

**RESPONSE OF SOME PEPPER CULTIVARS TO  
ORGANIC AND MINERAL NITROGEN  
FERTILIZERS UNDER SANDY  
SOIL CONDITIONS**

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**ABSTRACT:** This study was carried out during two summer seasons of 1998 and 1999, to study the effect of organic and mineral nitrogen fertilizers (180 kg N, 40m<sup>3</sup> FYM, 40m<sup>3</sup> FYM + 6m<sup>3</sup> Ch.M, 40m<sup>3</sup> FYM + 12m<sup>3</sup> Ch.M, 40m<sup>3</sup> FYM + 60kgN, 40m<sup>3</sup> FYM + 120 kg N, 40m<sup>3</sup> FYM + 180 kg N/ feddan) on the total dry weight, total uptake of NPK and both early and total yield of five pepper cultivars (California Wonder, Marconi, Cayenne Large Red Thick, Anaheim M and Balady) under sandy soil conditions, at El-Khattara Experimental Farm, Fac. Agric., Zagazig University.

Application of 40m<sup>3</sup> FYM + 120 or 180 kg N/ feddan gave the highest total dry weight / plant, total NPK uptake, early and total average fruit weight, average fruit number / plant and early and total yield per plant and per feddan. Anaheim M cv recorded maximum total dry weight / plant, and total uptake of N, P and K followed by cv Balady. Marconi cv gave the highest early and total yield per plant and per feddan. The cvs Cayenne Large Red Thick and Anaheim M gave the highest early and total average fruit number/plant.

The best interaction treatments were the applications of 40m<sup>3</sup> FYM + 120 or 180 kg N/feddan with cv Anaheim M for total dry weight, 40m<sup>3</sup> FYM + 180 kg N/feddan for early and total number of fruits / plant, and early and total yield per plant and per feddan, with cvs Cayenne Large Red Thick, and AnaheimM and Marconi cultivar, respectively.

**Key Words:** Pepper cultivars.. Organic fertilizers.. Nitrogen fertilizer.

## INTRODUCTION

Pepper (*Capsicum annum* L.) is considered as one of the most important vegetable crops in Egypt. It has attracted more attention due to its multifarious use and great nutritional value. Increasing the productivity of peppers, to meet with the increment in the human population, could be achieved through increasing the cultivated area, especially in the newly reclaimed sandy soil and using a high yielding cultivars. Such a soil is infertile and had high pH.

For improving the soil conditions and fertility for peppers, applying 10-15 tons of stable manure acre was recommended by Thompson and Kelly (1957). Furthermore, Choudhury (1977) mentioned that, applying 500q. (about 20 ton) of FYM to the soil at the time of preparation, and 350 kg of ammonium sulphate, both are per hectare, were recommended for growing pepper. Nutrient uptake can be rendered more under a proper ratio of the fertilizers (minerals) that are acting faster and those are acting slower (organic manures). This relationship requires attention, especially in the choice of N fertilizers (Somos, 1984).

The combination between FYM and mineral nitrogen fertilizer was found to be more effective in increasing dry weight of pepper (Midan, 1995; Abdel-Aty, 1997), and total yield (Tropea *et al.*, 1982; Shashidhara *et al.*, 1997; Patil and Biradar, 2001).

The differences among pepper cultivars were detected for dry weight (Swamy and Rao, 1992; Midan, 1995; Pundir and Porwal, 1999), for early yield (Gad, 1974 and Cebula 1995), and for total yield (Kawarkhe *et al.*, 1989; Swamy and Rao, 1992; Hellemans, 1998; Baudino *et al.*, 1999; Pundir and Porwal, 1999).

The stimulative effects of the interactions among farmyard manure, mineral nitrogen fertilizer and cultivars on dry weight and total yield of pepper have been illustrated by Midan (1995).

Therefore, the objective of the present work was to study the effect of N fertilizers, applied as combinations of organic manures (FYM and Chicken M) and mineral nitrogen fertilizer as ammonium sulphate on the dry weight and both the early and total yields of some pepper cultivars under sandy soil conditions.

## MATERIALS AND METHODS

This experiment was carried out during two consecutive summer seasons of 1998 and 1999, at El-Khattara Experimental Farm, Faculty of Agriculture, Zagazig University, to study the efficacy of some pepper cultivars to utilize organic and mineral nitrogen fertilizers under sandy soil conditions, with drip irrigation system. The analyses of the experimental soil, irrigation water, and organic manure are presented in Table 1 (a, b and c), respectively.

**Table 1a.** The physical and chemical properties of the experimental soil

Property	1998 season	1999 season
<b>Physical properties</b>		
Sand (%)	97.56	97.38
Silt (%)	1.32	1.42
Clay (%)	1.12	1.02
Texture	Sandy	Sandy
<b>Chemical properties</b>		
Organic matter (%)	0.05	0.06
Total N (%)	0.02	0.03
Available K ppm	60.00	63.00
Available P ppm	3.00	3.46
CaCO <sub>3</sub> (%)	0.28	0.23
PH	8.21	8.36
EC dsm <sup>-1</sup>	2.11	1.99

Soil samples were taken from 25cm soil depth.

