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

4.1. First experiment :

Effect of biofertilizers application on vegetative growth, chemical constituents, flowering, yield and fruit quality of sweet peppers.

4.1.1. Effect of biofertilizer treatments on vegetative growth :

Data on plant growth 70 days after transplanting (Table, 1), shows that all biofertilizer treatments significantly increased plant growth over the control when no bio or chemical fertilizers were added . Data also show that adding a mixture of Nitrobin + Phosphorin was able to save 25 % of chemical N and P fertilizers required for plant growth . Therefore , Nitrobin + Phosphorin + 3/4 N + 3/4 P + K (treatment No.15) gave the highest values regarding plant height, stem diameter , number of leaves , leaf area as compared with all treatments , in both seasons . Concerning dry weight ; plants received mixture biofertilizer of Nitrobin + Phosphorin + 3/4 N + 3/4 P + K (treatment No. 15) also gave the highest dry weight followed by those which received the full dose of NPK without biofertilizers (treatment No. 16)or those that received Nitrobin +Phosphorin + 1/2 N + 1/2 P + K . (treatment No.14) , as showen in both seasons of 2000 and 2001 . Data on plant fresh weight (Table, 1) show that

Table(1): Vegetative growth of sweet pepper at flowering stage (70 days after transplanting) as affected by biofertilizer treatments during the summer seasons of 2000 & 2001 .

	Treatments / Characters Biofertilizer + Chemical	Plant height cm	Stem diamter cm	Number of leaves/plant	Leaf area cm^2/plant	Fresh weight g/plant	Dry weight g/plant
	First season (2000)						
1	Nitrobin only	19.77 I	0.5 E	82.56 H	762.5 K	68.42 G	21.21 J
2	Nitrobin +PK	21.50 GH	0.6 D	88.50 G	859.5 I	79.68 F	25.14 HI
3	Nitrobin +1/4N+PK	22.77 EF	0.6 D	93.25 F	882.5 GH	85.04 DE	27.63 FG
4	Nitrobin +1/2N+PK	25.50 C	0.8 B	104.20 D	964.3 D	91.47 ABC	31.21 CD
5	Nitrobin +3/4N+PK	26.27 C	0.9 A	107.50 C	991.0 C	91.93 ABC	32.07 C
6	Phosphorin only	19.75 I	0.5 E	69.75 I	746.0 L	69.38 G	21.51 J
7	Phosphorin +NK	22.77 EF	0.6 D	93.01 F	878.5 H	81.33 EF	26.12 GH
8	Phosphorin +1/4P+NK	23.75 D	0.7 C	94.26 F	903.3 F	87.60 CD	29.57 DE
9	Phosphorin +1/2P+NK	25.52 C	0.7 C	97.64 E	925.3 E	88.18 BCD	29.79 DE
10	Phosphorin +3/4P+NK	26.00 C	0.8 B	106.50 CD	992.5 C	91.89 ABC	32.29 C
11	Nitrobin+Phosphorin	20.77 H	0.5 E	83.01 H	810.3 J	77.96 F	24.17 I
12	Nitr.+Phosph.+K	22.00 FG	0.6 D	90.13 G	861.8 I	79.96 F	25.42 HI
13	Nitr.+Phosph.+1/4N+1/4P+K	23.52 DE	0.7 C	94.00 F	887.0 G	87.13 CD	29.02 EF
14	Nitr.+Phosph.+1/2N+1/2P+K	27.50 B	0.9 A	114.80 B	1001.0 B	92.75 AB	35.13 B
15	Nitr.+Phosph.+3/4N+3/4P+K	28.52 A	0.9 A	121.30 A	1051.0 A	93.40 A	36.96 A
16	Not added +NPK	27.50 B	0.9 A	114.50 B	1007.0 B	93.44 A	35.58 AB
17	Control(without)	17.82 J	0.4 F	66.75 J	522.5 M	61.22 H	18.17 K
	Second season (2001)						
1	Nitrobin only	20.75 J	0.7 F	87.0 I	812.5 K	79.0 G	25.31 J
2	Nitrobin +PK	22.50 HI	0.8 E	93.50 H	909.5 I	89.6 F	29.15 HI
3	Nitrobin +1/4N+PK	23.75 FG	0.8 E	97.78 G	932.5 GH	94.9 DE	31.78 FG
4	Nitrobin +1/2N+PK	26.50 CD	1.0 C	109.00 E	1042.0 C	101.4 ABC	35.60 CD
5	Nitrobin +3/4N+PK	27.25 C	1.1 B	112.00 D	1041.0 C	102.4 AB	36.71 C
6	Phosphorin only	20.75 J	0.7 F	74.75 J	796.0 L	79.3 G	25.37 J
7	Phosphorin +NK	23.75 FG	0.8 E	97.50 G	928.5 H	91.2 EF	30.20 GH
8	Phosphorin +1/4P+NK	24.75 E	0.9 D	99.28 G	953.3 F	97.5 CD	33.88 DE
9	Phosphorin +1/2P+NK	26.00 D	0.9 D	102.00 F	975.2 E	98.1 BCD	34.11 DE
10	Phosphorin +3/4P+NK	27.00 C	1.0 C	111.50 D	1014.0 D	102.3 AB	36.96 C
11	Nitrobin+Phosphorin	21.75 I	0.7 F	87.50 I	860.3 J	87.8 F	28.11 I
12	Nitr.+Phosph.+K	23.00 GH	0.8 E	95.00 H	911.8 I	89.8 F	29.46 HI
13	Nitr.+Phosph.+1/4N+1/4P+K	24.50 EF	0.9 D	98.50 G	937.0 G	97.0 CD	33.28 EF
14	Nitr.+Phosph.+1/2N+1/2P+K	28.25 B	1.1 B	115.00 C	1046.0 C	102.7 AB	39.90 B
15	Nitr.+Phosph.+3/4N+3/4P+K	29.50 A	1.2 A	125.80 A	1101.0 A	105.0 A	42.60 A
16	Not added +NPK	28.50 B	1.1 B	119.50 B	1057.0 B	103.4 A	40.38 B
17	Control(without)	18.80 K	0.6 G	71.25 K	572.5 M	71.1 H	21.80 K

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

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treatments (No.4, 5, 9, 10, 14, 15 and 16) gave similar and higher fresh weight as compared with all other treatments . It means that , plants supplied with 100% NPK without biofertilizers or with 50 or 75% of the N requirments + Nitrobin or with 50 or 75% of the P requirments + Phosphorin or with 50 or 75% each of the N and P + Nitrobin + Phosphorin gave a higher fresh weight per plant compared to other treatments. Moreover, the high N-fertilizer level either in the bioform (Nitrobin) or in the chemical form $(NH_4)_2SO_4$ was associated with the high fresh weight but not with dry weight . Data also show that plants supplied with a mixed biofertilizer (Nitrobin + Phosphorin) treatment No. 11 , had better plant growth (plant height , number of leaves , leaf area , fresh and dry weight) than those which received a single biofertilizer; either Nitrobin only or Phosphorin only ; treatments No.1 and 6 , respectively . This trend was true in both seasons .

These results are in harmony with those of Bopaiah and Khader (1989) on sweet pepper, Monib et al . (1990) on tomato and Paramaguru and Natarajan (1993) on capsicum, who found that plant growth was increased by inoculation with *Azotobacter sp* . and *Azospirillum* . The Nitrobin used for inoculating seeds and seedlings grown in this study includs a mixture of free living bacteria such as *Azotobacter* and *Azospirillum* . Barakat and Gabr (1998) also indicated the favourable role of inoculating tomato seedlings with free living bacteria of *Azotobacter sp* . , *Azospirillum sp . and Klebsiella sp.* They also found that adding 100 kg N / fed . plus mixed or single biofertilizer of one or more of the three genera of the free living bacteria resulted a larger and heavier plant growth expressed as dry weight . The superiorlty of plants that received 1/2 or 3/4 N + P and K + Nitrobin (treat. No.4 and 5) was true in both seasons but only for fresh weight and not for dry weight . This result may be referred to the role of N on increasing moisture content of vegetative parts .

Many investigators mentioned the favourable role of inoculating seeds with phosphorus dissolving bacteria (PDB) on plant growth, among them Radwan (1983) and Saber and Gomaa (1995) on tomato . The increase in plant growth of sweet pepper plants supplied with Phosphorin + 3/4 P + NK is in complete agreement with the results of Hewedy (1999) on tomato using Phosphorin + NPK .

This superiority in plant growth by inoculating soil or seeds with a mixture of N-free living bacteria + Phosphorus dissolving bacteria is in agreement with the results obtained by Moustafa and Omar (1993) using *Bacillus* and *Azospirillum* , Saber (1993) using Microbin and Gomaa (1995) using *Azospirillum* , *Azotobacter* and *Bacillus* .

This high plant growth of treatment No.15 is in complete agreement with the studies of Ouda (2000) on tomato, he found that adding Phosphorin + Rizobacterin and Microbin to tomato plants which received 75% of the recommended NPK were similar to those which received 100% of the recommended chemical fertilizer. Results here indicates that we can save 25% of the required N and P fertilizer to sweet pepper plants by adding a mixed biofertilizer of Nitrobin + Phosphorin.

The role of N-free living bacteria in production of phytohormones or improving the availability and acquisition of nutrients or by both, may explain the encouraged growth of plants inoculated with these non – symbiotic N-fixing bacteria (Barakat and Gabr , 1998). Furthermore , *Azotobacter* and *Azospirillum* could produce IAA and cytokinins which increased the surface area per unit root length and were responsible for root hair branching with an eventual increase in acquisition of nutrients from the soil (Jain and Patriquim , 1985) .

Concerning plant growth 100 days after transplanting, (Table, 2) data also shows that plants which received 3/4 N + 3/4 P + K + Nitrobin + Phosphorin (treatment No.15) gave the highest plant growth , plant height and stem diameter as compared with all other treatments in the second season and leaf area , fresh and dry weight in both seasons .

Results also show that plants inoculated with a single biofertilizer; Nitrobin or Phosphorin and supplied with 0 , 25 , 50 , or 75% of the required level of N or P (treat's No. 2 , 3 , 4 , 5 or treat's No.7, 8 , 9 , 10 respectively) gave higher growth than

Table(2): Vegetative growth of sweet pepper at the 3 rd picking stage (100 days after transpla
as affected by biofertilizer treatments during the summer seasons of 2000 & 2001 .

	Treatments / Characters	Plant height cm	Stem diamter cm	Leaf area cm^2/plant	Fresh weight g/plant	Dry weight g/plant
	Biofertilizer + Chemical	First season (2000)				
1	Nitrobin only	34.5 HI	1.1 C	2986.0 M	280.3 K	95.36 I
2	Nitrobin +PK	37.5 FG	1.25 B	3387.0 K	317.0 HI	109.0 H
3	Nitrobin +1/4N+PK	40.0 E	1.25 B	3893.0 I	357.8 F	120.0 G
4	Nitrobin +1/2N+PK	44.5 D	1.30 B	4541.0 F	407.0 CD	148.7 D
5	Nitrobin +3/4N+PK	48.0 BC	1.40 A	4782.0 D	425.3 B	164.8 B
6	Phosphorin only	33.5 I	1.00 D	2913.0 N	298.5 J	99.07 I
7	Phosphorin +NK	40.0 E	1.25 B	3588.0 J	342.3 FG	118.2 G
8	Phosphorin +1/4P+NK	43.5 D	1.25 B	3961.0 H	388.3 E	141.1 EF
9	Phosphorin +1/2P+NK	44.0 D	1.25 B	4034.0 G	400.3 DE	145.5 DE
10	Phosphorin +3/4P+NK	47.5 C	1.30 B	4694.0 E	419.0 BC	158.2 C
11	Nitrobin+Phosphorin	36.0 GH	1.10 C	3243.0 L	309.3 IJ	105.5 H
12	Nitr.+Phosph.+K	38.0 F	1.25 B	3439.0 K	333.0 GH	114.5 G
13	Nitr.+Phosph.+1/4N+1/4P+K	40.5 E	1.25 B	3927.0 HI	385.0 E	136.0 F
14	Nitr.+Phosph.+1/2N+1/2P+K	49.7 AB	1.45 A	5108.0 C	430.0 B	167.0 B
15	Nitr.+Phosph.+3/4N+3/4P+K	51.0 A	1.45 A	6000.0 A	466.0 A	188.2 A
16	Not added +NPK	49.5 AB	1.45 A	5230.0 B	432.0 B	168.1 B
17	Control(without)	29.5 J	0.90 E	1898.0 O	186.1 L	61.24 J
		Second season (2001)				
1	Nitrobin only	35.5 GH	1.30 H	3033.0 O	308.5 L	107.7 J
2	Nitrobin +PK	38.5 EF	1.35 G	3436.0 M	327.0 J	115.7 I
3	Nitrobin +1/4N+PK	41.0 D	1.40 F	3940.0 J	355.5 H	127.1 G
4	Nitrobin +1/2N+PK	45.5 C	1.50 D	4592.0 F	417.0 E	156.5 D
5	Nitrobin +3/4N+PK	49.0 B	1.50 D	4829.0 D	435.5 C	173.1 B
6	Phosphorin only	34.5 H	1.20 I	2963.0 P	306.5 L	104.8 J
7	Phosphorin +NK	41.0 D	1.40 F	3635.0 K	352.5 H	125.2 GH
8	Phosphorin +1/4P+NK	44.5 C	1.45 E	4011.0 H	398.5 G	148.8 E
9	Phosphorin +1/2P+NK	45.0 C	1.45 E	4081.0G	410.5 F	153.3 D
10	Phosphorin +3/4P+NK	48.5 B	1.50 D	4744.0 E	429.0 D	166.3 C
11	Nitrobin+Phosphorin	37.0 FG	1.30 H	3290.0 N	319.5 K	112.1 I
12	Nitr.+Phosph.+K	39.0 E	1.40 F	3490.0 L	343.0 I	121.3 H
13	Nitr.+Phosph.+1/4N+1/4P+K	41.5 D	1.45 E	3974.0 I	395.0 G	143.4 F
14	Nitr.+Phosph.+1/2N+1/2P+K	49.0 B	1.55 C	5158.0 C	440.0 BC	175.3 B
15	Nitr.+Phosph.+3/4N+3/4P+K	52.0 A	1.70 A	6359.0 A	476.0 A	196.9 A
16	Not added +NPK	49.0 B	1.65 B	5280.0 B	442.0 B	176.4 B
17	Control(without)	30.5 I	1.10 J	1945.0 Q	196.0 M	66.4 K

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

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Table(4): Mineral nutrients uptake (mg element/plant) in vegetative growth and chlorophyll content (mg/100g) in leaves of sweet pepper at flowering stage (70 days after transplanting) as affected by biofertilizer treatments during the summer season of 2001.

Treatments	Characters: Biofertilizer + Chemical	mg N/plant: Leaves	mg N/plant: Stem	mg N/plant: Total	mg P/plant: Leaves	mg P/plant: Stem	mg P/plant: Total	mg K/plant: Leaves	mg K/plant: Stem	mg K/plant: Total	Chlorophyll A mg/100g	Chlorophyll B mg/100g	Total chlorophyll mg/100g
1	Nitrobin only	240.4 JK	195.2 I	435.6 LM	29.8 FG	29.6 EF	59.4 FG	425.5 M	401.1 K	826.6 N	78.60 K	32.40 DE	111.0 IJ
2	Nitrobin +PK	264.0 I	207.0 H	471 K	49.2 CD	39.6 CDE	88.8 D	606.5 K	528.2 I	1134.7 L	84.90 IJ	35.10 BCDE	120.0 H
3	Nitrobin +1/4N+PK	381.2 G	265.6 G	646.8 I	55.8 C	42.9 BCD	98.7 D	718.7 I	584.3 G	1303 I	95.70 FG	40.30 ABCD	136.0 E
4	Nitrobin +1/2N+PK	487.7 D	318.8 D	806.5 E	70.9 AB	50.4 AB	121.3 BC	1005.8 E	727.9 D	1733.7 E	102.0 BCD	44.00 AB	146.0 CD
5	Nitrobin +3/4N+PK	539.2 B	344.6 BC	883.8 C	80.0 A	55.0 A	135 A	1160.3 C	805.1 B	1965.4 C	104.0 ABC	45.00 AB	149.0 BC
6	Phosphorin only	227.6 K	188.8 I	416.4 M	31.5 EFG	30.7 EF	62.2 F	442.6 LM	435.2 J	877.8 M	77.90 K	32.10 DE	110.0 J
7	Phosphorin +NK	377.6 G	263.8 G	641.4 I	40.2 DE	35.1 DE	75.3 E	698.7 I	574.3 G	1273 J	91.40 GH	38.60 ABCD	130.0 F
8	Phosphorin +1/4P+NK	455.7 E	302.8 E	758.5 G	66.8 B	48.4 ABC	115.2 C	933.0 G	691.5 E	1624.5 G	97.60 DEF	41.40 ABCD	139.0 E
9	Phosphorin +1/2P+NK	474.1 D	312.0 DE	786.1 F	70.1 AB	50.0 AB	120.1 BC	967.8 F	708.9 DE	1676.7 F	100.7 CDE	43.30 ABC	144.0 D
10	Phosphorin +3/4P+NK	554.2 B	352.1 B	906.3 B	76.1 A	53.0 A	129.1 AB	1098.7 D	774.3 C	1873 D	104.0 ABC	45.00 AB	149.0 BC
11	Nitrobin+Phosphorin	249.2 IJ	199.6 I	448.8 L	33.7 EFG	31.8 EF	65.5 EF	447.7 L	445.5 J	893.2 M	81.80 JK	33.20 CDE	115.0 I
12	Nitr.+Phosph.+K	285.7 H	217.8 H	503.5 J	38.8 EF	34.4 DE	73.2 E	658.0 J	554.0 H	1212 K	87.60 HI	37.40 ABCD	125.0 G
13	Nitr.+Phosph.+1/4N+1/4P+K	433.3 F	291.6 F	724.9 H	64.4 BC	47.2 ABC	111.6 C	873.2 H	661.6 F	1534.8 H	96.90 EF	41.10 ABCD	138.0 E
14	Nitr.+Phosph.+1/2N+1/2P+K	521.7 C	335.8 C	857.5 D	81.7 A	55.8 A	137.5 A	1182.9 B	816.4 AB	1999.3 B	105.0 ABC	45.00 AB	150.0 ABC
15	Nitr.+Phosph.+3/4N+3/4P+K	600.4 A	375.2 A	975.6 A	82.6 A	56.3 A	138.9 A	1218.1 A	834.0 A	2052.1 A	108.0 A	46.00 A	154.0 A
16	Not added +NPK	553.4 B	351.7 B	905.1 B	80.8 A	55.4 A	136.2 A	1193.3 B	821.6 AB	2014.9 B	106.0 AB	46.00 A	152.0 AB
17	Control(without)	134.4 L	118.9 J	253.3 N	27.0 G	24.0 F	51 G	246.3 N	120 L	366.3 O	66.50 L	26.50 E	93.0 K

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

Generally, data show that inoculating plants with Nitrobin and/or Phosphorin significantly increased NPK uptake of plant foliage 70 days after transplanting and this increase was significant and gradual with increasing levels of N and/or P application from 25%, 50% upto 75% of each element. Therefore, the maximum NPK uptake was obtained from (treatment No.15) when plants inoculated with Nitrobin + Phosphorin and fertilized with 3/4 N +3/4 P +K in both seasons. This means that we can save 25% of the required nitrogen and phosphorus fertilizers by inoculating seeds and transplants before growing with a mixed biofertilizer (Nitrobin + Phosphorin). This trend was true in both seasons and results could be referred to the role of Nitrobin and Phosphorin on the availability of soil nitrogen and phosphorus.

On the other hand, plants supplied with N, P and K in the mineral form without any biofertilizers (treatment No.16) accumulated less N and K in leaves and stem as compared with plants supplied with a mixed biofertilizer + 3/4 N +3/4 P + K (treatment No.15). Results are confirmed with those indicated by Monib *et al.* (1990), Sorial *et al.* (1992), Gomaa (1995) on tomato , Poi (1998) on chili and tomato and Ouda (2000) on tomato who mentioned the favorable role of Nitrobin (*Azotobacter* or *Azospirillum*) and Phosphorin on both N and P uptake by plant roots.

Concerning the effect of biofertilizer treatments on chlorophyll content in leaves, (Tables, 3&4) data shows that treatments (No.5, 10, 12, 13, 14, 15 and 16) gave similar and higher chlorophyll A, treatments (No.3, 4, 5, 7, 8, 9, 10, 12, 13, 14, 15 and 16) gave similar and higher chlorophyll B. This means that plants inoculated with Nitrobin and / or Phosphorin had high chlorophyll content with respect to total chlorophyll content. Therefore, treatments No.14, 15 and 16 gave similar and higher total chlorophyll as compared with all other treatments, as shown in both seasons. Moreover, a mixed biofertilizer treatment No.11 and a single biofertilizer (treatments No.1 and 6), significantly increased chlorophyll A and total chlorophyll over the control when no bio or chemical fertilizers were added, with no significant differences in chlorophyll B as shown in both seasons.

Results are in harmony with Barakat and Gabr (1998) on tomato plants, who indicated a significant increase in leaf chlorophyll content of plants with increasing N applied rate up to 100 kg N / fed. or inoculation with either the single or mixed biofertilizer .

4.1.3. Effect of biofertilizer treatments on NPK uptake (100 days after transplanting) :

Data shown in Tables (5 and 6) and Figs. (1, 2 and 3) on NPK uptake allover the season show the same trend previously

Table(5): Mineral nutrients uptake (mg element/plant) of sweet pepper at the 3 rd picking stage (100 days after transplanting), as affected by biofertilizer treatments during the summer season of 2000.