**Table 1b.** The analysis of irrigation water

Property	1998 season	1999 season
Ph	8.02	8.00
EC dsm <sup>-1</sup>	1.42	1.39
Ca <sup>++</sup> mol/l	1.21	1.29
Mg <sup>++</sup> mol/l	1.08	1.00
Na <sup>++</sup> mol/l	12.20	12.39
K <sup>+</sup> mol/l	0.12	0.11
SO <sub>4</sub> <sup>-</sup> mol/l	1.44	1.36
Cl <sup>-</sup> mol/l	5.79	5.42
CO <sub>3</sub> <sup>-</sup> mol/l	0.00	0.00
HCO <sub>3</sub> <sup>-</sup> mol/l	7.38	7.43

**Table 1 c.** Total N% in different organic manure sources

Property	1998 season	1999 season
<b>Farmyard manure (FYM)</b>		
Total N%	0.45	0.48
Total N units in Kg /m <sup>3</sup> (335 Kg)	1.51	1.61
<b>Chicken manure (Ch.M)</b>		
Total N%	3.79	3.76
Total N units in Kg /m <sup>3</sup> (262 Kg)	9.93	9.85

This experiment included 35 treatments which were the combinations of seven N treatments and five pepper cultivars as follows:

### A. Nitrogen fertilizers treatments

For the combined treatments of organic manures (FYM and Ch.M)

and of organic manures with mineral N, data in Table 1c were used to adjust N-units for each N-level. The mineral N source was ammonium sulphate. The treatments were:

1. 180 Kg N (mineral) /feddan (180 unit),
2. 40m<sup>3</sup> FYM/feddan (60 unit),
3. 40m<sup>3</sup> FYM + 6 m<sup>3</sup> chicken manure / feddan (120 unit),
4. 40m<sup>3</sup> FYM + 12 m<sup>3</sup> chicken manure / feddan (180 unit),
5. 40m<sup>3</sup>FYM+ 60 kgN (mineral) / feddan (120 unit),
6. 40m<sup>3</sup>FYM+120kgN (mineral) / feddan (180 unit), and
7. 40m<sup>3</sup>FYM+180kgN (mineral) / feddan (240 unit)

#### B. Pepper cultivars

1. California Wonder (CW): Royal Sluis, Holland,
2. Marconi (Rosso) (Mar.) Nickerson Zwaan b.v., Holland,
3. Cayenne Large Red Thick (CR): Castle Seed, USA,
4. Anaheim M (Ah): Royal Sluis, Holland, and
5. Balady (Bal.): Shamah Agricultural Development, Egypt.

These treatments were arranged in a split plot in randomized

complete block design with three replications. The different nitrogen fertilizers treatments were randomly allocated in the main plots. While, the cultivars were randomly arranged in the sub plots. Plot area was 12.6 m<sup>2</sup>, which consisted of three rows of 6m long and 70 cm wide for each.

Pepper seeds were sown in a nursery under low plastic tunnels on 3rd and 5th January in 1998 and 1999 seasons, respectively, and transplanted in the open field on 11th and 5th April in 1998 and 1999 seasons, respectively. Plant to plant distance was 30 cm.

Farmyard manure was obtained from the animal yard at El-Khattara Farm and added at the time of soil preparation, which trenched in the bottom of the row and covered with 20 cm of sand. The chicken manure was obtained from the chicken Farm at the Faculty of Agriculture, Zagazig University, divided into two equal portions and added to the soil beside the plant (at 5cm apart from the plant stem) at 30 and 60 days after transplanting.

Ammonium sulphate(NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub> (20.5% N) was divided into three portions; i.e., 20, 35 and 45% of the total amount for each N level. Each of these portions was split into three equal parts. The resulted

nine parts were weekly added via irrigation water as fertigation, beginning at 30 days after transplanting, during the plant life cycle, according to the previous sequence.

All the plots received the other fertilizers, as fertigation, as recommended for drip irrigation. The other agricultural practices for growing pepper in the district were followed.

#### **Data Recorded**

##### **1. Dry weight**

One of the three rows per plot was devoted for plant samplings. Three plants from every plot were randomly taken at 70, 90 and 110 days after transplanting, separated to different plant parts and oven dried at 70°C till constant weight. The dry weight of different plant organs were summed and total dry weight/plant was calculated.

##### **2. Plant chemical compositions**

The contents of N, P and K in different plant organs were determined on the basis of dry weight of the 2nd sample in the first season, according to the methods described by Bremner and Mulvaney (1982), Olsen and Sommers (1982) and Jackson (1970), respectively. Their uptakes per plant were computed.

#### **3. Yield and its components**

Fruits at proper maturity stage (green mature) were picked, counted, weighed and recorded for every picking.

##### **a. Early yield**

The first three pickings (starting from 75-95 days after transplanting) were considered as early yield. The following traits were recorded:

1. Average fruit weight,
2. Average fruit number / plant,
3. Early yield / plant, and
4. Early yield / feddan.

##### **b. Total yield**

The following traits, as in the early yield, were recorded:

1. Average fruit weight,
2. Average number of fruits/ plant,
3. Total yield/plant, and
4. Total yield/feddan.

#### **Statistical Analysis**

Recorded data were subjected to the statistical analysis of variance according to Snedecor and Cochran (1967), and the means separation were done according to Duncan (1958).

## RESULTS AND DISCUSSION

### 1. Dry Weight

#### 1.1 Effect of nitrogen fertilizer source

Data in Table 2 show that, different N fertilizer sources and levels had significant effects on pepper plant dry weight (DW) in the two growing seasons. Fertilization of pepper with 40m<sup>3</sup> FYM + 120 or 180 kg N/feddan gave the highest values of total DW per plant at the three sampling dates in both seasons. On the other hand, applications of 180 kg N or 40 m<sup>3</sup> FYM/feddan, each alone, recorded the lowest values of DW per plant.

Farmyard manure contains many species of living organisms which release phytohormones. That may stimulate the plant growth, absorption of nutrients and photosynthesis (Reynders and Vlassak, 1982). Such organisms need nitrogen for multiplication, so that combined additions of organic manure with N fertilizer showed a beneficial effect on dry matter accumulation.

These results are in accordance with Midan (1995) and Abdel-Aty (1997) who reported that, organic manures with chemical fertilizers

gave maximum dry weight of different plant organs of pepper.

#### 1.2 Effect of the cultivar

Results in Table 2 illustrate that *cv* Anaheim M followed by *cv* Balady gave the highest significant values of total dry weight / plant at the three sampling dates in the two growing seasons. On the other hand, *cvs* California Wonder and Cayenne Large Red Thick produced the lowest yields of the total dry weight per plant, during growth periods in the two seasons. Meanwhile, *cv* Marconi lay inbetween.

Since the cultivars had varied genotypes, the differences among pepper cultivars were illustrated by Swamy and Rao (1992), who reported that chilli cultivars LCA-235 and G4 had a high dry matter accumulation. Also, genotype 5-9-A showed superior root dry weight (Midan, 1995), and chilli *cv* Local Desi recorded the highest dry weight/ plant (Pundir and Porwal, 1999).

#### 1.3 Effect of nitrogen fertilizer source and level x cultivar interaction

Data in Tables 3 and 4 show insignificant effect of N fertilizer x cultivar interaction on pepper DW per plant at 70 days in the two growing seasons, and at 90 days in

**Table 2. Effect of nitrogen fertilizer (source and level) and cultivar on the total dry weight of pepper (gm/plant).**

Variable	Days after transplanting					
	1998			1999		
	70	90	110	70	90	110
Effect of nitrogen source and level*						
1	21.78d	31.87e	41.91f	21.08c	30.78d	43.48d
2	24.66d	35.56d	48.00e	24.03c	33.91d	46.35d
3	28.13c	42.44c	59.51d	26.30bc	38.74c	53.80c
4	33.86b	50.67b	69.13b	29.81b	45.42b	61.12b
5	31.01bc	45.37c	63.14c	27.31bc	41.94bc	57.08c
6	37.06a	55.15a	75.37a	32.21ab	37.36ab	64.45ab
7	39.60a	58.61a	78.85a	34.61a	50.48a	67.46a
Effect of cultivars**						
CW	24.43d	39.17d	48.57e	22.11c	35.19d	43.72e
Mar.	29.94c	45.63c	59.35c	27.39b	41.77c	54.32c
CR	25.27d	36.41e	51.51d	22.60c	32.42e	45.80d
Ah.	39.71a	57.90a	81.12a	35.62a	52.12a	73.99a
Bal.	35.01b	49.23b	69.68b	31.80a	44.67b	63.40b

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN / fed. ; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farnyard manure, Ch.M. = Chicken manure)

\*\* CW = California Wonder, Mar. = Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim M, and Bal.= Balady.

Table 3. Effect of the interaction between nitrogen fertilizer (source and level) and cultivars on the total dry weight of pepper in summer 1998

Variable	Nitrogen treatments*						
	1	2	3	4	5	6	7
Cvs**	70 days after transplanting						
CW	17.50a	20.74a	22.63a	25.87a	23.75a	27.66a	33.12a
Mar.	21.60a	25.07a	26.42a	30.32a	27.83a	37.60a	40.75a
CR	14.38a	19.29a	23.06a	30.07a	26.62a	31.30a	32.20a
Ah	26.80a	28.67a	37.14a	45.35a	41.38a	48.65a	49.98a
Bal.	28.61a	29.82a	31.40a	37.70a	35.50a	40.11a	41.95a
	90 days after transplanting						
CW	25.68rs	29.79p-r	32.86o-r	45.23f-k	36.57m-p	49.91d-g	54.15c-e
Mar.	37.22l-p	38.45k-o	41.92k-m	48.70e-h	43.24g-m	52.68c-f	57.18cd
CR	20.33s	27.76qr	33.82n-q	41.53h-n	38.70k-o	44.87g-l	47.84e-i
Ah.	36.65m-p	40.01i-o	56.73cd	64.51b	60.13bc	71.73a	75.53a
Bal.	39.46j-o	40.79h-m	46.87e-j	53.39c-e	48.22e-h	56.55cd	58.35be
	110 days after transplanting						
CW	31.60 tu	35.68t	44.86rs	54.92l-p	48.68p-s	60.24i-m	64.01g-k
Mar.	44.20s	53.02m-q	57.72j-o	63.49g-k	60.69h-m	67.23g-i	69.12g
CR	25.90u	34.17t	52.17n-r	58.82j-n	56.37k-o	64.85g-j	68.31gh
Ah	61.19g-l	66.82g-i	78.71f	87.94cd	51.35d-f	98.03ab	100.80a
Bal.	45.68q-s	50.33o-s	64.12g-k	40.47ef	68.62gh	86.51c-e	92.02bc

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN / fed. ; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farmyard manure, Ch.M. = Chicken manure)

\*\* , CW = California Wonder, Mar. = Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim M, and Bal.= Balady.



**Table 4. Effect of the interaction between nitrogen fertilizer (source and level) and cultivar on the total dry weight (gm/plant) in summer 1999**

Variable	Nitrogen treatments*						
	1*	2	3	4	5	6	7
<i>Cvs**</i>	70 days after transplanting						
CW	17.52a	18.59a	21.30a	23.34a	22.14a	24.94a	47.09a
Mar.	20.29a	25.63a	25.44a	29.30a	26.62a	30.91a	33.54a
CR	16.97a	19.30a	19.66a	23.20a	20.26a	27.42a	31.41a
Ah	28.60a	31.27a	32.87a	39.09a	34.50a	40.38a	42.62a
Bal.	22.01a	25.36a	32.22a	34.14a	33.06a	37.41a	38.38a
	90 days after transplanting						
CW	24.92a	27.19a	33.37a	39.39a	36.98a	41.11a	43.36a
Mar.	32.07a	35.01a	40.32a	45.65a	41.08a	48.01a	50.27a
CR	24.43a	27.52a	28.72a	36.46a	38.38a	37.95a	39.51a
Ah.	40.14a	44.22a	48.39a	56.96a	53.79a	57.35a	63.99a
Bal.	32.37a	35.62a	42.89a	48.64a	45.45a	52.41a	55.29a
	110 days after transplanting						
CW	35.35p	37.49op	41.67no	46.68l-n	43.18n	48.66k-m	52.03j-l
Mar.	41.43no	44.96mn	52.53jk	59.13g-i	55.98ij	61.44f-h	64.76ef
CR	35.39p	37.01op	43.09n	49.43k-m	46.77l-n	53.55jk	55.40ij
Ah	53.26jk	57.38h-j	72.05cd	82.72b	76.56c	86.00ab	90.00a
Bal.	51.99j-l	54.91i-k	59.66f-i	67.64de	62.92e-g	71.61cd	75.11c