	Treatments / Characters	mg N/plant				mg P/plant				mg K/plant			
	Biofertilizer + Chemical	Leaves	Stem	Fruit	Total	Leaves	Stem	Fruit	Total	Leaves	Stem	Fruit	Total
1	Nitrobin only	988.5 K	361.2 F	789.4 H	2139.0 J	54.9 E	34.8 DE	81.09 H	170.8 J	775.1 K	521.1 N	823.8 H	2120 I
2	Nitrobin +PK	1039.8 J	327.8 G	1004.4 G	2372.0 I	63.2 CDE	42.0 CD	133.97 F	239.2 G	1100.8 H	849.8 K	1212.5 G	3163 H
3	Nitrobin +1/4N+PK	1142.8 H	405.8 D	1548.4 E	3097.0 G	68.4 C	40.6 CD	158.78 E	267.8 F	1231.2 G	958.2 J	1448.7 E	3638 G
4	Nitrobin +1/2N+PK	1324.0 E	375.0 F	2108.0 C	3807.0 D	71.9 C	39.9 CD	217.5 C	329.3 D	1624.5 DEF	1286.5 G	1986.0 C	4897 D
5	Nitrobin +3/4N+PK	1568.5 B	516.5 A	2129.0 C	4214.0 B	92.9 A	54.9 AB	219.7 C	367.6 B	1983.5 B	1625.5 B	2007.0 C	5616 B
6	Phosphorin only	926.3 L	307.4 H	797.4 H	2031.0 J	57.9 DE	38.9 CD	80.28 H	177.2 J	868.2 JK	648.2 M	814.7 H	2331 I
7	Phosphorin +NK	1198.2 G	463.2 B	1382.7 F	3044.0 GH	67.9 CD	43.4 CD	109.51 G	220.9 H	1272.2 G	1011.2 I	1285.7 F	3569 G
8	Phosphorin +1/4P+NK	1435.0 D	511.0 A	1645.0 D	3591.0 EF	86.1 A	56.6 A	169 D	311.7 E	1669.6 DE	1328.6 F	1548.8 D	4547 EF
9	Phosphorin +1/2P+NK	1262.5 F	384.5 E	2091.0 C	3738.0 DE	72.6 BC	37.7 CD	215.7 C	325.9 D	1556.0 F	1221.0 H	1970.0 C	4747 DE
10	Phosphorin +3/4P+NK	1482.5 C	443.5 C	2373.0 B	4299.0 B	83.8 A	49.0 ABC	218.3 C	351.1 C	1841.5 C	1482.5 E	1993.0 C	5317 C
11	Nitrobin+Phosphorin	1076.4 J	397.4 DE	815.3 H	2289.0 I	66.3 CD	44.0 CD	82.96 H	193.3 I	1002.0 I	735.0 L	844.0 H	2581 H
12	Nitr.+Phosph.+K	1110.9 I	582.9 E	1039.3 G	2533.0 H	64.7 CD	41.1 C	106.79 G	212.6 H	1203.9 G	953.9 J	1256.3 FG	3414 G
13	Nitr.+Phosph.+1/4N+1/4P+K	1482.4 C	412.4 D	1581.3 E	3476.0 F	84.3 A	54.8 AB	162.3 E	301.4 E	1582.7 EF	1265.7 GH	1484.6 E	4333 F
14	Nitr.+Phosph.+1/2N+1/2P+K	1470.0 CD	469.0 B	2116.0 C	4055.0 C	82.9 AB	44.4 CD	245.3 B	372.5 B	1918.0 BC	1538.0 D	2238.0 B	5694 B
15	Nitr.+Phosph.+3/4N+3/4P+K	1667.0 A	513.0 A	2483.0 A	4663.0 A	84.1 A	39.3 CD	256.7 A	380.1 A	2149.5 A	1726.5 A	2343.0 A	6219 A
16	Not added +NPK	1497.5 C	465.5 B	2383.0 B	4346.0 B	79.8 B	45.0 BC	246.3 B	371.1 B	1941.5 BC	1555.5 CD	2247.0 B	5744 B
17	Control(without)	422.1 M	123.4 I	708.6 I	1254. K	39.3 F	25.5 E	71.54 I	136.3 K	204.5 L	67.5 O	723.1 I	995 J

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

Table(6): Mineral nutrients uptake (mg element/plant) of sweet pepper at the 3 rd picking stage (100 days after transplanting), as affected by treatments during the summer season of 2001.

Treatments / Characters		mg N/plant				mg P/plant				mg K/plant			
	Biofertilizer + Chemical	Leaves	Stem	Fruit	Total	Leaves	Stem	Fruit	Total	Leaves	Stem	Fruit	Total
1	Nitrobin only	1021.7 K	358.7 F	797.5 H	2178.1 IJ	55.2 DE	34.7 C	80.2 H	170.1 K	963.1 M	718.1 M	823.8 H	2505 K
2	Nitrobin +PK	1052.6 JK	305.6 G	996.7 G	2355.1 H	70.9 CD	48.5 BC	134.4 F	253.8 G	1255.0 K	974.0 K	1210.0 G	3439 I
3	Nitrobin +1/4N+PK	1252.9 H	425.9 E	1555.1 E	3234.1 G	75.4 C	47.4 BC	159.4 E	282.2 F	1395.8 I	1104.8 I	1448.4 E	3949 G
4	Nitrobin +1/2N+PK	1450.0 EF	477.0 D	2106.0 C	4033.0 D	82 BC	47.9 BC	217.2 C	347.1 D	1810.0 F	1468.0 E	1976.0 C	5254 D
5	Nitrobin +3/4N+PK	1703.5 B	586.5 A	2129.0 C	4419.0 B	103.2 A	63.4 A	219.5 C	386.0 B	2177.0 A	1781.0 A	1998.0 C	5956 B
6	Phosphorin only	955.0 L	285.0 H	842.0 H	2082.0 J	59.9 D	37.2 CD	81.1 H	178.1 JK	899.6 N	646.6 N	813.8 H	2660 J
7	Phosphorin +NK	1307.6 G	509.6 C	1389.8 F	3207.0 G	65.8 D	40.7 CD	108.9 G	215.5 GH	1433.1 H	1139.1 H	1285.8 F	3858 G
8	Phosphorin +1/4P+NK	1554.5 D	587.5 A	1651.0 D	3793.0 E	95.8 AB	64.1 A	169.6 D	329.4 E	1846.1 E	1529.1 D	1547.8 D	4923 E
9	Phosphorin +1/2P+NK	1405.0 F	435.0 E	2091.0 C	3931.0 DE	82.6 B	45.5 C	215.6 C	343.7 D	1743.5 G	1375.5 G	1962.0 C	5081 DE
10	Phosphorin +3/4P+NK	1619.0 C	547.0 B	2366.0 B	4532.0 B	93.9 AB	57.4 AB	217.9 C	369.1 C	2031.0 D	1663.0 C	1982.0 C	5676 C
11	Nitrobin+Phosphorin	1082.5 IJ	346.5 F	814.9 H	2244.0 HI	63.9 D	40.6 CD	82.9 H	187.5 IJ	1055.2 L	808.2 L	843.6 H	2707 J
12	Nitr.+Phosph.+K	1121.6 I	364.6 F	1031.8 G	2518.0 G	64.9 D	38.3 CD	106.0 G	209.2 H	1362.9 J	1055.9 J	1254.1 FG	3673 H
13	Nitr.+Phosph.+1/4N+1/4P+K	1498.6 E	537.6 B	1588.8 DE	3625.0 F	94.1 AB	62.0 A	163.0 DE	319.0 E	1756.4 G	1409.4 F	1485.2 DE	4651 F
14	Nitr.+Phosph.+1/2N+1/2P+K	1601.5 C	573.5 A	2113.0 C	4288.0 C	95.9 AB	53.1 AB	244.4 B	393.3 B	2117.5 C	1719.5 B	2222.0 B	6059 B
15	Nitr.+Phosph.+3/4N+3/4P+K	1810.0 A	592.0 A	2476.0 A	4878.0 A	93.8 AB	47.5 B	255.9 A	397.1 A	2157.0 AB	1735.0 B	2327.0 A	6219 A
16	Not added +NPK	1633.0 C	517.0 C	2376.0 B	4526.0 B	90.4 AB	53.7 AB	245.4 B	389.5 B	2138.0 B	1738.0 B	2230.0 B	6106 B
17	Control(without)	401.8 M	144.5 I	720.6 I	1267.0 K	43.2 E	30.1 D	72.8 I	146.1 L	260.7 O	112.7 O	736.7 I	1110 L

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

Fig. (1) : Total N-uptake (leaves, stem and fruits) all over the season as affected by bio and chemical fertilizer application during the summer seasons of 2000 & 2001.

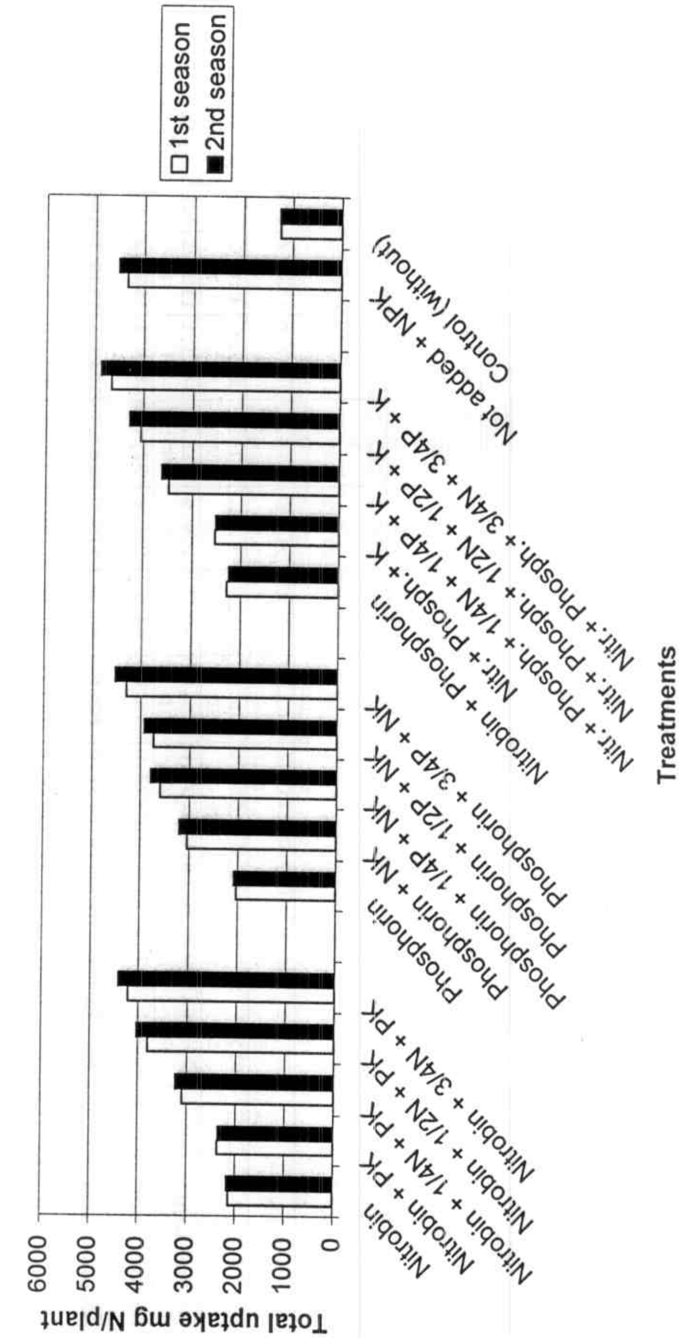


Fig. (2) : Total P-uptake (leaves, stem and fruits) all over the season as affected by bio and chemical fertilizer application during the summer seasons of 2000 & 2001.

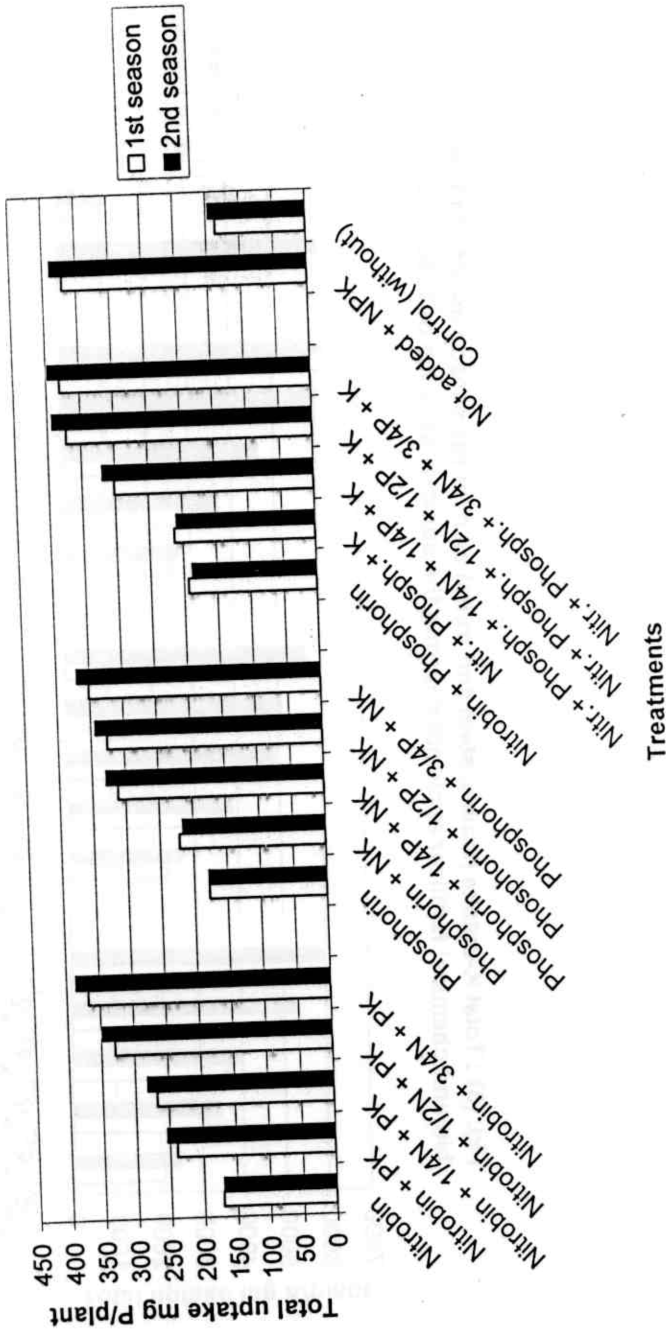
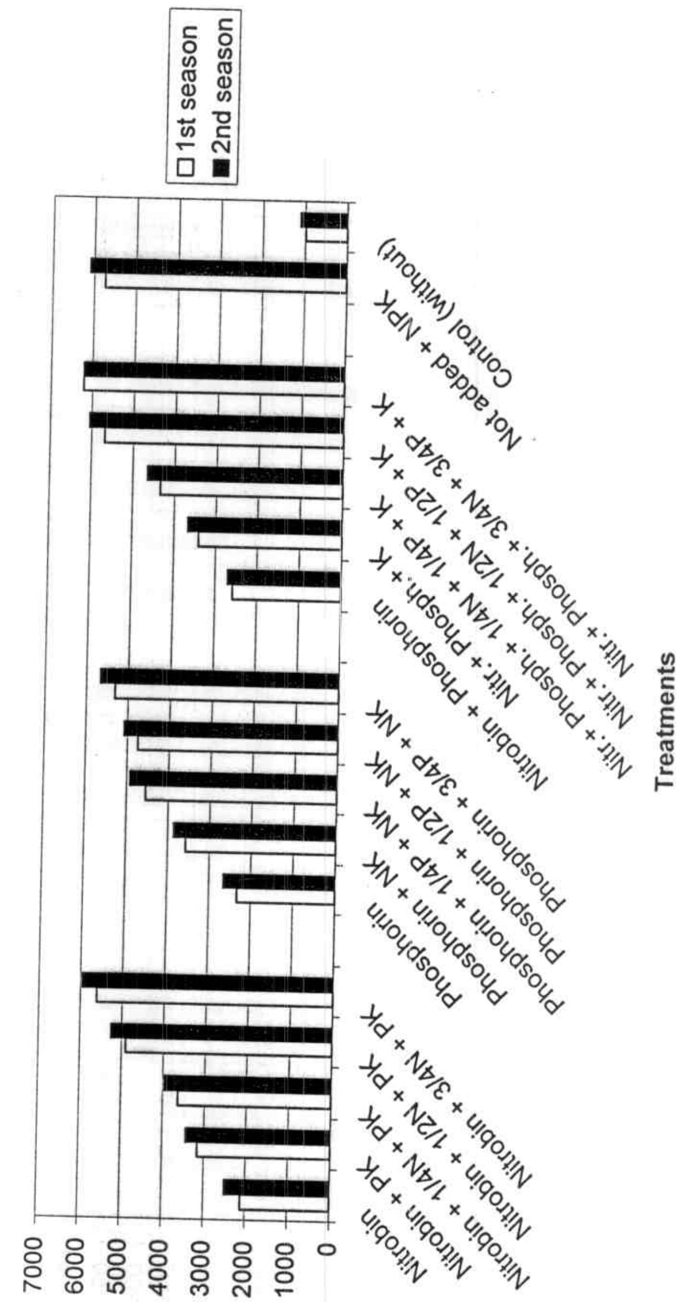


Fig. (3) : Total K-uptake (leaves, stem and fruits) all over the season as affected by bio and chemical fertilizer application during the summer seasons of 2000 & 2001.



mentioned 70 days after transplanting (Tables 3 and 4). i.e. the highest total NPK uptake was found in plants of treatment (No.15) which was inoculated with a mixture of Nitrobin and Phosphorin and fertilized with 75% of the required dose of N and P plus K. Inoculating sweet pepper seeds and transplant roots with Nitrobin and /or Phosphorin without adding any chemical fertilizers (treatments No. 1, 6 and 11) gave lower NPK uptake as compared with all other treatments except the control in which no bio or chemical fertilizers were added. This trend was true in both seasons of this work at the two sampling stages (70 days after transplanting and 100 days after transplanting). It means that the biofertilizers application neither Nitrobin nor Phosphorin or together were able to provide plants with its full requirement of N and P.

Generally, data show that inoculating plants with Nitrobin and/or Phosphorin significantly increased NPK uptake in the two stages and this increase was significant and gradual with increasing levels of N and/or P application from 25%, 50% upto 75% of each element. Therefore, the maximum NPK uptake was obtained from (treatment No.15) when plants were inoculated with Nitrobin + Phosphorin and fertilized with 3/4 N + 3/4 P + K in both seasons the two stages i.e. 70 and 100 days after transplanting. **This means that 25% of the required nitrogen and phosphorus fertilizers could be saved by inoculating seeds and transplants before growing with a mixed biofertilizer consisted of Nitrobin + Phosphorin. This trend**

was true in both seasons and results could be referred to the role of Nitrobin and Phosphorin on increasing the availability of both N and P in the soil.

On the other hand, plants supplied with NPK in the mineral form without any biofertilizers (treatment No.16) accumulated less NK uptake 70 days after transplanting and less NPK uptake 100 days after transplanting as compared with plants supplied with a mixed biofertilizer + 3/4 N + 3/4 P + K (treatment No.15) in both seasons. Results are confirmed with those of Monib *et al.* (1990) on tomato , Sorial *et al.* (1992) and Gomaa (1995) on tomato , Poi (1998) on chili and tomato and Ouda (2000) on tomato. They mentioned the favorable role of Nitrobin (*Azotobacter* or *Azospirillum*) and Phosphorin on both N and P uptake by plant roots.

4.1.4. Effect of biofertilizer treatments on flowering and fruit setting of sweet pepper:

Data (Table, 7) show that plants supplied with NPK without biofertilizer or that supplied with 50% or 75% of the required N and P level + Nitrobin and / or Phosphorin gave similar and higher fruit setting. Therefore, treatments (No.4, 5, 9, 10, 14, 15, and 16) gave similar and higher fruit setting% as compared with all other treatments. This improvement in fruit setting by biofertilizers application have been mentioned by Hewedy (1999) on tomato. Results also means that we can save

Table(7): Flowering time and fruit setting % of sweet pepper as affected by biofertilizer treatments during the summer seasons of 2000 & 2001 .

	Treatments / Characters	First season (2000)		Second season (2001)	
	Biofertilizer + Chemical	Anthesis of 1st Flower (days)	Fruit setting (%)	Anthesis of 1st Flower (days)	Fruit setting (%)
1	Nitrobin only	71.4 AB	33.63 FG	72.11 ABC	34.61 G
2	Nitrobin +PK	70.7 AB	37.4 EFG	71.41 ABC	38.48 FG
3	Nitrobin +1/4N+PK	68.7 BCD	44.96 DEF	69.41 CDE	45.42 DEF
4	Nitrobin +1/2N+PK	66.8 CDE	58.73 ABC	67.52 EF	58.24 AB
5	Nitrobin +3/4N+PK	65.8 DE	61.65 AB	66.52 EF	60.53 AB
6	Phosphorin only	71.7 AB	33.33 FG	72.41 AB	31.76 G
7	Phosphorin +NK	69.7 BC	40.13 EFG	70.41 BCD	41.35 EFG
8	Phosphorin +1/4P+NK	67.0 CDE	52.93 BCD	67.70 DEF	51.72 BCDE
9	Phosphorin +1/2P+NK	66.8 CDE	56.99 ABCD	67.52 EF	55.50 ABCD
10	Phosphorin +3/4P+NK	66.7 CDE	59.25 ABC	67.41 EF	57.80 ABC
11	Nitrobin+Phosphorin	71.4 AB	37.20 EFG	72.11 ABC	34.27 G
12	Nitr.+Phosph.+K	70.4 B	37.74 EFG	71.11 BC	38.75 FG
13	Nitr.+Phosph.+1/4N+1/4P+K	68.7 BCD	48.09 CDE	69.41 CDE	47.61 CDEF
14	Nitr.+Phosph.+1/2N+1/2P+K	65.8 DE	62.17 AB	66.50 EF	61.04 AB
15	Nitr.+Phosph.+3/4N+3/4P+K	65.4 E	66.55 A	66.10 F	65.30 A
16	Not added +NPK	65.8 DE	64.82 AB	66.50 EF	63.19 A
17	Control(without)	73.4 A	29.38 G	74.10 A	32.21 G

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

25-50% of the required N and P requirements of sweet pepper nutrition by inoculating seeds and transplants roots with a mixture of Nitrobin + Phosphorin. Naturally the microorganisms of free living bacteria in Nitrobin and phosphorus dissolving bacteria (PDB) involved in Phosphorin led to increase the available N and P in the soil and consiquently its uptake by plant roots.

Moreover, data (Table, 7) show that plants supplied with a single or mixed biofertilizer Nitrobin and / or Phosphorin (treatments No.1, 6 and 11) without any chemical fertilizers had the lowest fruit setting % and was similar to that of the control when no bio or chemical fertilizers were added as shown in both seasons. **This result means that adding single or mixed biofertilizer without any chemical fertilizers is not enough to supply plants with macronutrients. This result is in harmony with Barakat and Gabr (1998) on tomato.**

It is also evident from (Table, 7) that treatments (No. 4, 5, 8, 9, 10, 14, 15 and 16) were earlier to the anthesis of 1st flower than the other treatments, as a general trend in both seasons. It means that the inoculation of sweet pepper seeds and transplant roots with Nitrobin and / or Phosphorin + 50 or 75% of the required N-dose + PK led to early anthesis than other treatments. Moreover, inoculating plants with Nitrobin and / or Phosphorin only without adding chemical fertilizers (treatments No.1, 6, 11 and No.17) delayed the anthesis of the first flower to be similar to the control when no bio or chemical fertilizers were addad, as shown in both seasons. As a conclusion, results show that inoculating sweet pepper seeds and transplant roots with single or mixed biofertilizers (Nitrobin and / or Phosphorin) were not able to improve fruit seeting % and delayed the anthesis of the first flower when NPK mineral fertilizers were not added.

However, the most favourable results i.e the highest fruit setting and early anthesis were obtained in plants inoculated with Nitrobin and / or Phosphorin and received 1/2 of the required level of N and P.

As average of both seasons, the earliness in flowering time by treatment (No. 15) reached 8 days and fruit setting percentage was increased from 30.8 up to 65.9 as compared with the control treatment No. 17, without bio or mineral fertilizers. Moreover, a single or mixed biofertilizer treatments did not significantly increase fruit setting or enhance flowering time as compared with solely NPK mineral fertilization (treat. No. 16).

4.1.5. Effect of biofertilizer treatments on early and total fruit yield of sweet pepper and its components:

Data (Table 8 and Figs. 4&5) show that plants received a mixed biofertilizer of Nitrobin and Phosphorin plus 75% of N and P requirements (treatment No.15) gave the highest early and total yield per plant and per feddan as compared with the other treatments followed by treatment No.16 which received the full

Table(8): Fruit yield and its components of sweet pepper as affected by biofertilizer treatments during the summer seasons of 2000 & 2001 .

	Treatments / Characters	Early yield g/plant	Early yield ton/fed	Total yield g/plant	Total yield ton/fed
	Biofertilizer + Chemical	First season (2000)			
1	Nitrobin only	13.81 L	0.221 GH	178.6 F	2.858 H
2	Nitrobin +PK	15.75 JK	0.252 FG	308.3 E	4.932 F
3	Nitrobin +1/4N+PK	17.31 HI	0.277 F	357.1 DE	5.714 E
4	Nitrobin +1/2N+PK	21.50 F	0.344 DE	510.7 B	8.171 C
5	Nitrobin +3/4N+PK	24.54 D	0.393 C	440.0 C	8.240 C
6	Phosphorin only	8.37 M	0.134 I	175.9 F	2.815 H
7	Phosphorin +NK	16.99 HI	0.272 F	318.0 DE	5.087 F
8	Phosphorin +1/4P+NK	18.73 G	0.300 EF	372.5 D	5.960 D
9	Phosphorin +1/2P+NK	18.81 G	0.301 EF	504.8 B	8.077 C
10	Phosphorin +3/4P+NK	23.25 E	0.372 CD	513.2 B	8.211 C
11	Nitrobin+Phosphorin	15.09 K	0.196 H	189.3 F	3.029 G
12	Nitr.+Phosph.+K	16.58 IJ	0.265 FG	316.8 DE	5.068 F
13	Nitr.+Phosph.+1/4N+1/4P+K	17.64 H	0.282 F	359.3 DE	5.749 E
14	Nitr.+Phosph.+1/2N+1/2P+K	25.53 C	0.408 BC	587.7 A	9.403 B
15	Nitr.+Phosph.+3/4N+3/4P+K	30.65 A	0.491 A	617.8 A	9.882 A
16	Not added +NPK	27.76 B	0.444 B	590.9 A	9.454 B
17	Control(without)	4.11 N	0.066 J	111.2 G	1.779 I
		Second season (2001)			
1	Nitrobin only	26.27 K	0.420 N	191.0 H	3.057 H
2	Nitrobin +PK	28.26 IJ	0.452 L	320.8 F	5.132 F
3	Nitrobin +1/4N+PK	29.76 H	0.476 I	369.5 E	5.913 E
4	Nitrobin +1/2N+PK	34.00 F	0.544 F	523.2 C	8.371 C
5	Nitrobin +3/4N+PK	36.98 D	0.592 D	527.4 C	8.439 C
6	Phosphorin only	20.88 L	0.334 O	188.4 H	3.015 H
7	Phosphorin +NK	29.43 H	0.471 J	330.4 F	5.286 F
8	Phosphorin +1/4P+NK	31.24 G	0.500 G	385.0 D	6.160 D
9	Phosphorin +1/2P+NK	31.25 G	0.500 G	517.3 C	8.276 C
10	Phosphorin +3/4P+NK	35.76 E	0.572 E	525.7 C	8.411 C
11	Nitrobin+Phosphorin	27.53 J	0.440 M	201.7 G	3.228 G
12	Nitr.+Phosph.+K	29.08 HI	0.465 K	329.3 F	5.268 F
13	Nitr.+Phosph.+1/4N+1/4P+K	30.09 H	0.481 H	371.8 E	5.948 E
14	Nitr.+Phosph.+1/2N+1/2P+K	38.03 C	0.608 C	600.2 B	9.602 B
15	Nitr.+Phosph.+3/4N+3/4P+K	43.09 A	0.690 A	630.2 A	10.080 A
16	Not added +NPK	40.26 B	0.644 B	603.4 B	9.653 B
17	Control(without)	16.55 M	0.265 P	123.6 I	1.978 I

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

Fig. (4) : Sweet pepper early yield (ton/fed) as affected by bio and chemical fertilizer application during the summer seasons of 2000 & 2001.

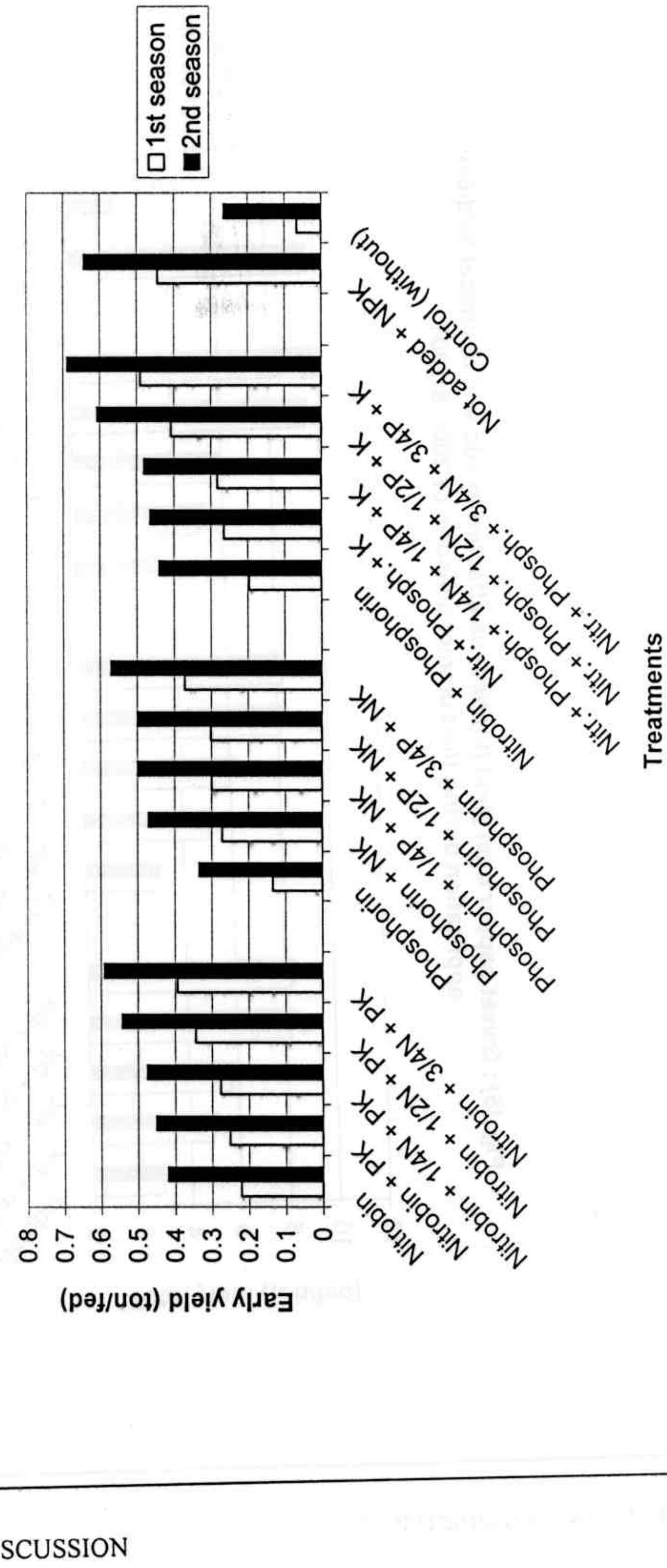
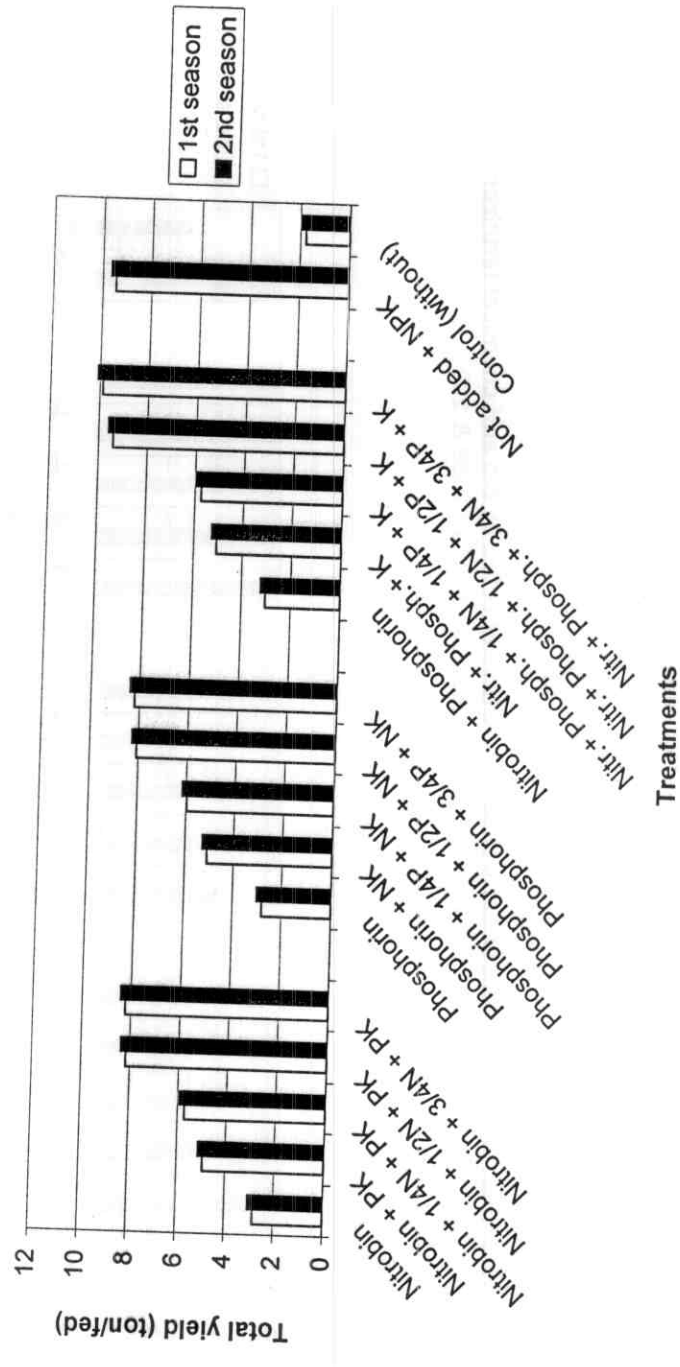


Fig. (5) : Sweet pepper total yield (ton/fed) as affected by bio and chemical fertilizer application during the summer seasons of 2000 & 2001.



dose of NPK in the chemical form without any biofertilizers. These results were true in both seasons. Moreover, data show that plants supplied with a mixed biofertilizer (Nitrobin + Phosphorin) without any chemical fertilizers (treatment No.11) had higher early and total yield than those which received a single biofertilizer i.e either Nitrobin or Phosphorin only; (treatments No.1 and 6, respectively).

Inoculating seeds with Nitrobin and / or Phosphorin singnificantly increased early and total yield over the control when no bio or chemical fertilizers were added, as shown in both seasons. Results on the favourable effect of biofertilizers application on early and total yield have been mentioned by Jackson *et al.* (1964) Mehorta and Lehri , (1971) on eggplant, Antipchuk *et al.* (1982), Mohandas (1987), Bashan and Singh (1989) and Bashan *et al.* (1989) on sweet pepper, Moustafa and Omar (1990) and Gomaa (1995) on tomato.

Generally results show that adding 1/4 , 1/2 or 3/4 of the required level of N and / or P plus inoculation with Nitrobin and/or Phosphorin significantly and gradually increased early yield production per plant and per feddan, as shown in Table 8 and Figs 4&5. Therefore, treatment No.15 gave the highest total yield per feddan and per plant as compared with all other treatments, as shown in both seasons. It means that we can save 25% of the required N and 25% of the required P chemical fertilizer and replace it by inoculating seeds and transplant roots with Nitrobin and Phosphorin. The stimulating effect of living N-fixing bacteria involved in Nitrobin and PDB involved in Phosphorin on increasing plant growth, fruit setting, early anthesis, chlorophyll content, N and P uptake may explain the increase in fruit early and total yield of sweet peppers obtained when plants inoculated with Nitrobin + Phosphorin and received 75% of the required N and P. It means that we cane save 25% of the required level of N and P for sweet pepper nutrition by adding a mixed biofertilizer. This increment in early and total yield production of sweet pepper have been mentioned by Terry *et al.* (1995) and (1996) and Hameedunnisa and Begum (1998) on tomato who saved 25% of the required level of N and Ouda (2000) on tomato who saved 25% of the required level of NPK and could be referred to the role of free living bacteria involved in Nitrobin on N-fixation in the soil and the role of PDB on increasing the available-P in the soil. Moreover, the mechanism of microorganisms on plant growth and fruit yield depends on producing growth promoting substances (El-Haddad *et al.*, 1986) and enhancing nutrients uptake (Sarig, 1984).

Plants which received the full dose of NPK without biofertilizers (treatment No.16) and those that received Nitrobin + Phosphorin + 1/2 N +1/2 P + K. (treatment No. 14) came in the second rank and produced similar total yield per plant and per feddan, as shown in both seasons.

As a general conclusion, inoculating seeds and roots of transplants with Nitrobin + Phophorin and adding 3/4 N + 3/4 P + K (treatment No.15) could be recommended to increase early yield/fed. by 7.14-10.58% and total fruit yield /fed. by 4.42 – 4.53% as compared with the control which recived 100% NPK without any biofertilizers in both seasons, respectively. Treatment No. 15 also increased fruit early yield per fed. by 1.6 – 6.4 times and the total yield/fed. by 4.1 – 4.5 times as compared with the control without bio and chemical fertilizers application in both seasons, respectively.

4.1.6. Effect of biofertilizer treatments on quality of sweet pepper fruits:

4.1.6.a. Fruit physical characteristics :

Data (Table, 9) show that treatments (No. 14, 15 and 16) gave longer, thicker and heavier fruits as compared with all other treatments in both seasons. With respect to fruit diameter, data show that treatments No.15 and 16 gave similar and higher fruit diameter, however treatment No. 15 gave the largest fruit size as compared with all other treatments, in both seasons. This means that 25% of the required N and P fertilizers could be saved by inoculating seeds and transplant roots with Nitrobin + Phosphorin. Saving 50% of the required chemical N and P fertilizers came in the second rank respecting with physical

Table(9): Fruit quality (physical characteristics)of sweet pepper as affected by biofertilizer treatments during the summer seasons of 2000 & 2001 .

Treatments / Characters		Fruit length cm	Fruit diameter cm	Fruit size cm^3/fruit	Average weight of fruit (g)
	Biofertilizer + Chemical	First season (2000)			
1	Nitrobin only	7.525 E	6.1 HI	128.3 J	68.2 JK
2	Nitrobin +PK	7.825 CD	6.2 FGH	133.3 HI	82.0 I
3	Nitrobin +1/4N+PK	7.925 CD	6.3 EFGH	142.3 EF	105.3 F
4	Nitrobin +1/2N+PK	8.025 C	6.6 CD	151.3 D	125.0 C
5	Nitrobin +3/4N+PK	8.675 A	6.8 C	158.3 C	126.3 BC
6	Phosphorin only	7.525 E	5.9 I	114.3 K	66.0 KL
7	Phosphorin +NK	7.925 CD	6.3 EFGH	138.3 FG	92.2 G
8	Phosphorin +1/4P+NK	7.925 CD	6.4 EF	145.3 E	115.0 D
9	Phosphorin +1/2P+NK	7.925 CD	6.5 DE	145.3 E	125.3 C
10	Phosphorin +3/4P+NK	8.425 B	6.6 CD	156.3 C	125.0 C
11	Nitrobin+Phosphorin	7.725 D	6.2 GH	130.3 IJ	70.2 J
12	Nitr.+Phosph.+K	7.825 CD	6.3 EFG	137.3 GH	87.0 H
13	Nitr.+Phosph.+1/4N+1/4P+K	7.925 CD	6.3 EFGH	143.3 E	110.3 E
14	Nitr.+Phosph.+1/2N+1/2P+K	8.775 A	6.8 BC	168.3 B	129.3 AB
15	Nitr.+Phosph.+3/4N+3/4P+K	8.825 A	7.0 AB	176.3 A	131.6 A
16	Not added +NPK	8.825 A	7.0 A	171.3 B	129.3 AB
17	Control(without)	6.925 F	5.5 J	93.2 L	64.2 L
		Second season (2001)			
1	Nitrobin only	8.0 F	6.6 H	138.0 I	73.0IJ
2	Nitrobin +PK	8.3 E	6.7 GH	142.0 HI	87.0 H
3	Nitrobin +1/4N+PK	8.4 E	6.8 FG	151.0 EF	110.0 E
4	Nitrobin +1/2N+PK	8.6 D	7.1 CD	160.0 D	130.0 B
5	Nitrobin +3/4N+PK	9.1 B	7.3 B	167.0 C	131.0 B
6	Phosphorin only	8.0 F	6.4 I	123.0 J	71.0 J
7	Phosphorin +NK	8.4 E	6.8 FG	148.0 FG	97.0 F
8	Phosphorin +1/4P+NK	8.4 E	6.9 EF	155.0 E	120.0 C
9	Phosphorin +1/2P+NK	8.4 E	7.0 DE	155.0 E	130.0 B
10	Phosphorin +3/4P+NK	8.9 C	7.2 BC	166.0 C	130.0 B
11	Nitrobin+Phosphorin	8.2 E	6.7 GH	140.0 I	75.0 I
12	Nitr.+Phosph.+K	8.3 E	6.8 FG	146.0 GH	92.0 G
13	Nitr.+Phosph.+1/4N+1/4P+K	8.4 E	6.8 FG	152.0 EF	115.0 D
14	Nitr.+Phosph.+1/2N+1/2P+K	9.1 B	7.3 B	177.0 B	134.3 A
15	Nitr.+Phosph.+3/4N+3/4P+K	9.3 A	7.5 A	186.0 A	136.3 A
16	Not added +NPK	9.3 A	7.5 A	181.0 B	134.3 A
17	Control(without)	7.4 G	5.9 J	102.0 K	64.0 K

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

characteristics of fruit length, diameter and size as a general trend especially in the second season.

Data also show that plants supplied only with a mixed biofertilizer (Nitrobin + Phosphorin , treatment No.11) had better fruit length, diameter and size as well as average fruit weight than in those received a single biofertilizer especially Phosphorin; treatment No.6, as shown in both seasons. It means that the role of Nitrobin on physical characteristics of sweet pepper fruit was more pronounced than Phosphorin, however the interaction between Nitrobin and Phosphorin on fruit quality was clear and increased with adding N and P chemical fertilizers.