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN / fed. ; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farmyard manure, Ch.M. = Chicken manure)

\*\* , CW = California Wonder, Mar. = Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim M, and Bal.= Balady.

the 2nd season only. But, it had significant effect on DW/plant at 110 days, in both seasons and at 90 days in the 1st season. In the last three cases, cv Anaheim M fertilized with 40m<sup>3</sup> FYM + 120 or 180 kg N/feddan recorded the highest values of total dry weight/plant. Whereas, cv Cayenne Large Red Thick gave the lowest values of total dry weight, when fertilized with 180 kg N/feddan, alone.

Such different responses of pepper cultivars to N-fertilizers were also reported by Midan (1995), who found that pepper genotypes; i.e., 25-2 and 5-9-A gave the highest values of stems and leaves dry weight/plant, respectively, when both received 50 or 60m<sup>3</sup> FYM+120 kg N/feddan.

## 2. Total Uptake of N, P and K

### 2.1 Effect of nitrogen fertilizer source

Data in Table 5 indicate that the whole uptake of N, P and K per pepper plant was differed according to N-treatment. The uptake of N per plant or per feddan at 90 days in 1998 was significantly high with 40m<sup>3</sup> FYM + 180 kg N followed by 40m<sup>3</sup> FYM + 120 kg N, and of P and K were with 40 m<sup>3</sup> FYM + 180 kg N, or 120 kg N and/or + 12 m<sup>3</sup> Ch.M.

It is interesting to note that the total uptake of K relative to N ranged from 1.5-2.0 times, of most cases. On the other side, the lowest uptake of N, P and K was observed with 180 kg N mineral form followed by 40m<sup>3</sup> FYM, each alone. With respect to total uptake of N, P and K, the maximum was observed with 40m<sup>3</sup> FYM + 180 kg / N (mineral)/feddan.

These results illustrate that, adding organic manures in combination with chemical fertilizers improved the uptakes of N, P and K better than the additions of each singly. That is may be not only due to that the organic manure improved the soil conditions, but also due to that addition of the chemical fertilizers with the organic one may increase the exchangeable water soluble N, P and K in the organic one, since the soil is sandy and consequently the uptake of these elements increased.

### 2.2 Effect of the cultivar

Data in Table 5 clarify significant differences in the uptake of N, P and K by studied pepper cultivars. The cultivar Anaheim M recorded maximum N, P and K uptake followed by cv Marconi for N uptake, and by cv Balady for P and K uptake. The

Table 5. Effect of nitrogen fertilizer (source and level) and cultivar on the total uptake by pepper plants in summer 1998

Variable	mg/plant			kg/fad.		
	N	P	K	N	P	K
Effect of nitrogen source and level*						
1	919e	129.1d	1381d	18.38e	2.582d	27.62d
2	866e	171.6c	1734c	17.32e	3.432c	34.68c
3	1116d	205.5b	2105b	22.32d	4.110b	42.10b
4	1388c	230.6a	2661a	27.76c	4.612a	53.22a
5	1171d	187.8c	2146b	23.42d	3.756c	42.92b
6	1497b	221.2ab	2580a	29.94b	4.424ab	51.60a
7	1607a	228.5a	2686a	32.14a	4.570a	53.72a
Effect of cultivars**						
CW	1155c	180.8c	1979d	23.10c	3.616c	39.58d
Mar.	1280b	208.0b	2211c	25.60b	4.160b	44.22c
CR	948d	150.1d	1691e	18.96d	3.002d	33.82e
Ah.	1541a	239.6a	2609a	30.82a	4.792a	52.18a
Bal.	1193c	203.2b	2434b	23.86c	4.064b	48.68b

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance, according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN / fed. ; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farmyard manure, Ch.M. = Chicken manure)

\*\* , CW = California Wonder, Mar. = Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim-M., and Bal.= Balady.

lowest uptake values for N, P and K were recorded by cv Cayenne Large Red Thick per plant and per feddan.

### 2.3 Effect of nitrogen fertilizer sources x cultivar interaction

Data in Table 6 indicate significant effect of the interaction treatments on N, P and K uptake per plant and per feddan. Total uptake of N, P and K per plant and per feddan showed that cv Anaheim M fertilized with 40m<sup>3</sup> FYM + 12m<sup>3</sup> Ch.M/fed. and 40m<sup>3</sup> FYM + 120 or 180 kg N/feddan were the best combination treatments for N, P and K uptake by this cultivar.

Regarding to the effect of N-treatments on N, P and K uptake per pepper plant or per feddan on the same cultivar, the results (Table 5) showed that N, P and K uptake by cvs California Wonder and Marconi were favoured by using 40m<sup>3</sup> FYM + 180 kg N / feddan. For cvs Cayenne Large Red Thick and Balady, 40m<sup>3</sup> FYM + 120 or 180 kg N were the best treatments for the uptake of N, P and K as compared with the other used fertilizers treatments.

## 3. Yield and Its Components

### 3.1 Early Yield

#### 3.1.1 Effect of nitrogen fertilizer source

Results in Table 7 show no response of fruit weight to nitrogen source and level, but fruit number and early yield were significantly affected by N-applications. The application of 40m<sup>3</sup> FYM + 120 or 180 kg N/fed. gave superior average early number of fruits / plant, early yield / plant and early yield / feddan. On the other hand, addition of 180 kgN/fed. or 40m<sup>3</sup> FYM/fed., each alone, had the lowest values of the above mentioned traits in both seasons (Table 7).