Treatment inoculated with Nitrobin + Phosphorin +3/4 N +3/4 P + K (treatment No.15) gave the highest fruit size as compared with other treatments next treatment No.14 which received Nitrobin + Phosphorin + 1/2 N +1/2 P + K and treatment No.16 which received the full dose of NPK without biofertilizers in both seasons. Moreover, treatment No.14, 15 and 16 gave the highest average weight of fruit as compared with other treatments. Also, all biofertilizer treatments significantly increased fruit length, diameter, size and average fruit weight over the control when no bio or chemical fertilizers were added. This trend was true in both seasons.

4.1.6.b. Fruit chemical characteristics :

Data on chemical constituents of sweet pepper fruits are given in (Tables, 10&11). Such data show that inoculating seeds and roots of sweet pepper with Nitrobin and / or Phosphorin did not improve fruit acidity, T.S.S, vitamin C and sugars content unless NPK were added in the chemical form. Therefore, treatments No.1, 6 and 11 gave low and similar fruit quality as a general trend in both seasons.

Concerning the best fruit quality; fruit acidity, T.S.S, vitamin C, plants which received NPK fertilizer without any biofertilizers (treatment No.16) or those which received Nitrobin + Phosphorin + 1/2 N + 1/2 P +K or Nitrobin + Phosphorin + 3/4 N + 3/4 P + K (treatments No.14 or 15) gave similar fruit quality with higher acidity, T.S.S and vitamin-C, as shown in both seasons.

With respect to sugars content of sweet pepper fruit; plants which received all NPK fertilizers in the chemical form (treatment No.16) or that received 75% of the required N and P fertilizers in addition to inoculation with a mixed biofertilizer (treatment No.15) expressed the highest non reducing and total sugars content, in both seasons. This result confirm the role of biofertilizers Nitrobin and Phosphorin on saving 25% of the required level of each element and getting the best fruit quality. Moreover, data show that a mixed biofertilizer (treatment No.11)

Table(10): Fruit quality (chemical constituents) of sweet pepper fruit as affected by biofertilizer treatments during the summer season of 2000.

	Characters / Treatments	Acidity	T.S.S	Vitamin C	Sugars mg/100g (F.W.)		
	Biofertilizer + Chemical	mg/100cm^3	%	mg/100g	Reducing	Non-reducing	Total
1	Nitrobin only	191.0 B	5.0 G	166.0 D	36.0 J	80.0 GH	116.0 I
2	Nitrobin +PK	192.0 B	5.3 EF	167.3 CD	42.0 I	93.0 FG	135.0 GH
3	Nitrobin +1/4N+PK	195.0 AB	5.4 DE	170.0 BC	58.0 G	108.0 EF	166.0 F
4	Nitrobin +1/2N+PK	197.0 AB	5.7 ABC	172.3 AB	81.0 D	149.0 AB	230.0 CD
5	Nitrobin +3/4N+PK	199.0 AB	5.8 AB	173.0 AB	85.0 C	157.0 A	242.0 BC
6	Phosphorin only	190.0 B	5.0 G	166.3 D	36.0 J	74.0 H	110.0 I
7	Phosphorin +NK	194.0 B	5.4 DE	168.0 CD	47.0 H	119.0 DE	166.0 F
8	Phosphorin +1/4P+NK	195.0 AB	5.5 CDE	170.3 BC	64.0 F	125.0 CDE	189.0 E
9	Phosphorin +1/2P+NK	198.0 AB	5.6 BCD	172.0 AB	81.0 D	156.0 A	237.0 C
10	Phosphorin +3/4P+NK	198.0 AB	5.8 AB	173.3 AB	77.0 E	140.0 ABC	217.0 D
11	Nitrobin+Phosphorin	192.0 B	5.1 FG	166.0 D	37.0 J	81.0 GH	118.0 HI
12	Nitr.+Phosph.+K	192.0 B	5.3 EF	168.3 CD	48.0 H	93.0 FG	141.0 G
13	Nitr.+Phosph.+1/4N+1/4P+K	196.0 AB	5.4 DE	170.0 BC	60.0 G	115.0 E	175.0 EF
14	Nitr.+Phosph.+1/2N+1/2P+K	199.0 AB	5.8 AB	174.3 A	99.0 B	135.0 BCD	234.0 CD
15	Nitr.+Phosph.+3/4N+3/4P+K	201.0 AB	5.9 A	175.0 A	103.0 A	157.0 A	260.0 A
16	Not added +NPK	199.0 AB	5.9 A	174.3 A	98.0 B	159.0 A	257.0 AB
17	Control(without)	190.0 B	4.9 G	165.0 D	32.0 K	70.0 H	102.0 I

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

Table(11): Fruit quality (chemical constituents) of sweet pepper fruit as affected by biofertilizer treatments during the summer season of 2001.

	Treatments / Characters	Acidity	T.S.S	Vitamin C	Sugars mg/100g (F.W.)		
	Biofertilizer + Chemical	mg/100cm^3	%	mg/100g	Reducing	Non-reducing	Total
1	Nitrobin only	200.0 GH	5.1 G	171.0 D	38.0 HI	77.0 G	115.0 K
2	Nitrobin +PK	202.0 EFG	5.4 EF	172.0 CD	45.0 G	92.0 F	137.0 J
3	Nitrobin +1/4N+PK	204.0 DE	5.5 DE	175.0 BC	58.0 F	111.0 E	169.0 H
4	Nitrobin +1/2N+PK	207.0 BC	5.8 ABC	177.0 AB	83.0 CD	147.0 BC	230.0 D
5	Nitrobin +3/4N+PK	208.0 AB	5.9 AB	178.0 AB	87.0 C	157.0 A	244.0 B
6	Phosphorin only	200.0 GH	5.1 G	171.0 D	38.0 HI	72.0 G	110.0 L
7	Phosphorin +NK	203.0 DEF	5.5 DE	173.0 CD	48.0 G	119.0 DE	167.0 H
8	Phosphorin +1/4P+NK	205.0 CD	5.6 CDE	175.0 BC	66.0 E	124.0 D	190.0 F
9	Phosphorin +1/2P+NK	207.0 BC	5.7 BCD	177.0 AB	84.0 C	153.0 AB	237.0 C
10	Phosphorin +3/4P+NK	208.0 AB	5.9 AB	178.0 AB	79.0 D	141.0 C	220.0 E
11	Nitrobin+Phosphorin	201.0 FGH	5.2 FG	171.0 D	39.0 H	79.0 G	118.0 K
12	Nitr.+Phosph.+K	202.0 EFG	5.4 EF	173.0 CD	49.0 G	94.0 F	143.0 I
13	Nitr.+Phosph.+1/4N+1/4P+K	205.0 CD	5.5 DE	175.0 BC	60.0 F	117.0 DE	177.0 G
14	Nitr.+Phosph.+1/2N+1/2P+K	209.0 AB	5.9 AB	179.0 A	97.0 B	161.0 A	258.0 A
15	Nitr.+Phosph.+3/4N+3/4P+K	210.0 A	6.0 A	180.0 A	105.0 A	157.0 A	262.0 A
16	Not added +NPK	209.0 AB	6.0 A	179.0 A	97.0 B	161.0 A	258.0 A
17	Control(without)	199.0 H	5.0 G	170.0 D	34.0 I	70.0 G	104.0 M

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

and a single biofertilizer (treatments No.1 and 6) significantly increased total sugars over the control when no bio or chemical fertilizers were added. These results are in harmony with Tantawy (2000) who found that all biofertilizer treatments (nitrogen fixing bacteria alone or phosphat dissolving bacteria alone or together) caused a significant increase in T.S.S of tomato fruits .

As a general conclusion plants which received 75% of the required N and P and inoculated with Nitrobin + Phosphorin (treatment No.15) could be considered the best treatment which gave the highest early and total yield with the highest fruit quality in both seasons. Plants that received all NPK in the chemical form without biofertilizers (treatment No.16) or received 50% of the required dose of N and P and inoculated with Nitrobin + Phosphorin (treatment No.14) came in the second rank with respect to early and total yield production.

The stimulating effect of biofertilizers application on fruit early and total yield as well as fruit quality could be referred to the role of N-fixing bacteria involved in Nitrobin and PDB involved in Phosphorin on increasing the available N and P in soil which improved plant growth, NPK uptake, chlorophyll content and consequently increased early and total yield production and improved fruit quality.

4.2. Second Experiment :

Effect of organic fertilizer application on vegetative growth, chemical constituents, flowering, yield and fruit quality of sweet peppers.

4.2.1. Effect of organic-N fertilizer on vegetative growth :

The effect of organic-N fertilizer source on vegetative growth at flowering stage 70 days after transplanting, data (Table, 12) show that plants fertilized with Biogas gave the best vegetative growth characteristics; plant height, No. of leaves, leaf area, fresh and dry weight per plant as compared with other used organic N-sources in both seasons. Whereas, Chicken manure comes in the second rank and equal with Agrolig and FYM in fresh weight but not in dry weight. Also the Agrolig comes in the third rank and equal with FYM in plant height and fresh weight. Whereas, FYM or Agrolig application gave the lowest dry weight per plant, in both seasons.

The superiority of Biogas organic fertilizer on plant vegetative growth may be due to the fact that Biogas is a well ferminted organic fertilizer, free of pathogen sources and seed weeds, added to that the general benefits of organic-N fertilizers, thus it is a good source for most macro and micronutrients and it increases soil porosity and improve aeration of such clay loam soil of this experiment. El-Shimi (1998) and Mikhaeel,*et al.* (1997) on Biogas and FYM , Abo-El-Defan (1990), Eissa (1996)

Table(12): Vegetative growth of sweet pepper at flowering stage (70 days after transplanting), as affected by source or level of organic N-fertilizer during the summer seasons of 2000 & 2001.

Characters / Treatments	Plant height cm	Stem diamter cm	Number of leaves/plant	Leaf area cm^2/plant	Fresh weight g/plant	Dry weight g/plant
			First season (2000)			
N-Source 1. Biogas	23.10 A	0.83 A	95.69 A	971.5 A	84.72 A	28.88 A
2. FYM	21.42 C	0.81 AB	88.50 D	849.8 D	79.50 B	25.91 B
3. Chicken manure	22.15 B	0.83 A	93.26 B	905.1 B	81.54 B	27.86 A
4. Agrolig	21.86 B	0.78 B	91.26 C	870.8 C	80.21 B	26.28 B
N-Level Organic + Chemical 0 +60kg N+PK	23.82 A	0.92 A	102.5 A	952.8 B	87.76 A	30.90 A
30 kg N + 30kgN+PK	23.91 A	0.85 B	100.10 B	1024.0 A	86.40 A	30.39 A
60 kg N + PK	21.32 B	0.80 C	88.44 C	857.6 C	80.55 B	25.88 B
60 kg N + 0	19.49 C	0.70 D	77.63 D	763.0 D	71.26 C	21.75 C
			Second season (2001)			
N-Source 1. Biogas	24.08 A	1.04 A	100.10 A	1021.0 A	93.48 A	33.43 A
2. FYM	22.40 C	1.01 BC	92.82 D	899.5 D	88.25 B	29.59 C
3. Chicken manure	23.13 B	1.03 AB	97.64 B	954.7 B	90.29 B	31.71 B
4. Agrolig	22.84 B	1.00 C	96.26 C	920.5 C	88.96 B	29.98 C
N-Level Organic + Chemical 0 +60kg N+PK	24.80 A	1.10 A	107.50 A	1003.0 B	95.28 A	34.44 B
30 kg N + 30kgN+PK	24.88 A	1.07 A	103.80 B	1073.0 A	96.41 A	35.54 A
60 kg N + PK	22.30 B	1.00 B	94.07 C	907.6 C	88.05 B	29.13 C
60 kg N + 0	20.46 C	0.91 C	81.38 D	812.2 D	81.25 C	25.60 D

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

and Abd-El-Aty (1997) on Chicken manure, Corrales *et al.*, (1991) on Chicken and Compost, Lulakis and Petsas (1995) on humic substances, Gianquinto and Borin (1990), Shehata (1992) and Midan (1995) on FYM stated the superiority of Biogas organic fertilizer on plant growth as compared with FYM and Chicken manure.

Concerning the effect of organic-N fertilizer level on vegetative growth 70 days after transplanting, data (Table, 12) show that using 60 kg organic-N only without PK gave the lowest vegetative growth in both seasons.

This result means that organic-N fertilizers had not enough P and K to cover sweet pepper requirements all over the season. Therefore, plants supplied with 60 kg organic-N plus P and K, as super phosphate and potassium sulphate, encouraged vegetative growth. Moreover, it was clear that the most favourable growth of sweet pepper plants was obtained by using 60 kg mineral-N + PK or 30 kg organic-N + 30 kg mineral-N + PK as general trend in both seasons.

Data (Table, 12) also show that the lowest vegetative growth was obtained when plants were fertilized only with 60 kg organic-N/fed. with or without adding any chemical fertilizers i.e P and K. This result indicates that organic-N application only is not quite enough to provide plants with its requirements of macro and micro elements. It is well known that plants absorb N in the mineral form (NO_3^- or NH_4^+). However, organic-N needs several weeks to be converted from the organic-N to the mineral-N, (Tisdale and Nelson, 1975). This may explain the superiority of adding all N fertilizer requirements in the mineral form (60 kg N as ammonium sulphate) or 50% as mineral-N + 50% as organic-N (30 kg N as ammonium sulphate + 30 kg N in the organic source). i.e mineral-N is easly absorbed by plants and organic-N needs a couple of weeks to be converted to mineral-N. Results agree with Abd-El-Aty (1997) who found that addition of organic manure combined with mineral fertilizers is reflected in a slight superiority on plant growth.

Concerning the interaction effect between source and level of N-fertilizer on vegetative growth, 70 days after transplanting, data (Table, 13) show that using 30 kg organic-N as Biogas + 30 kg mineral-N + PK gave the best result in most plant growth characteristics as compared with all used treatments in both seasons. Whereas, using 30 kg organic-N (Chicken manure) + 30 kg mineral-N + PK comes in the second rank and was similar to the control (100% NPK) in most characteristics of plant vegetative growth. However, plants supplied with 60 kg N as FYM only gave the lowest plant growth as compared to all other treatments.

The superior growth of plants fertilized with 50% of N-requirements as Biogas + 50% as mineral-N + PK could be referred to the superiority of Biogas organic fertilizer on plant

Table(13): Vegetative growth of sweet pepper at flowering stage (70 days after transplanting) as affected by source and level of organic N-fertilizer during the summer seasons of 2000 & 2

	Treatments kg element/fed. / Characters	Plant height cm	Stem diamter cm	Number of leaves/plant	Leaf area cm^2/plant	Fresh weight g/plant	Dry weight g/plant
	Organic + chemical	First season (2000)					
1	Biogas(60N)	20.27 EF	0.7 C	82.0 FG	818.3 G	74.45 EFG	22.93 FGH
2	Biogas(60N) +PK	22.65 C	0.8 B	92.5 CD	884.0 E	84.35 BC	27.64 D
3	Biogas(30N) +30N+PK	25.65 A	0.9 A	105.8 A	1231.0 A	92.33 A	34.03 A
4	Not added +60kg N+PK	23.82 B	0.9 A	102.5 AB	952.8 C	87.76 AB	30.90 BC
5	FYM(60N)	18.82 G	0.7 C	72.0 I	707.8 J	68.98 G	20.82 H
6	FYM(60N) +PK	20.32 EF	0.8 B	84.25 EF	832.0 F	77.70 DEF	24.56 EFG
7	FYM(30N) +30N+PK	22.73 C	0.8 B	95.2 C	906.8 D	83.55 BCD	27.37 DE
8	Not added +60kg N+PK	23.82 B	0.9 A	102.5 AB	952.8 C	87.76 AB	30.90 BC
9	Chicken(60N)	19.52 FG	0.7 C	79.7 GH	772.5 H	71.78 FG	21.96 GH
10	Chicken(60N) +PK	21.42 D	0.8 B	90.2 D	882.0 E	81.53 BCD	26.36 DE
11	Chicken(30N) +30N+PK	23.82 B	0.9 A	100.5 B	1013.0 B	85.09 BC	32.21 AB
12	Not added +60kg N+PK	23.82 B	0.9 A	102.5 AB	952.8 C	87.76 AB	30.90 BC
13	Agrolig(60N)	19.32 G	0.7 C	76.7 H	753.3 I	69.81 G	21.31 H
14	Agrolig(60N) +PK	20.88 DE	0.7 C	86.7 E	832.5 F	78.61 CDE	24.98 DEF
15	Agrolig(30N) +30N+PK	23.42 BC	0.8 B	99.0 B	944.8 C	84.65 BC	27.93 CD
16	Not added +60kg N+PK	23.82 B	0.9 A	102.5 AB	952.8 C	87.76 AB	30.90 BC
		Second season (2001)					
1	Biogas(60N)	21.25 EF	0.9 CD	85.7 G	867.5 H	84.45 E	26.84 GH
2	Biogas(60N) +PK	23.63 C	1.0 B	97.5 CD	934.0 F	91.86 BC	30.95 DE
3	Biogas(30N) +30N+PK	26.63 A	1.1 A	109.5 A	1280.0 A	102.30 A	41.5 A
4	Not added +60kg N+PK	24.80 B	1.1 A	107.5 A	1003.0 C	95.28 B	34.44 C
5	FYM(60N)	19.80 G	0.9 D	75.7 I	757.0 K	78.98 F	24.6 I
6	FYM(60N) +PK	21.30 EF	1.0 B	89.2 F	882.0 G	85.20 DE	27.74 G
7	FYM(30N) +30N+PK	23.70 C	1.0 B	98.7 C	956.0 E	93.56 B	31.57 D
8	Not added +60kg N+PK	24.80 B	1.1 A	107.5 A	1003.0 C	95.28 B	34.44 C
9	Chicken(60N)	20.50 FG	0.9 CD	83.5 G	821.8 I	81.78 EF	25.82 HI
10	Chicken(60N) +PK	22.40 D	1.0 B	95.2 DE	932.0 F	89.03 CD	29.64 EF
11	Chicken(30N) +30N+PK	24.80 B	1.1 A	104.3 B	1062.0 B	95.10 B	36.94 B
12	Not added +60kg N+PK	24.80 B	1.1 A	107.5 A	1003.0 C	95.28 B	34.44 C
13	Agrolig(60N)	20.30 G	0.9 D	80.5 H	802.5 J	79.81 F	25.15 HI
14	Agrolig(60N) +PK	21.85 DE	0.9 BC	94.2 E	882.5 G	86.11 DE	28.18 FG
15	Agrolig(30N) +30N+PK	24.40 BC	1.0 B	102.8 B	994.0 D	94.66 B	32.15 D
16	Not added +60kg N+PK	24.80 B	1.1 A	107.5 A	1003.0 C	95.28 B	34.44 C

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

vegetative growth, thus Biogas is a well fermintated organic fertilizer ; free of pathogen sources and seed weeds, beside the general benefits of organic-N fertilizers thus it is a good source for most macro and micronutrients and increase soil porosity and improve aeration of such clay loam soil of this experiment. Results agree with El-Shimi (1998) and Mikhaeel, *et al.* (1997) who stated the superiority of Biogas organic fertilizer on plant growth.

Referring with the effect of organic-N fertilizer source on vegetative growth 100 days after transplanting, data (Table, 14) show that plants fertilized with Biogas gave the best vegetative growth characteristics; plant height, stem diameter, leaf area, fresh and dry weight per plant as compared with other used organic N-sources in both seasons. The Chicken manure came in the second rank followed by Agrolig , however FYM application led to the lowest fresh and dry weight per plant as compared with the other organic sources. Results on the effect of organic N-fertilizers on plant growth are in harmony with El-Shimi (1998) and Mikhaeel, *et al.* (1997) on Biogas and FYM , Abo-El-Defan (1990), Eissa (1996) and Abd-El-Aty (1997) on Chicken manure, Corrales *et al.*, (1991) on Chicken manure, Gianquinto and Borin (1990), Shehata (1992) and Midan (1995) on FYM who stated the superiority of Biogas organic fertilizer on plant growth.

With concern to the effect of organic-N fertilizer level on vegetative growth 100 days after transplanting, data (Table, 14)

Table(14): Vegetative growth of sweet pepper at the 3 rd picking stage (100 days after transplanting), as affected by source or level of organic N-fertilize during the summer seasons of 2000 & 2001.

Treatments \ Characters	Plant height cm	Stem diamter cm	Leaf area cm^2/plant	Fresh weight g/plant	Dry weight g/plant
			First season (2000)		
N-Source 1. Biogas	43.51 A	1.23 A	3808.0 A	374.9 A	140.9 A
2. FYM	39.51 C	1.13 B	3131.0 C	304.6 D	109.3 D
3. Chicken manure	41.01 B	1.15 B	3453.0 B	362.9 B	133.1 B
4. Agrolig	40.26 BC	1.13 B	3382.0 B	331.9 C	119.8 C
N-Level Organic + Chemical 0 +60kg N+PK	45.00 A	1.20 B	3831.0 B	371.5 B	135.7 B
30 kg N + 30kgN+PK	45.53 A	1.275 A	4100.0 A	391.0 A	153.4 A
60 kg N + PK	38.75 B	1.13 C	3308.0 C	318.0 C	114.5 C
60 kg N + 0	35.03 C	1.03 D	2534.0 D	293.8 D	99.47 D
			Second season (2001)		
N-Source 1. Biogas	44.50 A	1.44 A	3855.0 A	383.6 A	147.9 A
2. FYM	40.75 C	1.35 B	3181.0 C	313.4 D	115.5 D
3. Chicken manure	42.25 B	1.38 B	3503.0 B	371.6 B	140.0 B
4. Agrolig	41.25 C	1.35 B	3432.0 B	340.6 C	126.3 C
N-Level Organic + Chemical 0 +60kg N+PK	46.00 A	1.45 B	3881.0 B	381.5 B	143.2 B
30 kg N + 30kgN+PK	46.63 A	1.50 A	4150.0 A	398.5 A	160.3 A
60 kg N + PK	39.94 B	1.34 C	3358.0 C	328.0 C	121.3 C
60 kg N + 0	36.19 C	1.25 D	2581.0 D	301.3 D	105.0 D

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

show that using 60 kg organic-N without PK gave the lowest vegetative growth in both seasons. This result means that organic-N fertilizers alone had insufficient amount of P and K needed to cover sweet pepper requirements allover the season. Therefore, the application of 60 kg organic-N plus P as super phosphate and K as potassium sulphate encouraged vegetative growth. Moreover, it is clear that the most favourable growth of sweet pepper plants was obtained by using 30 kg organic-N + 30 kg mineral-N + PK followed by using 60 kg mineral-N + PK as general trend in both seasons. In this connection, Abd-El-Aty (1997) found that the addition of organic manure combined with chemical fertilizers reflected a slight superiority on plant growth.

The superiority of using 50% of the required N in the organic form and 50% in the mineral form on vegetative growth may be due to the favorable effect of the mineral nitrogen on the activity of micro organisms responsible for organic fertilizer analysis in the soil (Follett *et al.* , 1981).

With respect to the interaction between source and level of N-fertilizer on vegetative growth 100 days after transplanting, data (Table, 15) show that using 30 kg organic-N as Biogas + 30 kg mineral-N + PK gave the highest plant growth; plant height, stem diamter, leaf area, fresh and dry weight as compared with all used treatments in both seasons. Meanwhile, using 30 kg organic-N as Chicken manure + 30 kg as mineral-N + PK came in the second rank. Also using 30 kg organic-N as Agrolig + 30

Table(15): Vegetative growth of sweet pepper at the 3 rd picking stage (100 days after transplanti as affected by source and level of organic N-fertilizer during the summer seasons 2000 & 2(

Treatments kg element/fed. \ Characters		Plant height cm	Stem diamter cm	Leaf area cm^2/plant	Fresh weight g/plant	Dry weight g/plant
Organic + chemical		First season (2000)				
1	Biogas(60N)	36.0 EF	1.1 D	2818.0 I	344.5 F	118.7 G
2	Biogas(60N) +PK	42.0 C	1.2 C	3504.0 E	361.0 E	131.9 E
3	Biogas(30N) +30N+PK	51.0 A	1.4 A	5079.0 A	422.5 A	177.4 A
4	Not added +60kg N+PK	45.0 B	1.2 C	3831.0 C	371.5 D	135.7 D
5	FYM(60N)	34.0 G	1.0 E	1984.0 M	245.5 J	81.9 K
6	FYM(60N) +PK	37.0 DE	1.1 D	3072.0 H	260.0 I	92.7 I
7	FYM(30N) +30N+PK	42.0 C	1.2 C	3638.0 D	341.5 F	126.7 F
8	Not added +60kg N+PK	45.0 B	1.2 C	3831.0 C	371.5 D	135.7 D
9	Chicken(60N)	35.0 FG	1.0 E	2735.0 K	323.5 G	109.4 H
10	Chicken(60N) +PK	38.0 D	1.1 D	3354.0 F	345.0 F	123.8 F
11	Chicken(30N) +30N+PK	46.0 B	1.3 B	3890.0 B	411.5 B	163.5 B
12	Not added +60kg N+PK	45.0 B	1.2 C	3831.0 C	371.5 D	135.7 D
13	Agrolig(60N)	35.0 FG	1.0 E	2601.0 L	261.5 I	87.9 J
14	Agrolig(60N) +PK	38.0 D	1.1 D	3303.0 G	306.0 H	109.4 H
15	Agrolig(30N) +30N+PK	43.0 C	1.2 C	3794.0 C	388.5 C	146.1 C
16	Not added +60kg N+PK	45.0 B	1.2 C	3831.0 C	371.5 D	135.7 D
		Second season (2001)				
1	Biogas(60N)	37.0 EF	1.3 DE	2854.0 I	352.0 FG	124.7 G
2	Biogas(60N) +PK	43.0 C	1.4 C	3554.0 E	371.0 E	139.2 E
3	Biogas(30N) +30N+PK	52.0 A	1.6 A	5129.0 A	430.0 A	184.7 A
4	Not added +60kg N+PK	46.0 B	1.4 BC	3881.0 C	381.5 D	143.2 D
5	FYM(60N)	35.0 G	1.2 F	2034.0 M	253.0 K	86.9 K
6	FYM(60N) +PK	38.5 DE	1.3 DE	3122.0 H	270.0 J	99.04 I
7	FYM(30N) +30N+PK	43.5 C	1.4 BC	3688.0 D	349.0 G	132.9 F
8	Not added +60kg N+PK	46.0 B	1.4 BC	3881.0 C	381.5 D	143.2 D
9	Chicken(60N)	36.7 EFG	1.2 EF	2785.0 K	331.0 H	115.2 H
10	Chicken(60N) +PK	39.25 D	1.3 D	3404.0 F	355.0 F	130.9 F
11	Chicken(30N) +30N+PK	47.0 B	1.5 B	3940.0 B	419.0 B	170.6 B
12	Not added +60kg N+PK	46.0 B	1.4 BC	3881.0 C	381.5 D	143.2 D
13	Agrolig(60N)	36.0 FG	1.2 F	2651.0 L	269.0 J	93.0 J
14	Agrolig(60N) +PK	39.0 D	1.3 D	3353.0 G	316.0 I	116.2 H
15	Agrolig(30N) +30N+PK	44.0 C	1.4 C	3844.0 C	396.0 C	152.9 C
16	Not added +60kg N+PK	46.0 B	1.4 BC	3881.0 C	381.5 D	143.2 D

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

kg as mineral-N + PK comes in the third rank and plants supplied with 30 kg N as FYM + 30 kg mineral-N had the lowest plant growth, as shown in both seasons. These obtained results agree with Mikhaeel *et al.* (1997) and El-Shimi (1998), who stated the superiority of Biogas organic fertilizer on plant growth.

4.2.2. Effect of organic-N fertilizer on NPK uptake and chlorophyll content in leaves (at 70 days after transplanting):

Concerning the effect of organic-N fertilizer source on NPK uptake 70 days after transplanting, data of plant analysis (Table, 16) show that plants supplied with organic-N as Biogas removed higher quantities of N, P and K than that of plants supplied with other organic-N sources. Plants fertilized with Chicken manure accumulated similar quantities of phosphorus to that of Biogas, but comes in the second rank with respect to N and K uptake and accumulation in leaves, stem and total foliage. However, Plants supplied with FYM had the lowest N and K uptake (mg/plant) as compared with the other sources.

Generally, according to N and K uptake, Biogas led to the highest uptake followed by Chicken manure and followed by Agrolig, however, FYM gave the lowest N and K uptake, as a general trend in both seasons. This result may be referred to the high potassium content of Biogas and Chicken manure than that

Table(16): N, P and K uptake (mg element/plant) in vegetative growth and chlorophyll content (mg/100g)in leaves of sweet pepper at flowering stage (70 days after transplanting) as affected by source or level of organic N-fertilizer during the summer seasons of 2000 & 2001.

Characters / Treatments	mg N/plant			mg P/plant			mg K/plant			Chlorophyll A	Chlorophyll B	Total chlorophyll
	Leaves	Stem	Total	Leaves	Stem	Total	Leaves	Stem	Total	mg/100g	mg/100g	mg/100g
First season (2000)												
N-Source												
1. Biogas	384.9 A	267.4 A	652.4 A	62.7 A	46.3 A	109.1 A	848.4 A	649.2 A	1497.7 A	97.75 A	41.50 A	139.3 A
2. FYM	317.9 B	233.9 B	551.9 D	46.3 B	38.1 A	84.5 C	542.9 D	496.4 D	1039.4 D	93.25 D	40.00 A	133.3 B
3. Chicken manure	368.0 A	259.0 A	627.1 B	58.7 A	44.3 A	103.1 AB	773.8 B	611.9 B	1385.7 B	96.25 B	41.25 A	137.5 A
4. Agrolig	331.6 B	240.8 B	572.4 C	52.0 AB	41.0 A	93.0 BC	643.6 C	546.8 C	1190.4 C	94.75 C	39.75 A	134.5 B
N-Level												
Organic + Chemical 0 +60kg N+PK	410.1 A	280.0 A	690.2 A	60.2 A	45.1 AB	105.3 A	796.0 B	623.0 B	1419.0 B	102.0 A	45.00 A	147.0 A
30 kg N + 30kgN+PK	408.4 A	279.2 A	687.7 A	69.4 A	49.7 A	119.1 A	972.1 A	711.0 A	1683.2 A	101.5 B	42.75 A	144.3 B
60 kg N + PK	304.3 B	227.1 B	531.5 B	48.7 AB	39.3 B	88.1 B	594.2 C	522.1 C	1116.3 C	93.00 C	39.00 B	132.0 C
60 kg N + 0	279.6 C	214.8 B	494.5 C	41.5 B	35.7 B	77.2 B	446.5 D	448.2 D	894.7 D	85.50 D	35.75 C	121.3 D
Second season (2001)												
N-Source												
1. Biogas	383.3 A	266.6 A	649.9 A	66.1 A	48.0 A	114.2 A	916.7 A	683.3 A	1600.0 A	98.55 A	42.20 A	140.8 A
2. FYM	311.0 B	230.5 B	541.6 D	49.1 B	39.5 A	88.7 C	601.9 D	525.9 D	1127.9 D	94.90 D	40.35 A	135.3 C
3. Chicken manure	369.6 A	259.8 A	629.4 B	62.5 A	46.2 A	108.8 AB	841.8 B	645.9 B	1487.8 B	97.18 B	41.57 A	138.8 AB
4. Agrolig	331.0 B	240.5 B	571.6 C	55.4 AB	42.7 A	98.1 BC	709.8 C	579.9 C	1289.8 C	96.20 C	40.80 A	137.0 BC
N-Level												
Organic + Chemical 0 +60kg N+PK	408.1 A	279.0 A	687.2 A	64.8 AB	47.4 A	112.3 A	868.3 B	659.1 B	1527.5 B	103.0 A	45.00 A	148.0 A
30 kg N + 30kgN+PK	404.1 A	277.0 A	681.1 A	72.1 A	51.0 A	123.2 A	1039.9 A	744.9 A	1784.9 A	102.4 B	43.80 A	146.3 A
60 kg N + PK	306.0 B	228.0 B	534.1 B	53.1 BC	41.5 AB	94.7 B	660.9 C	555.4 C	1216.3 C	94.00 C	39.75 B	133.8 B
60 kg N + 0	276.7 C	213.3 B	490.1 C	43.1 C	36.5 B	79.7 B	501.1 D	475.5 D	976.7 D	87.38 D	36.38 C	123.8 C

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

of Agrolig or FYM. Added to that the Biogas organic fertilizer is well fermentated during Biogas production cycle in the fermentators. Abo-El-Defan (1990) on Chicken manure, Abd-El-Aty (1997) on pigon and Chicken manure, El-Shimi (1998) on Biogas and Siminis *et al.*(1998) on humic substances found that these fertilizers were the best organic sources.

With respect to the effect of organic-N fertilizer level, data (Table, 16) show that adding all nitrogen fertilizer requirements in the organic form (60 kg N/fed.) with or without adding P and K led to a lower nitrogen, phosphorus and potassium uptake as compared with that when all nitrogen fertilizer requirements were added as 50% or 100% as mineral nitrogen i.e as ammonium sulphate. Data also show that adding 30 kg N in the organic form + 30 kg N in the mineral form gave higher and similar N and P uptake to that treatment which received all N in the mineral form, as a general trend in both seasons. However, adding 50% of N as organic and 50% as mineral (30 kg organic-N + 30 kg chemical-N + PK) gave the highest K uptake, as shown in both seasons. These results may be referred to the high potassium content of organic fertilizer added to its effect on mineralization and availability of soil N,P and K.(Tisdale and Nelson, 1975)

With respect to the interaction between source and level of N-fertilizer, data (Tables, 17 and 18) show that plants supplied with 30 kg N as Biogas or Chicken manure + 30 kg N in the

Table(17): N, P and K uptake (mg element/plant) in vegetative growth and chlorophyll content (mg/100g)in leaves of sweet pepper at flowering stage (70 days after transplanting) as affected by source and level of organic N-fertilizer during the summer season of 2000.

	Treatments kg element/fed. / Characters	mg N/plant			mg P/plant			mg K/plant			Chlorophyll A	Chlorophyll B	Total chlorophyll
	Organic + chemical	Leaves	Stem	Total	Leaves	Stem	Total	Leaves	Stem	Total	mg/100g	mg/100g	mg/100g
1	Biogas(60N)	347.8 DE	248.9 CD	596.8 D	51.7 BC	40.8 BCDE	92.6 BC	634.3 H	542.1 G	1176.4 H	88.00 I	37.00 C	125.0 FG
2	Biogas(60N) +PK	354.4 CD	252.2 CD	606.6 D	57.4 BC	43.7 BC	101.2 B	761.0 E	605.5 E	1366.5 E	96.00 E	40.00 ABC	136.0 CD
3	Biogas(30N) +30N+PK	427.4 A	288.7 A	716.2 A	81.5 A	55.7 A	137.3 A	1202.5 A	826.2 A	2028.8 A	105.0 A	44.00 AB	149.0 A
4	Not added +60kg N+PK	410.1 A	280.0 A	690.2 B	60.2 B	45.1 B	105.3 B	796.0 D	623.0 D	1419.0 D	102.0 B	45.00 A	147.0 A
5	FYM(60N)	225.4 H	187.7 G	413.2 I	32.7 D	31.3 E	64.1 E	277.6 L	363.8 K	641.5 L	82.00 L	35.00 C	117.0 I
6	FYM(60N) +PK	262.9 G	206.4 F	469.4 G	37.4 CD	33.7 CDE	71.1 DE	383.0 J	416.5 I	799.5 J	90.00 H	39.00 ABC	129.0 EF
7	FYM(30N) +30N+PK	373.3 C	261.6 BC	635.0 C	55.1 BC	42.5 BCD	97.6 BC	715.0 F	582.5 F	1297.5 F	99.00 D	41.00 ABC	140.0 BC
8	Not added +60kg N+PK	410.1 A	280.0 A	690.2 B	60.2 B	45.1 B	105.3 B	796.0 D	623.0 D	1419.0 D	102.0 B	45.00 A	147.0 A
9	Chicken(60N)	306.1 F	228.0 E	534.2 F	46.2 C	38.1 BCDE	84.3 CD	541.2 I	495.6 H	1036.8 I	87.00 J	36.00 C	123.0 GH
10	Chicken(60N) +PK	328.9 E	239.4 DE	568.4 E	53.8 BC	41.9 BCD	95.7 BC	685.5 G	567.7 F	1253.3 G	94.00 F	39.00 ABC	133.0 DE
11	Chicken(30N) +30N+PK	427.0 A	288.5 A	715.6 A	74.7 A	52.3 A	127.0 A	1072.5 B	761.2 B	1833.8 B	102.0 B	45.00 A	147.0 A
12	Not added +60kg N+PK	410.1 A	280.0 A	690.2 B	60.2 B	45.1 B	105.3 B	796.0 D	623.0 D	1419.0 D	102.0 B	45.00 A	147.0 A
13	Agrolig(60N)	239.2 H	194.6 FG	433.8 H	35.2 CD	32.6 DE	67.8 E	332.9 K	391.4 J	724.3 K	85.00 K	35.00 C	120.0 HI
14	Agrolig(60N) +PK	271.2 G	210.6 F	481.8 G	46.2 CD	38.1 BCDE	84.3 CD	547.1 I	498.5 H	1045.7 I	92.00 G	38.00 BC	130.0 E
15	Agrolig(30N) +30N+PK	406.0 B	278.0 AB	684.0 B	66.3 A	48.1 B	114.4 B	898.5 C	674.2 C	1572.7 C	100.0 C	41.00 ABC	141.0 B
16	Not added +60kg N+PK	410.1 A	280.0 A	690.2 B	60.2 B	45.1 B	105.3 B	796.0 D	623.0 D	1419.0 D	102.0 B	45.00 A	147.0 A

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

Table(18): N, P and K uptake (mg element/plant) in vegetative growth and chlorophyll content (mg/100g) in leaves of sweet pepper at flowering stage (70 days after transplanting) as affected by source and level of organic N-fertilizer during the summer season of 2001.

	Treatments / Characters kg element/fed.	mg N/plant			mg P/plant			mg K/plant			Chlorophyll A	Chlorophyll B	Total chlorophyll
	Organic + chemical	Leaves	Stem	Total	Leaves	Stem	Total	Leaves	Stem	Total	mg/100g	mg/100g	mg/100g
1	Biogas(60N)	347.0 CD	248.5 B	595.6 DE	53.2 D	41.6 BCD	94.8 EF	689.7 G	569.8 G	1259.6 H	89.50 I	37.50 CDE	127.0 FG
2	Biogas(60N) +PK	359.3 BC	254.6 B	614.0 CD	62.6 C	46.3 B	108.9 DE	834.5 E	642.2 E	1476.7 E	96.70 E	41.30 ABCD	138.0 C
3	Biogas(30N) +30N+PK	418.6 A	284.3 A	703.0 AB	83.9 E	56.9 A	140.9 A	1274.2 A	862.1 A	2136.4 A	105.0 A	45.00 A	150.0 A
4	Not added +60kg N+PK	408.1 A	279.0 A	687.2 B	64.8 C	47.4 AB	112.3 CD	868.3 D	659.1 D	1527.5 D	103.0 B	45.00 A	148.0 AB
5	FYM(60N)	212.9 H	181.4 E	394.4 J	32.9 F	31.4 E	64.3 H	322.7 K	386.3 K	709.1 L	85.00 L	35.00 E	120.0 H
6	FYM(60N) +PK	253.0 G	201.5 D	454.6 H	41.2 EF	35.6 C	76.8 GH	444.6 I	447.3 I	891.9 J	91.60 H	38.40 BCDE	130.0 EF
7	FYM(30N) +30N+PK	370.1 B	260.0 B	630.2 C	57.6 CD	43.8 BCD	101.5 DEF	772.0 F	611.0 F	1383.0 F	100.0 D	43.00 ABC	143.0 B
8	Not added +60kg N+PK	408.1 A	279.0 A	687.2 B	64.8 C	47.4 AB	112.3 CD	868.3 D	659.1 D	1527.5 D	103.0 B	45.00 A	148.0 AB
9	Chicken(60N)	311.6 E	230.8 C	542.4 F	48.8 DE	39.4 BCDE	88.3 F	601.7 H	525.8 H	1127.6 I	88.00 J	37.00 CDE	125.0 G
10	Chicken(60N) +PK	336.8 D	243.4 BC	580.2 E	58.2 C	44.1 BC	102.4 DEF	752.0 F	601.0 F	1353.0 G	94.90 F	40.10 ABCDE	135.0 CD
11	Chicken(30N) +30N+PK	421.8 A	285.9 A	707.8 A	78.3 AB	54.1 A	132.4 AB	1145.3 B	797.6 B	1943.0 B	102.8 BC	44.20 AB	147.0 AB
12	Not added +60kg N+PK	408.1 A	279.0 A	687.2 B	64.8 C	47.4 AB	112.3 CD	868.3 D	659.1 D	1527.5 D	103.0 B	45.00 A	148.0 AB
13	Agrolig(60N)	235.3 D	192.6 E	428.0 I	37.6 EF	33.8 DE	71.5 H	390.3 J	420.1 J	810.4 K	87.00 K	36.00 DE	123.0 GH
14	Agrolig(60N) +PK	275.0 F	212.5 D	487.6 G	50.5 D	40.2 BCDE	90.7 FG	612.5 H	531.2 H	1143.7 I	92.80 G	39.20 ABCDE	132.0 DE
15	Agrolig(30N) +30N+PK	405.7 A	277.8 A	683.6 B	68.6 BC	49.3 AB	117.9 BCD	968.2 C	709.1 C	1677.3 C	102.0 C	43.00 ABC	145.0 AB
16	Not added +60kg N+PK	408.1 A	279.0 A	687.2 B	64.8 C	47.4 AB	112.3 CD	868.3 D	659.1 D	1527.5 D	103.0 B	45.00 A	148.0 AB

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

mineral form as ammonium sulphate (treatments No.3 and 11) had higher N, P and K uptake than those that received the same dose of organic fertilizer as FYM or Agrolig (treatments No.7 and 15), as shown in both seasons. However, plants supplied with 60 kg N as FYM only gave lower NPK uptake than all other treatments. Abd-El-Aty (1997) reached to simillar results and found that addition of organic manure (pigeon or chicken manures) combined with chemical fertilizers increased N, P, and K content of leaves.

Concerning the effect of organic-N fertilizer source on chlorophyll content of leaves, data (Table, 16) show that organic sources (Biogas, Chicken manure, Agrolig and FYM) significantly differed from each other in a descending order, with respect to chlorophyll-A in leaves. With respect to chlorophyll-B content of leaves, it did not differ significantly due to organic-N fertilizer source, in both seasons. Plants fertilized with Biogas and Chicken manure had higher total chlorophyll content in leaves than that of the other sources. However, no significant differences between Agrolig and FYM were detected with respect to total chlorophyll content, in both seasons.

Concerning the effect of organic-N fertilizer level on chlorophyll content, data (Table, 16) show that using 60 kg organic-N without PK led to the lowest content of chlorophyll-A and/or B in leaves, in both seasons. The highest chlorophyll-A and total chlorophyll content in leaves were obtained by using 60 kg mineral-N + PK followed by using 30 kg organic-N + 30 kg mineral-N + PK, especially in the first season with no significant difference in chlorophyll-B content in both seasons. However, adding 30 kg organic-N + 30 kg mineral-N + PK or adding 60 kg mineral-N + PK gave similar total chlorophyll content in leaves, in the second season.