#### 3.1.2 Effect of the cultivar

Data in Table 7 clearly show that there were significant differences among the studied pepper cultivars in early yield traits. California Wonder, in this respect, showed the highest average fruit weight and the lowest fruit number. On the other hand, cvs Cayenne Large Red Thick and Anaheim M produced the highest fruit number and the lowest average fruit weight. In this connection, Balady cv lay inbetween.

Regarding early yield per plant and per feddan, cv Marconi

Table 6. Effect of the interaction between nitrogen fertilizer source and level x cultivar on total uptake by pepper plants in summer 1998.

N source* cvs**	mg / plant			kg / fed.			
	N	P	K	N	P	K	
1	CW	773no	108.4o	1171no	15.46no	2.17o	23.42no
	Mar.	1109i-l	158.4j-n	1664i-m	22.18i-f	3.17j-n	33.28i-m
	CR	524p	65.2p	866o	10.48p	1.30p	17.32o
	Ah	1082j-m	150.3k-m	1427i-n	21.64j-m	3.01k-m	28.54i-n
	Bal.	1107i-l	163.4i-n	1776h-l	22.14i-l	3.27i-n	35.52h-l
2	CW	792no	136.5m-o	1586k-m	15.84no	2.73m-o	31.72k-m
	Mar.	987k-n	196.7e-j	1949h-k	19.74k-n	3.93e-j	38.98h-k
	CR	729o	126.0no	1316mn	14.58o	2.52no	26.32mn
	Ah	935i-o	195.7e-j	1816h-l	18.70i-o	3.91e-j	36.32h-l
	Bal.	886i-o	203.1d-i	2001g-k	17.72i-o	4.06d-i	40.02g-k
3	CW	906i-o	180.4g-l	1642i-m	18.12i-o	3.61g-l	32.84i-m
	Mar.	1064j-m	234.7c-e	2180e-h	21.28j-m	4.69c-e	43.60e-h
	CR	874m-o	142.7i-o	1635j-m	17.48m-o	2.85i-o	32.70j-m
	Ah	1569c-e	260.2bc	2678cd	31.38c-e	5.21bc	53.56cd
	Bal.	1167h-k	209.4d-h	2392d-g	23.34h-k	4.19d-h	47.84d-g
4	CW	1473d-f	226.1c-f	2522c-e	29.46d-f	4.52c-f	50.44c-e
	Mar.	1326f-i	216.6d-h	2634cd	26.52f-i	4.33d-h	52.68cd
	CR	1052j-m	182.5f-l	2077f-i	21.04j-m	3.65f-l	41.54f-i
	Ah	1825ab	305.1a	3224a	36.50ab	6.10a	64.48a
	Bal.	1269f-j	222.1c-g	2850a-c	25.38f-j	4.44c-g	57.00a-c
5	CW	1065j-m	176.7h-m	1782h-l	21.30j-m	3.53h-m	35.64h-l
	Mar.	1327f-i	193.2e-j	1959h-k	26.54f-i	3.86e-j	39.18h-k
	CR	939i-o	161.2i-n	1857h-k	18.78i-o	3.22i-n	37.14h-k
	Ah	1415e-g	218.8d-h	2722cd	28.30e-g	4.38d-h	54.44cd
	Bal.	1107i-l	189.3f-k	2411d-g	22.14i-l	3.79f-k	48.22d-g
6	CW	1437d-f	201.9d-l	2380d-g	28.74d-f	4.04d-i	47.60d-g
	Mar.	1447d-f	211.9d-h	2476c-f	28.94d-f	4.24d-h	49.52c-f
	CR	1206g-k	189.3f-k	2034g-j	24.12g-k	3.79f-k	40.68g-j
	Ah	1961a	283.9ab	3167ab	39.22a	5.68ab	63.34ab
	Bal.	1433d-f	218.8d-h	2845a-c	28.66d-f	4.38d-h	56.90a-c
7	CW	1640b-d	235.3c-e	2769b-d	32.80b-d	4.71c-e	55.38b-d
	Mar.	1699bc	244.7cd	2614cd	33.98bc	4.89cd	52.28cd
	CR	1311f-i	183.9f-l	2053g-j	26.22f-i	3.68f-l	41.06g-j
	Ah	1999a	262.4bc	3232a	39.98a	5.25bc	64.64a
	Bal.	1386e-h	216.3d-h	2761b-d	27.72e-h	4.33d-h	55.22b-d

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance, according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN/ fed.; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farmyard manure, Ch.M. = Chicken manure)

\*\* CW = California Wonder, Mar. = Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim M., and Bal.= Balady.

**Table 7. Effect of nitrogen fertilizer (source and level) and cultivar on the early yield and its components of pepper in 1998 and 1999.**

Variable	1998				1999			
	Average fruit weight (gm)	Average fruit no. / plant	Early yield		Average fruit weight Plant	Average fruit no. / Plant	Early yield	
			gm/ plant	ton/ fed.			gm/ plant	ton/ fed.
<b>Effect of nitrogen fertilizer source and level*</b>								
1	17.01a	7.30c	124.21e	2.460d	16.90a	7.50d	126.77e	2.431d
2	17.82a	7.73c	137.77d	2.649d	17.42a	7.63d	132.99e	2.582d
3	18.61a	8.50bc	158.22c	3.078c	17.13a	8.76c	150.14d	2.952c
4	19.30a	9.86b	190.39b	3.762b	18.22a	9.93b	180.94b	3.552b
5	18.67a	9.10bc	170.07c	3.301c	17.94a	9.20bc	165.06bc	3.375b
6	19.28a	11.01a	208.21a	4.045a	17.97a	10.83ab	194.59a	3.752ab
7	18.77a	11.66a	218.92a	4.346a	18.49a	11.06a	204.51a	3.986a
<b>Effect of the cultivars**</b>								
CW	39.12a	5.00d	195.60b	3.823b	38.64a	4.80d	185.45b	3.660b
Mar.	33.20b	6.45c	214.27a	4.161a	31.51b	6.47c	203.84a	3.931a
CR	10.23e	13.73a	140.57e	2.772e	9.78e	13.83a	135.25e	2.751d
Ah	11.59d	12.91a	149.62d	2.907d	11.30d	12.71a	143.61d	2.786d
Bal.	19.24c	8.45b	162.63c	3.221c	18.56c	8.54b	156.82c	3.034c