According to the interaction effect between source and level of organic-N fertilizer on chlorophyll content, data (Tables, 17&18) show that using 30 kg organic-N as Biogas + 30 kg mineral-N + PK (treatment No.3) gave high chlorophyll-A content as compared with all other treatments followed by using 30 kg organic-N as Chicken manure + 30 kg mineral-N + PK (treatment No.11) with no significant differences than using 60 kg mineral-N + PK (control) treatment No.12, in both seasons.

Data also show that adding 50% of nitrogen within all used organic sources (Biogas, FYM, Chicken manure or Agrolig) + 50% mineral-N + PK (treatments 3, 7, 11, 15) gave equally higher chlorophyll-B content with that received 100% of N as mineral form, as shown, in both seasons. It seems that organic-N application had a pronounced effect on chlorophyll-B content of leaves. Generally, adding 30 kg organic-N as (Biogas or Chicken manure) + 30 kg mineral-N + PK gave higher total chlorophyll content as compared with all other treatments and equal with that of the control in both seasons. Results agree with Abd-El-Aty (1997) who found that addition of organic manure (pigeon or chicken manures) combined with chemical fertilizers increased chlorophyll content of leaves.

4.2.3. Effect of organic-N fertilizer on NPK uptake (100 days after transplanting):

The effect of organic-N fertilizer source, data (Table, 19) on N, P and K uptake in different plant organs; leaf, stem and fruits allover the season show that plants fertilized with Biogas manure had significantly higher nitrogen and potassium uptake than the other used sources, as shown in both seasons. However, plants supplied with Biogas, Chicken and Agrolig manure gave similar results of P-uptake as a total accumulation in leaves, stem and fruits, as shown in both seasons. On the other hand, plants supplied with FYM show the lowest N and K content as total uptake (mg/plant). Abo-El-Defan (1990) on Chicken manure, Abd-El-Aty (1997) on pigon and Chicken manure, El-Shimi (1998) on Biogas and Siminis *et al.*(1998) on humic substances, reported that these sources were the best organic fertilizers.

Cocerning with the effect of organic-N fertilizer level on NPK uptake, data (Table, 19) show clearly that adding all nitrogen requirements in the organic form (60 kg organic-N/fed.) decreased NPK uptake. However, adding all N fertilizer in the mineral form (60 kg N as ammonium sulphate) gave higher N and P uptake and similar to that received 30 kg organic-N + 30 kg mineral-N. However, potassium uptake showed the highest

Table(19): N, P and K uptake (mg element/plant) of sweet pepper at the 3 rd picking stage (100 days after transplanting), as affected by source or level of organic N-fertilizer during the summer seasons of 2000 & 2001.

Characters / Treatments	mg N/plant				mg P/plant				mg K/plant			
	Leaves	Stem	Fruit	Total	Leaves	Stem	Fruit	Total	Leaves	Stem	Fruit	Total
First season (2000)												
N-Source 1. Biogas	1150.5 A	725.2 A	1386.5 A	3262.2 A	101.9 A	65.9 A	143.8 A	311.8 A	1731.5 A	1315.7 A	1491.1 A	4538.5 A
2. FYM	906.9 B	603.4 B	1249.2 D	2759.7 D	64.9 C	47.4 B	129.2 D	241.6 B	909.3 D	904.6 C	1335.7 D	3149.7 D
3. Chicken manure	1101.3 A	700.6 A	1333.5 B	3135.5 B	94.3 AB	62.1 AB	138.2 B	294.7 A	1545.3 B	1222.6 A	1431.2 B	4199.2 B
4. Agrolig	956.4 B	628.2 B	1277.5 C	2862.2 C	78.9 BC	54.4 A	132.2 C	265.7 AB	1193.1 C	1046.5 B	1367.7 C	3607.5 C
N-Level Organic + Chemical 0 +60kg N+PK	1173.3 A	736.6 A	1541.0 A	3451.0 A	83.8 B	56.9 AB	160.4 A	301.1 AB	1456.0 B	1178.0 B	1666.0 A	4300.0 B
30 kg N + 30kgN+PK	1161.1 A	730.5 A	1546.8 A	3438.5 A	109.5 A	69.7 A	160.9 A	340.3 A	1985.2 A	1442.6 A	1672.8 A	5100.7 A
60 kg N + PK	898.1 B	599.0 B	1160.5 B	2657.7 B	77.9 B	53.9 AB	119.7 B	251.7 BC	1131.6 C	1015.8 C	1235.2 B	3392.7 C
60 kg N + 0	882.6 B	591.3 B	998.5 C	2472.5 C	68.8 B	49.4 B	102.5 C	220.7 C	806.5 D	853.2 D	1051.6 C	2711.5 D
Second season (2001)												
N-Source 1. Biogas	1150.8 A	725.4 A	1373.5 A	3249.7 A	112.6 A	71.3 A	142.4 A	326.4 A	1948.1 A	1424.0 A	1476.5 A	4848.7 A
2. FYM	879.7 B	589.8 B	1238.3 D	2708.0 D	73.6 C	51.8 B	128.0 D	253.6 B	1096.3 D	998.1 C	1323.4 D	3418.0 D
3. Chicken manure	1117.3 A	708.6 A	1321.0 B	3147.0 B	106.1 AB	68.0 AB	136.9 B	311.0 A	1760.9 B	1330.4 A	1417.0 B	4508.5 B
4. Agrolig	961.1 B	630.5 B	1266.2 C	2858.0 C	89.5 BC	59.7 AB	131.0 C	280.4 AB	1402.2 C	1151.1 B	1355.1 C	3908.5 C
N-Level Organic + Chemical 0 +60kg N+PK	1169.0 A	734.5 A	1532.5 A	3436.0 A	97.6 B	63.8 AB	159.4 A	320.9 A	1681.3 B	1290.6 B	1657.0 A	4629.0 B
30 kg N + 30kgN+PK	1151.6 A	725.8 A	1528.3 A	3405.7 A	118.6 A	74.3 A	159.0 A	352.0 A	2204.7 A	1552.3 A	1651.8 A	5409.0 A
60 kg N + PK	912.1 B	606.0 B	1152.2 B	2670.5 B	91.1 BC	60.5 AB	118.9 B	270.7 B	1340.0 C	1120.0 C	1225.9 B	3686.0 C
60 kg N + 0	876.3 B	588.1 B	985.9 C	2450.5 C	74.4 C	52.2 B	101.1 C	227.9 B	981.5 D	940.7 D	1037.4 C	2959.7 D

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

values when plants received 50% of N each as organic or mineral form. These results show the same trend previously discussed 70 days after transplanting (4.2.2) .

Respecting with the effect of interaction treatments on NPK uptake, data (Tables, 20 and 21) and Figs (6, 7 and 8) show that adding 50% of nitrogen fertilizer in the organic form especially as Biogas or Chicken manure and the other 50% of nitrogen in the mineral form (30 kg organic-N + 30 kg mineral-N , treatments No.3 and 11) gave higher N, P and K uptake as compared with all other treatments in both seasons. This result could be referred to the high PK analysis of Biogas and Chicken manure (Table, C), added to that Biogas manure is a well fermentated organic source, easy to be mineralized in the soil (El-Shimi 1998). On the other hand, plants supplied with 50% of nitrogen as FYM or Agrolig (treatments No. 7 and 15) and the other 50% as mineral N, did not increase N and P uptake as compared with those received all N-requirements in the mineral form.

As a general conclusion, adding 50% of N requirements of sweet pepper fertilization as Biogas or Chicken manure and the other 50% as mineral-N as ammonium sulphate (treatments No. 3 and 11) could be recommended to increase NPK uptake than adding all nitrogen fertilizer requirements in the organic or mineral form. Results completely agree with Abd-El-Aty (1997) who found that addition of organic manure (pigeon or chicken

Table(20): N, P and K uptake (mg element/plant) of sweet pepper at the 3 rd picking stage (100 days after transplanting) , as affected by source and level of organic N-fertilizer during the summer season of 2000.

	Treatments kg element/fed. / Characters	mg N/plant				mg P/plant				mg K/plant			
	Organic + chemical	Leaves	Stem	Fruit	Total	Leaves	Stem	Fruit	Total	Leaves	Stem	Fruit	Total
1	Biogas(60N)	1199.4 AB	749.7 AB	1034.8 I	2984 D	95.5 BC	62.7 AB	106.3 I	264.7 E	1348.1 F	1124.0 E	1092.8 I	3565 H
2	Biogas(60N) +PK	1114.5 B	707.2 B	1211.2 F	3033 D	99.3 BC	64.6 AB	125.1 F	289.2 DE	1598.8 D	1249.4 D	1292.7 F	4141 E
3	Biogas(30N) +30N+PK	1114.6 B	707.3 B	1759.0 A	3581 A	129.1 A	79.5 A	183.6 A	392.3 A	2523.3 A	1711.6 A	1913.0 A	6148 A
4	Not added +60kg N+PK	1173.3 AB	736.6 AB	1541.0 C	3451 B	83.8 CD	56.9 B	160.4 C	301.1 CD	1456.0 E	1178.0 DE	1666.0 C	4300 D
5	FYM(60N)	636.5 E	468.2 E	961.2 K	2066 I	46.5 E	38.2 C	98.5 K	183.4 G	323.0 I	611.5 G	1009.4 K	1944 L
6	FYM(60N) +PK	732.3 DE	516.1 DE	1098.5 H	2347 G	50.0 E	40.0 C	113.1 H	203.2 FG	538.6 H	719.3 GH	1165.0 H	2423 J
7	FYM(30N) +30N+PK	1085.7 BC	692.8 BC	1396.4 E	3175 C	79.3 CD	54.6 BC	144.9 E	279.0 CDE	1319.6 F	1109.8 E	1502.5 E	3932 F
8	Not added +60kg N+PK	1173.3 AB	736.6 AB	1541.0 C	3451 B	83.8 CD	56.9 B	160.4 C	301.1 CD	1456.0 E	1178.0 DE	1666.0 C	4300 D
9	Chicken(60N)	1006.2 C	653.1 C	1011.6 IJ	2671 F	81.4 CD	55.7 B	103.9 IJ	241.1 EF	1083.7 G	991.8 F	1066.4 IJ	3142 I
10	Chicken(60N) +PK	1000.3 C	650.1 C	1191.5 F	2842 E	90.2 BCD	60.1 B	123.1 F	273.5 DE	1385.0 EF	1142.5 E	1270.4 F	3798 G
11	Chicken(30N) +30N+PK	1225.3 A	762.6 A	1590.0 B	3578 A	121.6 A	75.8 A	165.6 B	363.1 AB	2256.6 B	1578.3 B	1722.0 B	5557 B
12	Not added +60kg N+PK	1173.3 AB	736.6 AB	1541.0 C	3451 B	83.8 CD	56.9 B	160.4 C	301.1 CD	1456.0 E	1178.0 DE	1666.0 C	4300 D
13	Agrolig(60N)	688.3 D	494.1 D	986.5 JK	2169 H	51.7 E	40.8 C	101.2 JK	193.8 FG	471.2 H	685.6 H	1038.1 JK	2195 K
14	Agrolig(60N) +PK	745.4 D	522.7 D	1140.9 G	2409 B	72.2 D	51.1 BC	117.6 G	241.0 EF	1004.0 G	952.0 F	1213.0 G	3169 I
15	Agrolig(30N) +30N+PK	1218.8 A	759.4 A	1441.8 D	3420 B	108.1 B	69.0 A	149.7 D	327.0 BC	1841.3 C	1370.6 C	1554.0 D	4766 C
16	Not added +60kg N+PK	1173.3 AB	736.6 AB	1541.0 C	3451 B	83.8 CD	56.9 B	160.4 C	301.1 CD	1456.0 E	1178.0 DE	1666.0 C	4300 D

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

Table(21): N, P and K uptake (mg element/plant) of sweet pepper at the 3 rd picking stage (100 days after transplanting) , as affected by source and level of organic N-fertilizer during the summer season of 2001.

	Treatments kg element/fed. (Organic + chemical) / Characters	mg N/plant				mg P/plant				mg K/plant			
		Leaves	Stem	Fruit	Total	Leaves	Stem	Fruit	Total	Leaves	Stem	Fruit	Total
1	Biogas(60N)	1204.6 A	752.3 A	1021.1 G	2978 D	100.7 CD	65.3 B	104.9 G	271.0 C	1526.4 F	1213.2 E	1077.3 G	3817 G
2	Biogas(60N) +PK	1145.0 AB	722.5 ABC	1202.4 E	3070 C	114.6 BC	72.3 AB	124.2 E	311.2 C	1828.2 D	1364.1 D	1282.7 E	4475 E
3	Biogas(30N) +30N+PK	1084.6 B	692.3 B	1738.0 A	3515 AB	137.5 A	83.7 A	181.3 A	402.6 A	2756.6 A	1828.3 A	1889.0 A	6474 A
4	Not added +60kg N+PK	1169.0 AB	734.5 AB	1532.5 B	3436 B	97.6 CD	63.8 B	159.4 B	320.9 C	1681.3 E	1290.6 DE	1657.0 B	4629 D
5	FYM(60N)	581.5 D	440.7 F	949.7 I	1972 I	47.7 E	38.8 D	97.3 I	183.9 F	468.4 I	684.2 H	996.4 I	2149 K
6	FYM(60N) +PK	687.7 C	493.8 E	1091.4 F	2273 G	61.4 E	45.7 CD	112.4 F	219.6 DEF	730.7 H	815.3 G	1156.9 F	2703 I
7	FYM(30N) +30N+PK	1080.8 B	690.4 B	1379.7 D	3151 C	87.9 D	58.9 BC	143.1 D	290.1 C	1504.9 F	1202.4 E	1483.6 D	4191 F
8	Not added +60kg N+PK	1169.0 AB	734.5 AB	1532.5 B	3436 B	97.6 CD	63.8 B	159.4 B	320.9 C	1681.3 E	1290.6 DE	1657.0 B	4629 D
9	Chicken(60N)	1042.1 B	671.0 D	998.8 GH	2712 E	89.8 D	59.9 BC	102.5 GH	252.3 DE	1276.6 G	1088.3 F	1052.0 GH	3417 H
10	Chicken(60N) +PK	1045.6 B	672.8 CD	1182.6 E	2901 D	103.6 CD	66.8 AB	122.1 E	292.6 C	1593.1 EF	1246.5 E	1260.3 E	4100 F
11	Chicken(30N) +30N+PK	1212.6 A	756.3 A	1570.1 B	3539 A	133.3 AB	81.6 A	163.5 B	378.5 AB	2492.6 B	1696.3 B	1699.0 B	5888 B
12	Not added +60kg N+PK	1169.0 AB	734.5 AB	1532.5 B	3436 B	97.6 CD	63.8 B	159.4 B	320.9 C	1681.3 E	1290.6 DE	1657.0 B	4629 D
13	Agrolig(60N)	677.1 CD	488.5 EF	974.3 HI	2140 H	59.6 E	44.8 CD	99.9 HI	204.4 EF	654.5 H	777.2 GH	1024.2 HI	2456 J
14	Agrolig(60N) +PK	770.2 C	535.1 E	1132.7 F	2438 F	85.0 D	57.5 BC	116.8 F	259.4 D	1208.1 G	1054.0 F	1203.8 F	3466 H
15	Agrolig(30N) +30N+PK	1228.2 A	764.1 A	1425.6 C	3418 B	115.8 BC	72.9 AB	148.0 C	336.9 B	2064.8 C	1482.4 C	1535.7 C	5083 C
16	Not added +60kg N+PK	1169.0 AB	734.5 AB	1532.5 B	3436 B	97.6 CD	63.8 B	159.4 B	320.9 C	1681.3 E	1290.6 DE	1657.0 B	4629 D

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

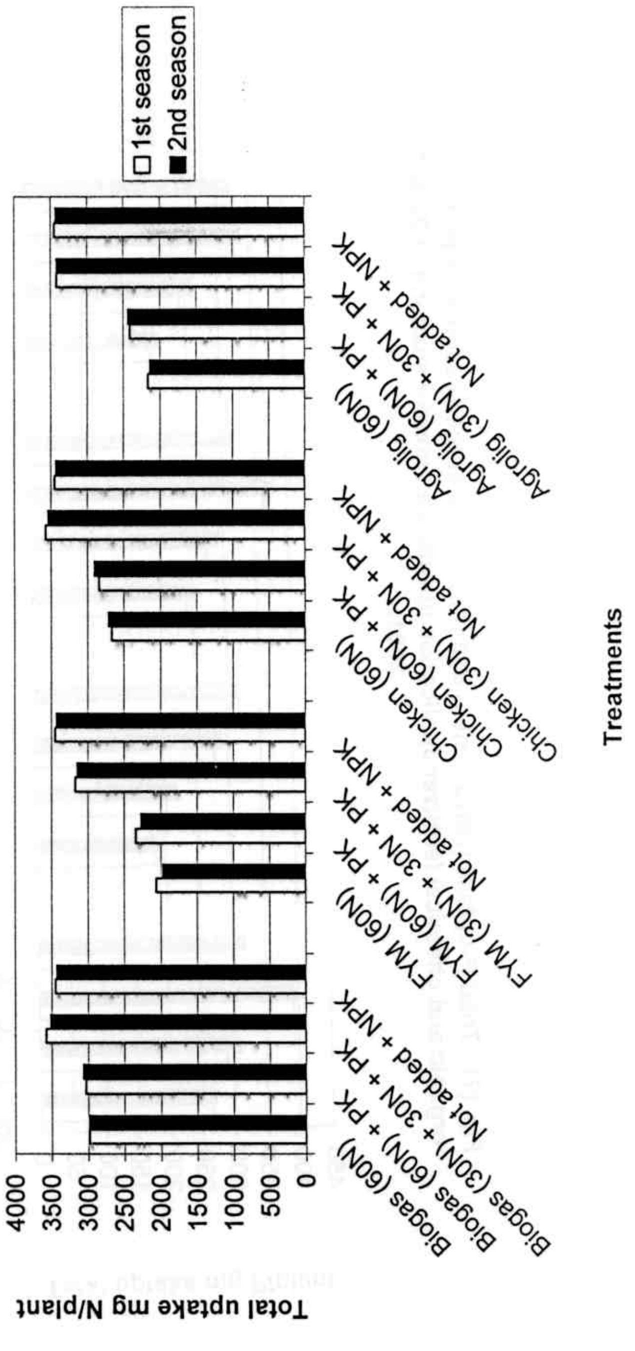


Fig. (6) : Total N-uptake (leaves, stem and fruits) all over the season as affected by organic and chemical fertilizer application during the summer seasons of 2000 & 2001.

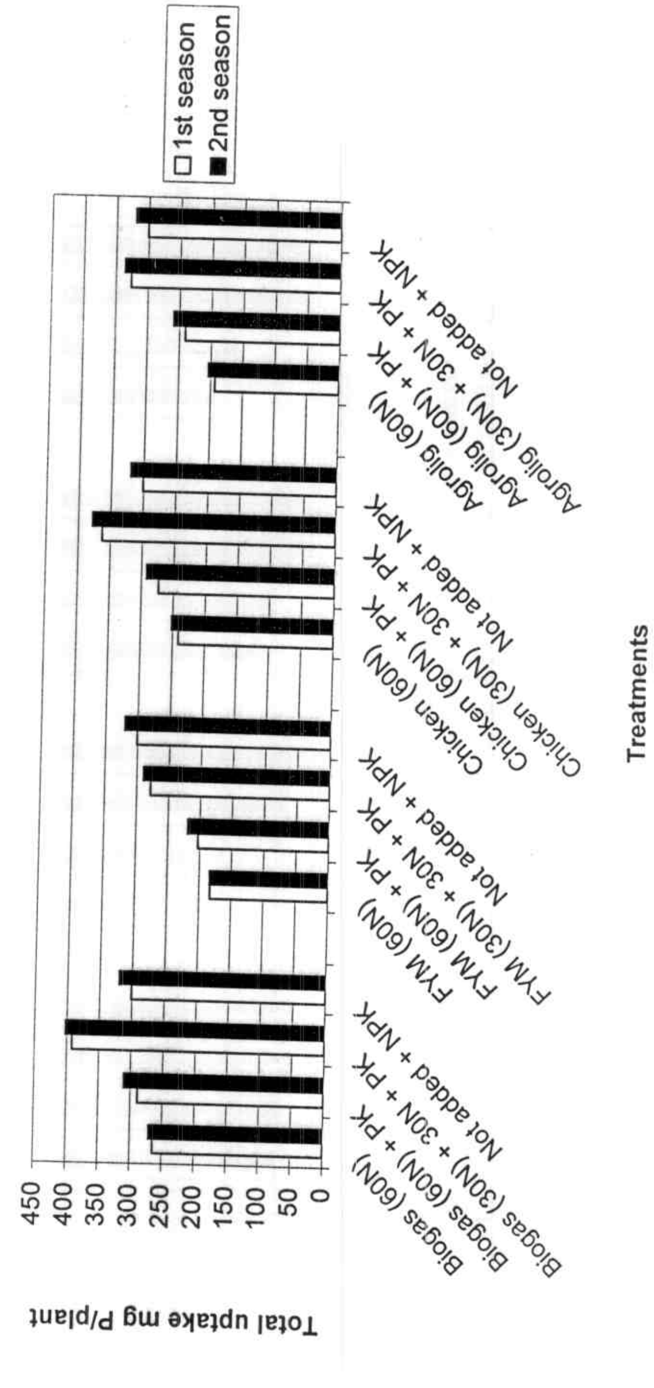
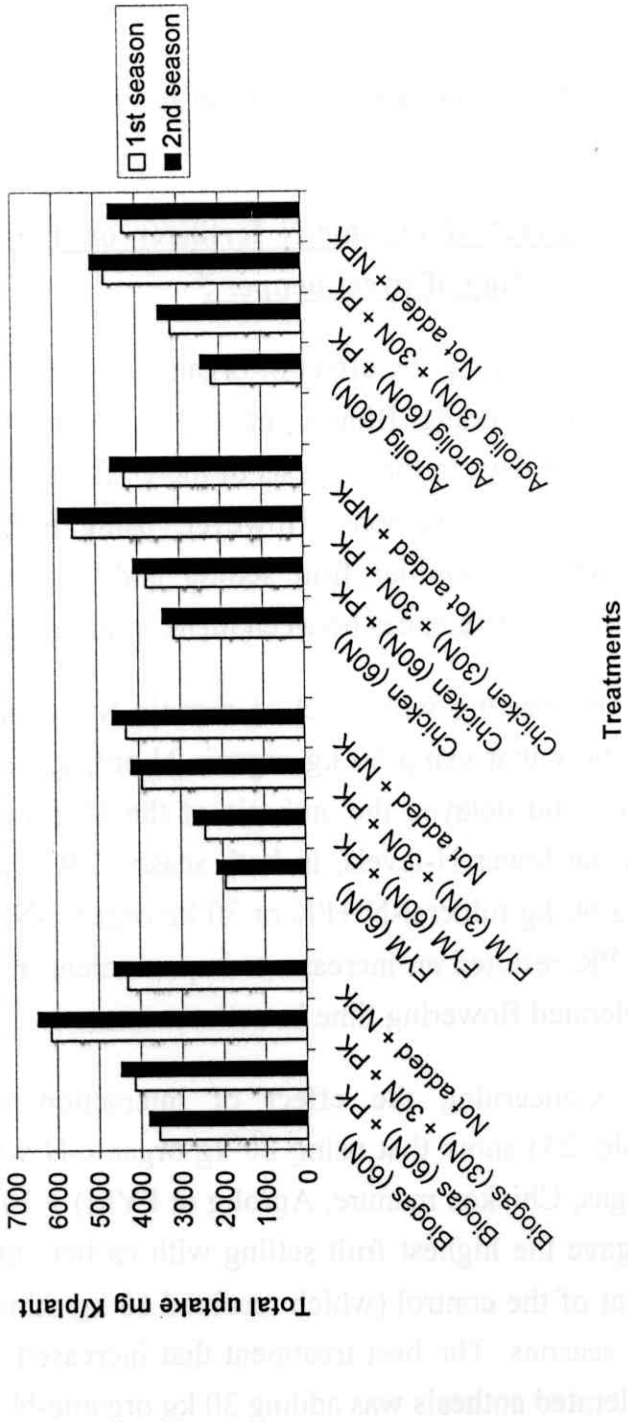


Fig. (7) : Total P-uptake (leaves, stem and fruits) all over the season as affected by organic and chemical fertilizer application during the summer seasons of 2000 & 2001.