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance, according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN / fed.; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farmyard manure, Ch.M. = Chicken manure)

\*\* CW=California Wonder, Mar.=Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim M., and Bal.= Balady.

followed by California Wonder gave the highest values of the early yield. While, *cv* Cayenne Large Red Thick had the lowest values in this respect, in the two growing seasons. On early yield traits, a previous report by Gad (1974) showed a similar conclusion, regarding *cvs* Yolo Wonder and Cayenne peppers.

These results are in agreement with those obtained by Cebula (1989), who found that the earliest *cvs* were Bendigo F<sub>1</sub>, Vigorio F<sub>1</sub>, Sirono F<sub>1</sub>, Bell Boy F<sub>1</sub>, and Gold F<sub>1</sub>. Moreover, pepper genotype 25-2 gave the highest values of early yield/plant followed by *cv* California Wonder (Midan, 1995).

### 3.1.3 Effect of the nitrogen fertilizer source and cultivar interaction

Data in Tables 8 and 9 indicate that the interaction treatments had significant effect on early yield per plant and per feddan, and on its contributing traits, except that for average fruit weight in the 1<sup>st</sup> season which was insignificant. In the 2<sup>nd</sup> season, *cv* California Wonder had the highest average fruit weight, when fertilized with 40m<sup>3</sup> FYM + 120 kg N / feddan followed by 40m<sup>3</sup> FYM + 180 kg N / feddan.

For fruit number, *cvs* Anaheim M and Cayenne Large Red Thick produced the highest fruit number with 40m<sup>3</sup> FYM + 120 kg N / and with 40m<sup>3</sup> FYM + 180 kgN/feddan in the two growing seasons. On the contrary, both the *cvs* California Wonder and Marconi with all fertilizer treatments gave the lowest fruit number / plant.

For early yield / plant and per feddan (Tables 8 and 9), the results revealed that the highest early yield was gained by *cv* Marconi followed by California Wonder, when both were fertilized with 40m<sup>3</sup> FYM + 180 kgN/fed. or 40m<sup>3</sup> FYM + 120 kgN/feddan. For all the studied cultivars, the highest values of early yield/plant and per feddan could be obtained with 40m<sup>3</sup> FYM + 180 Kg N or with 40m<sup>3</sup> FYM + 120 kgN/feddan, that is true in the two growing seasons.

## 3.2 Total Yield

### 3.2.1 Effect of nitrogen fertilizer source

Results in Table 10 show that N-fertilizer had significant effect on pepper total yield and fruit number per plant, while average fruit weight was not affected, in the two growing seasons. The highest average fruit number and total yield/plant as well as / feddan were obtained with 40m<sup>3</sup>FYM +

**Table 8. Effect of the interaction between nitrogen fertilizer (source and level) and cultivar on early yield and its components of pepper in summer 1998**

Variable	Nitrogen treatments*						
	1	2	3	4	5	6	7
<b>Cvs**</b>	<b>Average fruit weight (gm)</b>						
CW	38.80a	40.12a	39.00a	36.69a	39.76a	41.21a	38.77a
Mar.	31.82a	33.56a	34.49a	32.14a	33.24a	33.55a	33.69a
CR	9.15a	10.69a	9.61a	10.84a	10.51a	10.34a	10.63a
Ah	10.94a	10.22a	11.63a	13.08a	11.84a	11.33a	11.89a
Bal.	16.62a	18.83a	21.74a	20.29a	18.79a	20.35a	18.13a
	<b>Fruit No. / plant</b>						
CW	3.83m	4.00lm	4.66l	5.66k	4.83l	5.66k	6.33j-k
Mar.	4.66l	4.83l	5.66k	7.66i	6.33j-k	7.83hi	8.16hi
CR	11.16e	11.33e	13.50c	14.50b	13.33c	16.00a	16.33a
Ah	10.16f	12.00de	12.00de	12.50d	12.50d	15.55a	15.66a
Bal.	6.66j	6.50j	6.66j	9.00g	8.50gh	10.00f	11.83de
	<b>Early yield / plant (gm)</b>						
CW	148.60k-m	160.50h-l	181.75fg	207.70cd	192.05ef	233.25b	245.40b
Mar.	148.30k-m	162.10h-k	195.25d-f	246.25h	210.40c	262.70a	274.90a
CR	102.15q	121.15op	129.70no	151.95j-m	140.10mn	165.40h-j	173.60g-i
Ah	111.25pq	122.65op	139.55mn	163.50h-k	148.05k-m	176.20gh	186.20fg
Bal.	110.75pq	122.40op	144.85lm	182.60fg	159.75l-l	203.50c-e	214.55c
	<b>Early yield (ton/fed.)</b>						
CW	2.978i-k	3.090h-j	3.571e-g	4.084d	3.710e	4.431c	4.906b
Mar.	2.958i-k	3.131hi	3.640e-g	4.925b	3.996d	5.075b	5.400a
CR	2.043o	2.363n	2.593m	2.936jk	2.801kl	3.195h	3.471g
Ah	2.075o	2.328n	2.696lm	3.213h	2.858kl	3.523fg	3.656ef
Bal.	2.248n	2.635n	2.888k	3.651e-g	3.136hi	4.000d	4.291c

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance, according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN / fed. ; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farmyard manure, Ch.M. = Chicken manure)

\*\* , CW=California Wonder, Mar.=Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim M., and Bal.= Balady.