Fig. (8) : Total K-uptake (leaves, stem and fruits) all over the season as affected by organic and chemical fertilizer application during the summer seasons of 2000 & 2001.



manures) combined with chemical fertilizers increased N, P, and K content of leaves.

4.2.4. Effect of organic-N fertilizer on flowering and fruit setting of sweet pepper :

Concerning the effect of organic-N source, data (Table, 22) show that adding Biogas manure increased fruit setting and decreased days to the anthesis of the 1st flower as compared with FYM, in both seasons. However, using FYM, Chicken and Agrolig gave similar fruit setting and anthesis time with no significant differences between them, in both seasons.

Respecting with level of organic-N fertilizer, data (Table, 22) show that using 60 kg organic-N only gave the lowest fruit setting and delayed the anthesis of the 1st flower, as compared with the lower N-levels, in both seasons. It is also noticed that using 60 kg mineral-N +PK or 30 kg organic-N +30 kg mineral-N + PK resulted an increase or improvement in fruit setting and accelerated flowering time in both seasons.

Concerning the effect of interaction treatments, data (Table, 23) show that using 30 kg organic-N within any source (Biogas, Chicken manure, Agrolig or FYM) + 30 kg mineral-N + PK gave the highest fruit setting with earlier anthesis and equal to that of the control (which received 60 kg mineral-N + PK), in both seasons. The best treatment that increased fruit setting and accelerated anthesis was adding 30 kg organic-N in the form of

Table(22): Flowering time and fruit setting % of sweet pepper as affected by source or level of organic N-fertilizer during the summer seasons of 2000 & 2001.

Characters / Treatments	First season (2000)		Second season (2001)	
	Anthesis of 1st Flower days	Fruit setting %	Anthesis of 1st Flower days	Fruit setting %
N-Source				
1. Biogas	67.88 B	48.94 A	68.57 B	48.91 A
2. FYM	69.15 A	42.16 B	69.85 A	43.38 B
3. Chicken manure	68.25 AB	46.11 AB	68.95 AB	46.63 AB
4. Agrolig	68.60 AB	44.04 B	69.30 AB	44.64 AB
N-Level				
Organic + Chemical				
0 +60kg N+PK	66.80 C	53.85 A	67.50 C	53.18 A
30 kg N + 30kgN+PK	66.95 C	54.07 A	67.65 C	53.86 A
60 kg N + PK	68.90 B	40.81 B	69.60 B	41.96 B
60 kg N + 0	71.22 A	32.52 C	71.93 A	34.57 C

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

Table(23): Flowering time and fruit setting % of sweet pepper as affected by source and level of organic N-fertilizer during the summer seasons 2000 & 2001.

Treatments kg element/fed. (Organic + chemical) / Characters		First season (2000)		Second season (2001)	
		Anthesis of 1st Flower (days)	Fruit setting (%)	Anthesis of 1st Flower (days)	Fruit setting (%)
1	Biogas(60N)	70.4 ABCD	37.19 EFG	71.1 ABC	38.25 EFG
2	Biogas(60N) +PK	67.8 DEFG	44.19 CDE	68.5 DE	44.20 CDE
3	Biogas(30N) +30N+PK	66.5 G	60.53 A	67.2 E	60.03 A
4	Not added +60kg N+PK	66.8 FG	53.85 ABC	67.5 E	53.18 ABC
5	FYM(60N)	72.4 A	29.62 G	73.1 A	31.89 G
6	FYM(60N) +PK	69.7 BCDE	35.60 EFG	70.4 BCD	38.91 EFG
7	FYM(30N) +30N+PK	67.7 EFG	49.58 BCD	68.4 DE	49.54 BCD
8	Not added +60kg N+PK	66.8 FG	53.80 ABC	67.5 E	53.18 ABC
9	Chicken(60N)	70.7 ABC	32.75 FG	71.4 ABC	35.26 EFG
10	Chicken(60N) +PK	68.7 CDEFG	42.42 DEF	69.4 CDE	42.96 DE
11	Chicken(30N) +30N+PK	66.8 FG	55.41 AB	67.5 E	55.13 AB
12	Not added +60kg N+PK	66.8 FG	53.85 ABC	67.5 E	53.18 ABC
13	Agrolig(60N)	71.4 AB	30.51 G	72.1 AB	32.88 FG
14	Agrolig(60N) +PK	69.4 BCDEF	41.02 DEF	70.1 BCD	41.76 DEF
15	Agrolig(30N) +30N+PK	66.8 FG	50.77 ABCD	67.5 E	50.74 ABCD
16	Not added +60kg N+PK	66.8 FG	53.85 ABC	67.5 E	53.18 ABC

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

biogas + 30 kg mineral-N + PK or adding 60 kg as mineral-N +PK, meanwhile the worst treatment was adding 60 kg organic-N in the form of FYM only.

4.2.5. Effect of organic-N fertilizer on early and total yield of sweet pepper and its components :

According to early and total yield (ton/fed.) as affected by organic-N source, data (Table, 24 and Figs, 9&10) show that Biogas and Chicken manure were similar and better sources which gave higher early and total yield than that of FYM and Agrolig ,as shown in both seasons. With respect to early and total yield (g/plant), Biogas, Chicken, Agrolig and Farmyard manure significantly differed from each other in a descending order.

Such variation between different organic sources with respect to early and total yield may be due to the variation of humus substances production which improves the physical and chemical properties of soil as well as increasing nutrients released and hence their availability to plant uptake. Data (Tables 16, 17, 18, 19, 20 and 21) on NPK uptake and accumulation in leaves, stem and fruits indicate that Biogas and Chicken manure resulted higher NPK nutrients than that of other organic N-sources. These results are in agreement with those obtained by Singh (1989) on Biogas manure, Ranganna *et al.*

Table(24): Fruit yield and its components of sweet pepper as affected by source or level of organic N-fertilizer during the summer seasons of 2000 & 2001.

Treatments \ Characters	Early yield g/plant	Early yield ton/fed	Total yield g/plant	Total yield ton/fed
		First season (2000)		
N-Source 1. Biogas	19.4 A	0.310 A	486.2 A	7.591 A
2. FYM	15.3 D	0.244 B	435.3 D	6.955 B
3. Chicken manure	18.8 B	0.301 A	470.1 B	7.515 A
4. Agrolig	17.3 C	0.276 B	445.3 C	7.151 B
N-Level Organic + Chemical 0 +60kg N+PK	23.3 A	0.373 A	535.0 A	8.560 A
30 kg N + 30kgN+PK	23.4 A	0.373 A	527.6 B	8.280 A
60 kg N + PK	15.7 B	0.251 B	429.6 C	6.868 B
60 kg N + 0	8.4 C	0.133 C	344.7 D	5.504 C
		Second season (2001)		
N-Source 1. Biogas	31.8 A	0.508 A	498.6 A	7.977 A
2. FYM	27.7 D	0.442 C	447.1 D	7.153 B
3. Chicken manure	31.2 B	0.499 A	482.5 B	7.719 A
4. Agrolig	29.7 C	0.475 B	457.7 C	7.324 B
N-Level Organic + Chemical 0 +60kg N+PK	35.7 A	0.572 A	547.4 A	8.759 A
30 kg N + 30kgN+PK	35.7 A	0.571 A	539.9 B	8.639 A
60 kg N + PK	28.2 B	0.450 B	442.0 C	7.073 B
60 kg N + 0	20.7 C	0.331 C	356.4 D	5.702 C

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

Fig. (9) : Sweet pepper early yield (ton/fed) as affected by source and level of organic fertilizer application during the summer seasons of 2000 & 2001.

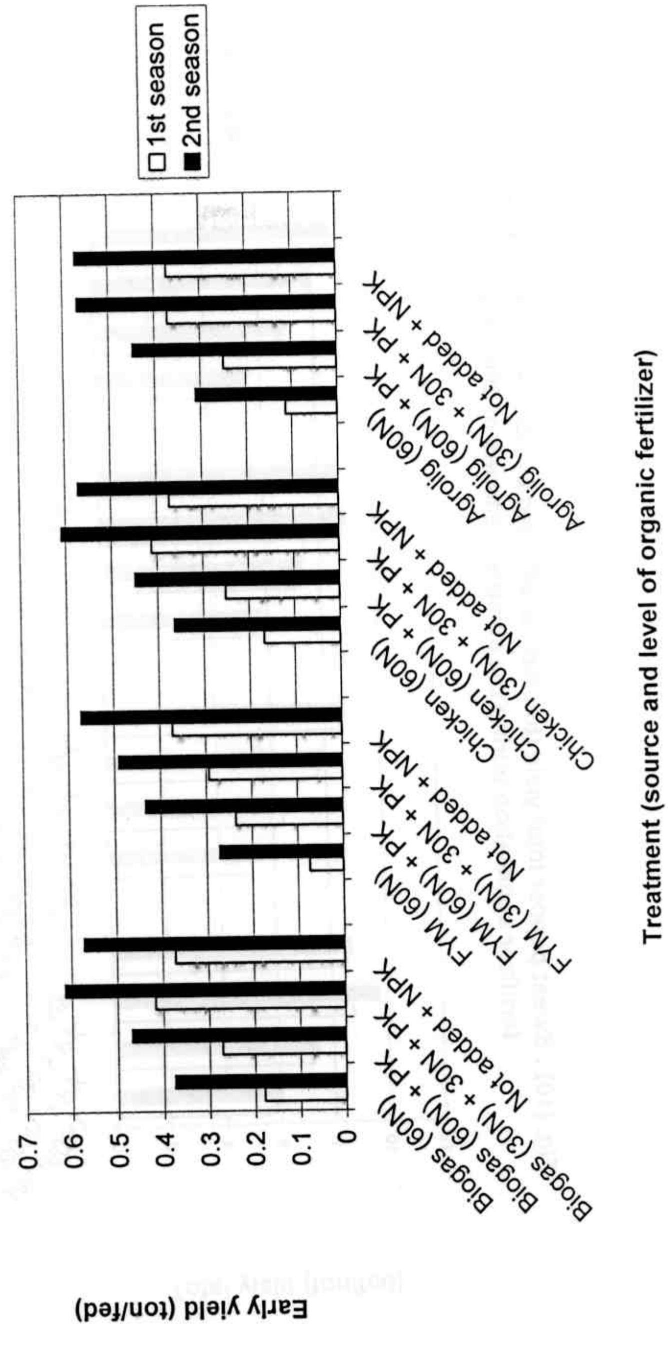
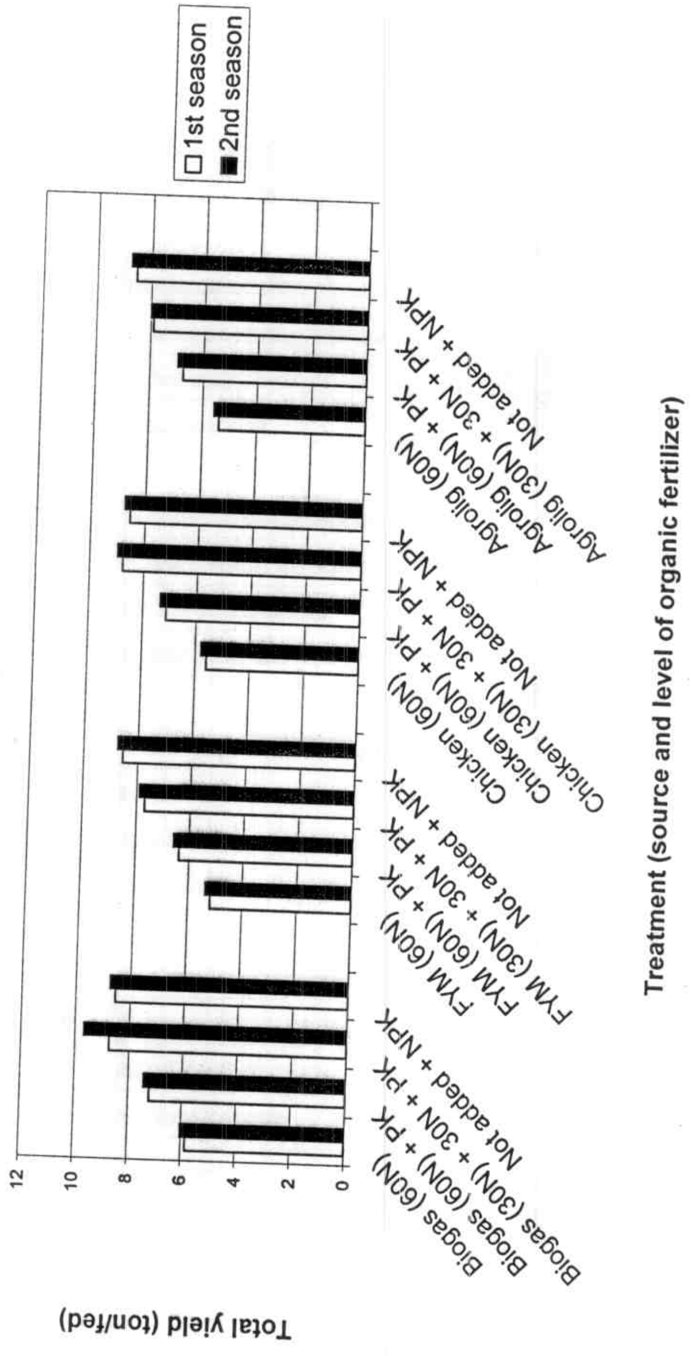


Fig. (10) : Sweet pepper total yield (ton/fed) as affected by source and level of organic fertilizer application during the summer seasons of 2000 & 2001.



(1991) on Biogas and FYM and Eissa (1996) on Chicken and FYM and El-Shimi (1998) on Biogas and FYM.

with respect to the effect of organic-N fertilizer level on early and total yield, data (Table, 24) show that adding all N-fertilizer in the mineral form as ammonium sulphate or adding 30 kg N in the organic form + 30 kg N in the mineral form gave similar early and total yield and were higher than adding all N requirements only in the organic form (60 kg organic-N/fed.) either with or without P and K application. The same trend was detected also in the second season. These results may be referred to the shortage of phosphorus and potassium content of the organic fertilizers. therefore, the treatments which supplied with 60 kg mineral nitrogen without any organic fertilizers plus PK gave higher early and total yield as compared with those received all nitrogen dose (60 kg N/fed.) in the organic form (Biogas, FYM, Chicken manure or Agrolig) without adding P and K. It means that the organic fertilizers may cover 50% of the required N nutrition of sweet pepper but it failed to cover P and K requirements. The superiority of adding 50% of N in the organic form (30 kg N in the organic form + 30 kg N in the mineral form + PK) over adding all N-fertilizer in the organic form (60 kg organic-N + PK) may be referred to the easier and quicker analysis of organic-N when soil received half of N in the mineral form which increased the available-N in the soil, and increased microorganisms activity in the same time (Follett *et al.* , 1981).

Results are confirmed with those of Abd-El-Aty (1997), who found that adding organic-N and mineral N-fertilizers together increased crop yield of sweet pepper than adding each N-source alone. In this connection, Patil *et al.* (1998) found that adding vermicompost save 50% of the required mineral-N applied to tomato.

Concerning the interaction between source and level of organic-N fertilizer, it is evident from Table (25) and Figs. (9 & 10) that the treatments which received 30 kg N in the organic form (Biogas and Chicken manure) + 30 kg N in the mineral form + PK, gave the highest early yield in both seasons, followed by Agrolig which came in the second rank and equal with the control (60 kg as mineral-N + PK). It is also evident that the treatments received 30 kg N in the organic form (Biogas manure) + 30 kg N in the mineral form + PK, gave the highest total yield, in both seasons. Whereas, plants received 30 kg N in the organic form (Chicken manure) + 30 kg N in the mineral form + PK, came in the second rank and equal with the control (60 kg as mineral-N + PK). However, plants supplied with 60 kg N as FYM only gave the lowest early and total yield than all other treatments. These results are in agreement with those obtained by Gianquinto and Borin (1990) on tomato and Abd-El-Aty (1997) on sweet pepper.

Table(25): Fruit yield and its components of sweet pepper as affected by source and level of organic N-fertilizer during the summer seasons 2000 & 2001.

	Treatments kg element/fed. / Characters	Early yield g/plant	Early yield ton/fed	Total yield g/plant	Total yield ton/fed
	Organic + chemical	First season (2000)			
1	Biogas(60N)	11.19 F	0.179 F	365.4 H	5.845 FG
2	Biogas(60N) +PK	16.92 D	0.271 D	451.1 E	7.218 CD
3	Biogas(30N) +30N+PK	26.10 A	0.417 A	593.3 A	8.743 A
4	Not added +60kg N+PK	23.29 B	0.373 B	535.0 C	8.560 A
5	FYM(60N)	4.66 H	0.074 H	326.3 J	5.180 H
6	FYM(60N) +PK	14.71 E	0.235 E	398.5 G	6.377 EF
7	FYM(30N) +30N+PK	18.36 C	0.293 C	481.4 D	7.701 BC
8	Not added +60kg N+PK	23.29 B	0.373 B	535.0 C	8.560 A
9	Chicken(60N)	10.47 F	0.167 F	349.9 I	5.599 GH
10	Chicken(60N) +PK	15.7 E	0.251 E	446.3 E	7.118 CD
11	Chicken(30N) +30N+PK	25.75 A	0.412 A	549.0 B	8.782 A
12	Not added +60kg N+PK	23.29 B	0.373 B	535.0 C	8.560 A
13	Agrolig(60N)	7.12 G	0.113 G	337.2 J	5.396 GH
14	Agrolig(60N) +PK	15.55 E	0.249 E	422.4 F	6.758 DE
15	Agrolig(30N) +30N+PK	23.24 B	0.371 B	486.8 D	7.892 B
16	Not added +60kg N+PK	23.29 B	0.373 B	535.0 C	8.560 A
		Second season (2001)			
1	Biogas(60N)	23.53 F	0.377 F	377.7 H	6.042 G
2	Biogas(60N) +PK	29.36 D	0.470 D	463.6 E	7.417 D
3	Biogas(30N) +30N+PK	38.44 A	0.615 A	605.6 A	9.690 A
4	Not added +60kg N+PK	35.73 B	0.572 B	547.4 C	8.759 B
5	FYM(60N)	17.01 H	0.272 H	336.1 K	5.377 J
6	FYM(60N) +PK	27.15 E	0.434 E	411.0 G	6.576 F
7	FYM(30N) +30N+PK	30.71 C	0.491 C	493.7 D	7.899 C
8	Not added +60kg N+PK	35.73 B	0.572 B	547.4 C	8.759 B
9	Chicken(60N)	22.81 F	0.365 F	362.3 I	5.796 H
10	Chicken(60N) +PK	28.14 E	0.450 E	458.8 E	7.340 D
11	Chicken(30N) +30N+PK	38.09 A	0.610 A	561.3 B	8.980 B
12	Not added +60kg N+PK	35.73 B	0.572 B	547.4 C	8.759 B
13	Agrolig(60N)	19.46 G	0.311 G	349.5 J	5.593 I
14	Agrolig(60N) +PK	27.99 E	0.448 E	434.8 F	6.957 E
15	Agrolig(30N) +30N+PK	35.58 B	0.569 B	499.1 D	7.986 C
16	Not added +60kg N+PK	35.73 B	0.572 B	547.4 C	8.759 B

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

4.2.6. Effect of organic fertilizer treatments on quality of sweet pepper fruits

4.2.6.a. Fruit physical characteristics:

Concerning the effect of organic-N fertilizer source on fruit quality, data (Table, 26) show that using Biogas as a source of organic-N gave the best quality of sweet pepper fruits i.e. length, diameter, size and weight as compared with the other used organic-N sources in both seasons. Concerning fruit length and diameter, Chicken manure produced similar results such Biogas only in the first season, but fruit size and average fruit weight of plants fertilized with Biogas manure is still the favourate one within all organic-N sources in both seasons. With respect to fruit size and average fruit weight, Agrolig fertilizer gave the smallest values as compared with the other organic-N sources, in both seasons. The superiority of Biogas organic fertilizer on fruit quality may be due to the fact that Biogas is a well fermentated organic fertilizer and free of pathogen sources and seed weeds and it is a good source for most macro and micro nutrients, (El-Shimi, 1998).

According to the effect of organic-N fertilizer level on fruit quality, data (Table, 26) show that adding 30 kg organic-N + 30 kg mineral-N + PK gave larger fruit size and similar fruit weight as compared with that of plants received all required-N in the mineral form; 60 kg mineral-N + PK, in both seasons. Data also

Table(26): Fruit quality (physical characteristics) of sweet pepper as affected by source or level of organic N-fertilizer during the summer seasons of 2000 & 2001.

Treatments \ Characters	Fruit length (cm)	Fruit diameter (cm)	Fruit size cm^3/fruit	Average weight of fruit (g)
First season (2000)				
N-Source 1. Biogas	7.613 A	6.450 A	154.9 A	99.63 A
2. FYM	7.463 C	6.125 B	143.6 D	91.63 D
3. Chicken manure	7.563 AB	6.300 AB	152.1 B	96.38 B
4. Agrolig	7.512 BC	6.438 A	149.1 C	93.88 C
N-Level Organic + Chemical 0 +60kg N+PK	7.825 A	6.525 A	155.0 B	113.30 A
30 kg N + 30kgN+PK	7.750 A	6.775 A	161.8 A	113.80 A
60 kg N + PK	7.475 B	6.200 B	148.8 C	82.75 B
60 kg N + 0	7.100 C	5.813 C	134.3 D	71.75 C
Second season (2001)				
N-Source 1. Biogas	8.100 A	6.925 A	164.3 A	104.0 A
2. FYM	7.950 C	6.600 C	153.0 D	96.00 D
3. Chicken manure	8.050 AB	6.775 B	161.5 B	100.80 B
4. Agrolig	8.000 BC	6.731 B	158.5 C	98.25 C
N-Level Organic + Chemical 0 +60kg N+PK	8.300 A	[illegible].000 B	165.0 B	117.00 A
30 kg N + 30kgN+PK	8.250 A	[illegible].250 A	170.5 A	118.80 A
60 kg N + PK	7.950 B	6.681 C	158.8 C	86.50 B
60 kg N + 0	7.600 C	6.100 D	143.0 D	76.75 C

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

show that adding all N-requirements of sweet pepper (60 kg N/fed.) in the organic form depressed all physical characteristics of fruit quality thus the smallest fruit size and weight was obtained when plants were supplied with 60 kg organic-N only i.e without adding P and K fertilizers.

These results elucidate that organic-N application alone is not enough to supply sweet pepper plants with NPK required for plant growth, yield and adequate to improve fruit quality. On the other hand, adding 50% of the required-N in the organic form and 50% in the mineral form improved fruit physical characteristics similar to that of using 100% of N application in the mineral form. The superiority of adding 30 kg organic-N + 30 kg mineral-N may be due to that mineral-N is easily and quickly taken up by plant roots than organic-N and the latter needs a time to be converted to NH^{+}_{4} and consequently to NO^{-}_{3} available for plant uptake. It means that the presence of mineral-N is quite preferable for the mineralization of organic-N which is essential first to increase the available soil-N. This explanation agree with those of Tisdale & Nelson, (1975).

Concerning the interaction between source and level of organic-N fertilizer on fruit quality (physical characteristics), data (Table, 27) show that using 30 kg N as Biogas + 30 kg mineral-N + PK gave the largest fruits with the heaviest weight as compared with all other treatments, in both seasons. The superiority of this treatment may be due to the interaction

Table(27): Fruit quality (physical characteristics) of sweet pepper as affected by source and level of organic N-fertilizer during the summer seasons 2000 & 2001.

	Characters / Treatments kg element/fed.	Fruit length (cm)	Fruit diameter (cm)	Fruit size cm^3/fruit	Average weight of fruit (g)
	Organic + chemical	First season (2000)			
1	Biogas(60N)	7.2 D	5.7 DE	140.3 F	74.0 H
2	Biogas(60N) +PK	7.5 BC	6.6 AB	153.0 DE	86.2 E
3	Biogas(30N) +30N+PK	7.9 A	6.9 A	171.3 A	125.0 A
4	Not added +60kg N+PK	7.8 A	6.5 AB	155.0 CD	113.3 BC
5	FYM(60N)	7.0 E	5.6 E	123.3 H	69.0 I
6	FYM(60N) +PK	7.4 C	5.8 CDE	143.0 F	79.2 G
7	FYM(30N) +30N+PK	7.6 BC	6.5 AB	153.3 DE	105.0 D
8	Not added +60kg N+PK	7.8 A	6.5 AB	155.0 CD	113.3 BC
9	Chicken(60N)	7.1 DE	5.5 E	140.3 F	73.0 H
10	Chicken(60N) +PK	7.5 BC	6.3 ABCD	150.0 DE	84.2 EF
11	Chicken(30N) +30N+PK	7.8 A	6.8 A	163.3 B	115.0 B
12	Not added +60kg N+PK	7.8 A	6.5 AB	155.0 CD	113.3 BC
13	Agrolig(60N)	7.1 DE	6.0 BCDE	133.3 G	71.0 HI
14	Agrolig(60N) +PK	7.4 C	6.3 ABC	149.0 E	81.2 FG
15	Agrolig(30N) +30N+PK	7.7 AB	6.8 A	159.3 BC	110.0 C
16	Not added +60kg N+PK	7.8 A	6.5 AB	155.0 CD	113.3 BC
		Second season (2001)			
1	Biogas(60N)	7.7 F	6.2 EF	149.0 F	79.0 G
2	Biogas(60N) +PK	8.0 DE	7.1 B	163.0 DE	90.0 E
3	Biogas(30N) +30N+PK	8.4 A	7.4 A	180.0 A	130.0 A
4	Not added +60kg N+PK	8.3 AB	7.0 B	165.0 CD	117.0 C
5	FYM(60N)	7.5 G	6.1 FG	132.0 H	74.0 H
6	FYM(60N) +PK	7.9 E	6.3 E	153.0 F	83.0 F
7	FYM(30N) +30N+PK	8.1 CD	7.0 B	162.0 DE	110.0 D
8	Not added +60kg N+PK	8.3 AB	7.0 B	165.0 CD	117.0 C
9	Chicken(60N)	7.6 FG	6.0 G	149.0 F	78.0 G
10	Chicken(60N) +PK	8.0 DE	6.8 C	160.0 E	88.0 E
11	Chicken(30N) +30N+PK	8.3 AB	7.3 A	172.0 B	120.0 B
12	Not added +60kg N+PK	8.3 AB	7.0 B	165.0 CD	117.0 C
13	Agrolig(60N)	7.6 FG	6.1 FG	142.0 G	76.0 GH
14	Agrolig(60N) +PK	7.9 E	6.5 D	159.0 E	85.0 F
15	Agrolig(30N) +30N+PK	8.2 BC	7.3 A	168.0 BC	115.0 C
16	Not added +60kg N+PK	8.3 AB	7.0 B	165.0 CD	117.0 C

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

between organic-N and mineral-N on mineralization and availability of nitrogen in the soil as previously discussed. Data also show that using 30 kg mineral-N + 30 kg N as Chicken manure comes in the second rank with respect to its effect on fruit physical quality, as shown in both seasons.

Generally, results show that adding 30 kg mineral-N + 30 kg N as Chicken manure plus PK (treatments No.11) gave better fruit quality than adding all N requirements in the mineral form (treatments No.12). Abd-El-Aty (1997) found that addition of organic manure (pigeon or chicken manures) combined with chemical fertilizers gave the best fruit quality.

On the other hand, using 50% of the required nitrogen as FYM or Agrolig (treatments 7 and 15) decreased or gave similar fruit quality as those of plants which received 100% of the required N in the mineral form i.e as ammonium sulphate.

4.2.6.b. Fruit chemical characteristics :

Respecting with the effect of organic-N fertilizer source on fruit chemical quality, data (Table, 28) show that there were no significant differences in fruit acidity due to organic-N source, in both seasons except for FYM which slightly decreased fruit acidity as compared with that of Biogas, in the second season. Data also show that adding Biogas and Chicken manure gave similar and higher T.S.S of sweet pepper fruits than that of FYM as a general trend in both seasons. However, T.S.S of fruits

Table(28): Fruit quality (chemical constituents) of sweet pepper fruit as affected by source or level of organic N-fertilizer during the summer seasons of 2000 & 2001.

Characters / Treatments	Acidity mg/100cm^3	T.S.S %	Vitamin C mg/100g	Sugars mg/100g (F.W.) Reducing	Non-reducing	Total	ppm (in dry weight) Pb	Ni	Cd
First season (2000)									
N-Source 1. Biogas	197.1 A	5.6 A	171.1 A	78.00 A	131.5 A	209.5 A	0.006	0.096	0.231
2. FYM	195.4 A	5.4 B	169.6 A	66.00 C	129.0 B	195.0 D	0.002	0.080	0.181
3. Chicken manure	196.6 A	5.6 A	170.9 A	77.00 A	129.0 B	206.0 B	0.008	0.111	0.259
4. Agrolig	196.1 A	5.5 AB	170.1 A	69.50 B	130.5 AB	200.0 C	0.004	0.085	0.212
N-Level Organic + Chemical 0 +60kg N+PK	198.0 A	5.8 A	172.0 A	91.00 B	149.0 A	240.0 A	0.000	0.067	0.140
30 kg N + 30kgN+PK	198.8 A	5.8 A	173.5 A	95.75 A	142.5 B	238.3 A	0.005	0.088	0.211
60 kg N + PK	195.0 B	5.5 B	169.3 B	66.00 C	122.0 C	188.0 B	0.006	0.097	0.234
60 kg N + 0	193.5 B	5.1 C	167.0 C	37.75 D	106.5 D	144.3 C	0.005	0.094	0.219
Second season (2001)									
N-Source 1. Biogas	206.5 A	5.7 A	175.5 A	81.25 A	132.3 A	213.5 A	0.009	0.119	0.276
2. FYM	204.8 B	5.5 B	174.0 A	68.50 D	126.8 B	195.3 D	0.004	0.087	0.218
3. Chicken manure	206.0 AB	5.7 A	175.3 A	78.50 B	130.0 A	208.5 B	0.023	0.195	0.339
4. Agrolig	205.5 AB	5.6 AB	174.5 A	70.50 C	131.8 A	202.3 C	0.007	0.101	0.239
N-Level Organic + Chemical 0 +60kg N+PK	208.0 A	5.9 A	177.0 A	94.00 B	148.0 A	242.0 A	0.004	0.082	0.202
30 kg N + 30kgN+PK	207.5 A	5.9 A	177.3 A	97.75 A	143.8 B	241.5 A	0.007	0.115	0.252
60 kg N + PK	205.0 B	5.6 B	174.3 B	67.50 C	121.0 C	188.5 B	0.016	0.136	0.287
60 kg N + 0	202.3 C	5.2 C	170.8 C	39.50 D	108.0 D	147.5 C	0.010	0.126	0.266

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

fertilized with FYM or Agrolig were not significantly differed from each other, in both seasons.

Vitamin-C content of sweet pepper fruits, did not differ significantly due to organic-N fertilizer source, in both seasons. It seems that vitamin-C is mainly affected by variety, ripening stage (Somos, 1984) and less affected by organic-N source.

According to sugar content of sweet pepper fruits, data show that plants fertilized with Biogas manure had the highest total sugar content, followed by Chicken manure, Agrolig and FYM in a descending order with a significant differences between organic-N sources. This result was true in both seasons and could be referred to the enhancing effect of Biogas manure application on reducing and non-reducing sugar of sweet pepper fruit as compared with that plants supplied with other N-sources especially FYM. This result is in harmony with Abd-El-Aty (1997) who found that pigeon and chicken manures were the best organic N-sources compared with cattle and town refuse.

The effect of organic-N fertilizer level on fruit quality; data (Table, 28) show that adding 60 kg mineral-N + PK or 30 kg organic-N + 30 kg mineral-N + PK led to the highest content of acidity, T.S.S, vitamin-C and total sugars content of sweet pepper fruits. Also using 60 kg organic-N + PK comes in the second rank, but using 60 kg organic-N only gave the lowest values, in both seasons.

Generally, data of sugars content show that increasing the quantity of organic-N application (from 30 up to 60 kg N) decreased non-reducing and total sugars content of sweet pepper fruits but increased its reducing sugars, i.e. that plants supplied with 60 kg organic-N + PK had lower non-reducing and total sugars than that of plant supplied with 30 kg organic-N + 30 kg mineral-N. Therefore, the highest non-reducing and total sugars content was obtained in fruits of plants fertilized with 60 kg mineral-N. This stimulating effect of mineral-N on fruit sugars content may be referred to the effect of mineral-N nutrition on chlorophyll content of leaves (Tables, 17&18) and consequently on sugars formation through photosynthesis.

Concerning the effect of interaction between source and level of organic-N fertilizer on fruit quality, data (Tables, 29&30) show that using 30 kg N within any organic form + 30 kg mineral-N + PK increased fruit acidity, T.S.S and vitamin-C content as compared with other treatments except when was added as 60 kg mineral-N + PK (control) , as shown in both seasons. Whereas, using 30 kg organic-N as Biogas + 30 kg mineral-N + PK gave highest fruit content of reducing and total sugars than using 60 kg mineral-N + PK (control), in both seasons. However, using 30 kg organic-N (Chicken manure) + 30 kg mineral-N + PK gave similar total sugars content to that of plants which received all N requirements in the mineral form (60 kg mineral-N + PK). Also, using 30 kg organic-N as Agrolig or FYM + 30 kg mineral-N + PK gave lower total sugars content

Table(29): Fruit quality (chemical constituents) of sweet pepper fruit as affected by source and level of organic N-fertilizer during the summer season of 2000.

No.	Treatments kg element/fed. Organic + chemical	Acidity mg/100cm^3	T.S.S %	Vitamin C mg/100g	Sugars mg/100g (F.W.) Reducing	Non-reducing	Total	ppm (in dry weight) Pb	Ni	Cd
1	Biogas(60N)	194.3 DEF	5.2 E	167.3 CD	41.0 G	112.0 H	153.0 H	0.006	0.096	0.233
2	Biogas(60N) +PK	196.0 BCDEF	5.6 BCD	170.0 BCD	76.0 D	120.0 F	196.0 E	0.007	0.103	0.239
3	Biogas(30N) +30N+PK	200.3 A	5.9 A	175.3 A	104.0 A	145.0 AB	249.0 A	0.005	0.089	0.221
4	Not added +60kg N+PK	198.0 ABCD	5.8 AB	172.0 ABC	91.0 B	149.0 A	240.0 B	0.000	0.067	0.140
5	FYM(60N)	192.3 F	5.0 E	166.3 D	35.0 H	97.0 J	132.0 J	0.001	0.080	0.178
6	FYM(60N) +PK	194.0 EF	5.4 D	168.0 CD	52.0 F	128.0 D	180.0 G	0.003	0.082	0.193
7	FYM(30N) +30N+PK	197.3 ABCDE	5.7 ABC	172.3 ABC	86.0 C	142.0 BC	228.0 D	0.001	0.077	0.173
8	Not added +60kg N+PK	198.0 ABCD	5.8 AB	172.0 ABC	91.0 B	149.0 A	240.0 B	0.000	0.067	0.140
9	Chicken(60N)	194.3 DEF	5.2 E	167.3 CD	40.0 G	111.0 H	151.0 H	0.008	0.113	0.249
10	Chicken(60N) +PK	195.0 CDEF	5.6 BCD	170.0 BCD	74.0 D	116.0 G	190.0 F	0.009	0.115	0.283
11	Chicken(30N) +30N+PK	199.3 AB	5.9 A	174.3 AB	103.0 A	140.0 C	243.0 B	0.008	0.104	0.246
12	Not added +60kg N+PK	198.0 ABCD	5.8 AB	172.0 ABC	91.0 B	149.0 A	240.0 B	0.000	0.067	0.140
13	Agrolig(60N)	193.3 F	5.1 E	167.3 CD	35.0 H	106.0 I	141.0 I	0.004	0.086	0.214
14	Agrolig(60N) +PK	195.0 CDEF	5.5 CD	169.0 CD	62.0 E	124.0 E	186.0 F	0.004	0.087	0.219
15	Agrolig(30N) +30N+PK	198.3 ABC	5.7 ABC	172.3 ABC	90.0 B	143.0 BC	233.0 C	0.004	0.082	0.202
16	Not added +60kg N+PK	198.0 ABCD	5.8 AB	172.0 ABC	91.0 B	149.0 A	240.0 B	0.000	0.067	0.140

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

Table(30): Fruit quality (chemical constituents) of sweet pepper fruit as affected by source and level of organic N-fertilizer during the summer season of 2001.

	Treatments kg element/fed. / Characters		Acidity mg'/100cm³	T.S.S %	Vitamin C mg/100g	Sugars mg/100g (F.W.)			ppm (in dry weight)		
	Organic	+ chemical				Reducing	Non-reducing	Total	Pb	Ni	Cd
1	Biogas(60N)		203.0 EFG	5.3 EF	171.0 DE	44.0 J	113.0 E	157.0 I	0.009	0.115	0.283
2	Biogas(60N)	+PK	206.0 BCD	5.7 BCD	175.0 ABCD	79.0 F	119.0 D	198.0 E	0.009	0.129	0.296
3	Biogas(30N)	+30N+PK	209.0 A	6.0 A	179.0 A	108.0 A	149.0 A	257.0 A	0.008	0.113	0.249
4	Not added	+60kg N+PK	208.0 AB	5.9 AB	177.0 ABC	94.0 C	148.0 A	242.0 B	0.004	0.082	0.202
5	FYM(60N)		201.0 G	5.1 F	170.0 E	36.0 L	97.0 F	133.0 K	0.004	0.087	0.219
6	FYM(60N)	+PK	204.0 DEF	5.5 DE	173.0 CDE	56.0 I	123.0 D	179.0 H	0.005	0.089	0.221
7	FYM(30N)	+30N+PK	206.0 BCD	5.8 ABC	176.0 ABC	88.0 E	139.0 C	227.0 D	0.004	0.086	0.214
8	Not added	+60kg N+PK	208.0 AB	5.9 AB	177.0 ABC	94.0 C	148.0 A	242.0 B	0.004	0.082	0.202
9	Chicken(60N)		203.0 EFG	5.3 EF	171.0 DE	42.0 K	112.0 E	154.0 I	0.020	0.199	0.322
10	Chicken(60N)	+PK	205.0 CDE	5.7 BCD	175.0 ABCD	73.0 G	119.0 D	192.0 F	0.040	0.222	0.384
11	Chicken(30N)	+30N+PK	208.0 AB	6.0 A	178.0 AB	105.0 B	141.0 BC	246.0 B	0.009	0.165	0.311
12	Not added	+60kg N+PK	208.0 AB	5.9 AB	177.0 ABC	94.0 C	148.0 A	242.0 B	0.004	0.082	0.202
13	Agrolig(60N)		202.0 FG	5.2 F	171.0 DE	36.0 L	110.0 E	146.0 J	0.007	0.103	0.239
14	Agrolig(60N)	+PK	205.0 CDE	5.6 CD	174.0 BCDE	62.0 H	123.0 D	185.0 G	0.008	0.104	0.246
15	Agrolig(30N)	+30N+PK	207.0 ABC	5.8 ABC	176.0 ABC	90.0 D	146.0 AB	236.0 C	0.006	0.096	0.233
16	Not added	+60kg N+PK	208.0 AB	5.9 AB	177.0 ABC	94.0 C	148.0 A	242.0 B	0.004	0.082	0.202

Means of the same column followed by the same letter were not significantly differed according to Duncan MRT at 5%.

than the control where all N-fertilizer was added in the mineral form, as shown in both seasons.

Generally, using 30 kg organic-N as Biogas + 30 kg mineral-N + PK gave the highest total sugars content of fruits followed by using 30 kg organic-N as Chicken manure + 30 kg mineral-N + PK, as shown in both seasons. Abd-El-Aty (1997) found that addition of organic manure (pigeon or chicken manures) combined with chemical fertilizers gave the highest fruit content of vitamin-C , acidity and TSS.

Concerning heavy metals content of sweet pepper fruits, data (Table, 28) show that organic-N sources were relative higher in heavy metals than the mineral N-source. The addition of Chicken manure led to the highest relative values of Pb, Ni and Cd in sweet pepper fruits. However, FYM gave the lowest content of these heavy metals in fruits.

Data (Tables, 29&30) show that adding organic manures within any used source FYM, Agrolig, Biogas or Chicken manure in ascending order, increased the concentrations of heavy metals, i.e. Pb, Ni and Cd in pepper fruit although these concentrations are still less than the critical limit permitted to be found in normal plants (Eissa, 1996).

Whereas, addition of 60 kg organic-N as Chicken manure + PK gave the highest relative values of Pb, Ni and Cd concentration but still less than the critical limits permitted to be found in normal plants, in both seasons, (Eissa, 1996).