**Table 9. Effect of the interaction between nitrogen fertilizer (source and level) and cultivar on early yield and its components of pepper in summer 1999**

Variable	Nitrogen treatments*						
	1*	2	3	4	5	6	7
Cvs**	Average fruit weight (gm)						
CW	37.68bc	37.78bc	39.02b	38.58b	36.57c	41.55a	38.32bc
Mar.	29.34f	29.28f	32.10e	31.41e	32.42de	34.09d	31.20e
CR	8.85m	10.13lm	9.31lm	9.84lm	10.30lm	9.68lm	10.21lm
Ah	10.92kl	10.74k-m	10.39lm	12.53j	10.97kl	10.60lm	11.19k
Bal.	19.32gh	19.70g	18.61g-i	17.62hi	18.16g-i	18.68g-i	17.34i
	Fruit No. / plant						
CW	3.66m	3.84m	4.33m	5.33l	5.17l	5.34l	6.00kl
Mar.	5.33lm	5.50kl	5.66kl	7.16j	6.33k	7.17j	8.16hi
CR	12.00de	11.83e	13.33c	14.66b	12.83cd	16.00a	16.17a
Ah	10.16fg	10.66f	12.83cd	12.83cd	13.16c	15.84a	15.50a
Bal.	6.33k	6.34k	7.66ij	9.67c	8.50h	9.83g	11.50e
	Early yield / plant (gm)						
CW	137.90mn	144.70lm	168.95g-j	205.65c	189.06de	221.90b	229.95b
Mar.	156.40i-l	161.05b-k	181.70e-g	224.90b	205.25c	244.45a	254.60a
CR	106.25r	119.80o-q	124.15o-q	144.25lm	132.20m-o	154.95j-l	165.15h-k
Ah	110.95qr	114.50p-r	133.30m-o	160.85h-k	144.40lm	167.95a-k	173.45f-h
Bal.	122.30o-q	124.90n-p	142.60lm	170.45f-i	154.40kl	183.70ef	188.45cd
	Early yield (ton/fed.)						
CW	2.620m-o	2.940k-m	3.378g-j	4.113cd	3.780d-f	4.286bc	4.516ab
Mar.	2.511i-m	2.951k-m	3.575e-g	4.390bc	4.106cd	4.636ab	4.838a
CR	2.020q	2.340o-q	2.481h-p	2.768l-n	3.365g-k	3.045i-l	3.303g-k
Ah	2.145pq	2.175pq	2.618m-o	3.110h-l	2.743l-o	3.298g-k	3.410f-i
Bal.	2.363o-q	2.498np	2.708l-o	3.350g-k	2.983j-m	3.488e-h	3.853de

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance, according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN / fed. ; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farmyard manure, Ch.M. = Chicken manure)

\*\* CW=California Wonder, Mar.=Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim M., and Bal.= Balady.

Table 10. Effect of nitrogen fertilizer (source and level) and cultivar on the total yield and its components of pepper

Variable	1998				1999			
	Average fruit weight (gm)	Average fruit no. / plant	Total yield		Average fruit weight plant	Average fruit no. / plant	Total yield	
			gm/ plant	ton/ fed.			gm/ plant	ton/ fed.
Effect of nitrogen fertilizer source and level*								
1	11.73a	17.85d	209.31e	4.148d	11.28a	18.39f	207.44e	3.989d
2	12.21a	19.06d	231.04e	4.459d	11.42a	19.90e	227.25e	4.410d
3	12.63a	20.97c	264.94d	5.156c	11.85a	22.24d	263.58d	5.154c
4	13.41a	24.47b	328.20b	6.486b	12.59a	25.33b	318.99b	6.262b
5	13.11a	22.09b	289.64c	5.622c	12.24a	23.34c	285.57c	5.608c
6	12.94a	27.85a	356.88a	6.936ab	12.35a	27.76a	342.93a	6.610ab
7	13.51a	28.71a	378.90a	7.521a	12.77a	28.45a	363.38a	7.077a
Effect of the cultivars**								
CW	26.00a	12.11d	326.83b	6.392b	25.91a	12.37d	320.54b	6.332b
Mar.	22.67b	16.53c	374.81a	7.281a	21.57b	17.02c	367.13a	7.084a
CR	6.91e	32.88a	227.16e	4.482e	6.54e	34.52a	225.95e	4.437e
Ah	7.78d	33.54a	260.78d	5.073d	7.37d	33.81a	249.26d	4.837d
Bal.	13.73c	20.47b	281.06c	5.577c	13.32c	20.43b	272.20c	5.268c

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance, according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN / fed. ; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farmyard manure, Ch.M. = Chicken manure)

\*\*, CW=California Wonder, Mar.=Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim M., and Bal.= Balady.

120 or 180 kg N/feddan and with 40m<sup>3</sup> FYM + 12m<sup>3</sup> Ch.M. While, additions of 180 kgN or 40 m<sup>3</sup> FYM, each alone, gave the lowest values of these characters in both seasons.

The increment in yield of pepper may be due to the increase in the yield of dry weight, total uptake of minerals (Tables 2, 5), and also due to the increase in fruit number per plant (Table 10).

The beneficial effect of organic manure on yield may be due not only to that the organic manure improves the soil structure conditions which encouraged the plant to have a good root development by improving the aeration of soil, but also due to that mineral N-fertilizer helps the living organisms in organic manure to multiply (Cooke, 1972). This conclusion agree with those reported by Tropea *et al.* (1982), Doikova *et al.* (1986), Surlekov and Rankov (1989), Meena and Peter (1990), Shashidhara *et al.* (1997) and Patil and Biradar (2001), who reported that application of NPK + FYM to pepper produced the highest yield compared to organic or inorganic fertilizers applied alone.

### **3.2.2 Effect of the cultivar**

The studied cultivars were significantly differed in their yield and its components in the two growing seasons (Table 10). In this respect, *cv* Marconi gave the highest values of yield/plant and total yield / feddan followed by *cv* California Wonder in both seasons. While, *cv* Cayenne Large Red Thick gave the lowest yield values, but gave the highest values of the number of fruits / plant and the lowest average fruit weight. Similar results on *cv*s Yolo Wonder and Cayenne peppers were also reported by Gad (1974).

The variability among the pepper cultivars for average fruit weight, average fruit number/plant, yield / plant and total yield / feddan were also reported by Kawarkhe *et al.* (1989), Swamy and Rao (1992), Cebula (1995), Hellemans (1998), Baudino *et al.* (1999) and Pundir and Porwal (1999).

### **3.2.3 Effect of the nitrogen fertilizer source and cultivar interaction**

Data in Table 11 and 12 show significant effect of the interaction treatments on pepper yield and its components, in the two growing seasons. For average fruit weight, the highest values were obtained

Table 11. Effect of the interaction between nitrogen fertilizer (source and level) x cultivar on the total yield and its components of pepper in summer 1998

Variable	Nitrogen treatments*						
	1	2	3	4	5	6	7
Cvs**	Average fruit weight (gm)						
CW	24.47e	27.24c	27.03cd	26.48d	28.04ab	28.21a	27.48bc
Mar.	20.71i	22.47h	23.69f	22.64gh	30.03f-h	22.94gh	23.39fg
CR	6.18s	6.92q-r	6.43rs	7.10o-r	7.07p-r	7.00pq	7.37n-q
Ah	7.06p-r	6.77q-s	7.72n-p	9.08m	7.40n-q	7.86no	8.22n
Bal.	13.05l	13.58k-l	14.45j	14.01jk	13.44kl	14.10jk	13.47kl
	Fruit No. / plant						
CW	9.82rs	9.50s	10.99qr	13.50p	11.50q	14.00op	15.17no
Mar.	12.39p	13.00p	14.17op	18.67lm	12.39n	19.67kl	20.84k
CR	25.85h	26.51h	31.70ef	35.36c	31.83e	39.43ab	39.48ab
Ah	26.17h	30.31g	30.52fg	32.17e	34.21d	40.34a	41.04a
Bal.	15.00no	15.98n	17.48m	22.67j	20.50k	24.47i	27.01h
	Total yield / plant (gm)						
CW	240.58no	258.66m	297.03j	357.46ef	322.41hi	394.91d	416.79c
Mar.	256.69lm	290.84jk	335.73gh	422.73c	372.11e	451.29b	485.27a
CR	159.75u	183.46t	203.80rs	251.06mn	225.02pq	276.01kl	291.00jk
Ah	184.77t	205.17rs	235.59op	292.07j	253.15mn	317.08i	337.59g
Bal.	195.75st	217.06qr	252.53mn	317.66i	275.48kl	345.08fg	363.86e
	Total yield (ton/fed.)						
CW	4.811m	4.992lm	5.839i	7.028f	6.234h	7.505d	8.337e
Mar.	5.307k	5.621j	6.267h	8.457c	7.069f	8.720b	9.536a
CR	3.195r	3.593q	4.076op	4.857lm	4.500n	5.334k	5.821ij
Ah	3.447q	3.900p	4.554n	5.742ij	4.894lm	6.343h	6.638g
Bal.	3.983p	4.194o	5.040l	6.353h	5.411k	6.781g	7.280e

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance, according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN / fed.; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farmyard manure, Ch.M. = Chicken manure)

\*\* , CW=California Wonder, Mar.=Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim M., and Bal.= Balady.

Table 12. Effect of the interaction between nitrogen fertilizer (source and level) x cultivars on the total yield and its components of pepper in summer 1999.

Variable	Nitrogen treatments (source and level)*						
	1	2	3	4	5	6	7
Cvs**	Average fruit weight (gm)						
CW	22.26de	25.20c	26.03b	26.76ab	27.43a	26.33b	26.42b
Mar.	18.90g	20.51f	22.79d	21.83e	22.29de	22.17de	21.89de
CR	6.12mn	6.47l-n	6.05n	6.53l-n	6.68l-n	6.68l-n	7.10kl
Ah	7.50kl	6.50l-n	7.04k-m	8.31j	7.10kl	7.34kl	7.89jk
Bal.	12.9li	13.34hi	13.97h	12.99i	13.25hi	13.41hi	13.39hi
	Fruit No. / plant						
CW	10.15u	9.83u	11.34t	13.44s	11.81t	14.67p-r	15.34n-p
Mar.	14.11q-s	14.00rs	14.66p-r	18.67m	16.33n	20.01l	21.34k
CR	27.01h	29.64g	35.06d	37.69c	33.38ef	39.34ab	39.54ab
Ah	25.50i	29.85g	32.33f	35.51e	34.83d	40.61a	40.03a
Bal.	15.16o-q	16.16no	17.82m	23.35j	20.34kl	24.17j	26.00hi
	Total yield / plant (gm)						
CW	225.90q	247.81p	295.07jk	359.55ef	323.94gh	386.26d	405.38c
Mar.	266.66no	287.11kl	334.13g	407.63c	364.06e	443.63b	466.88a
CR	165.31t	191.74s	212.11p	246.11p	223.01qr	262.73o	280.73lm
Ah	183.61s	194.03s	227.59q	278.48 l-n	247.32p	298.09jk	315.83hi
Bal.	195.75s	215.57qr	249.00p	303.30ij	269.52m-o	324.09gh	348.15f
	Total yield (ton/fed.)						
CW	4.294p	5.036m	5.903j	7.193e	6.482g	7.493d	7.966c
Mar.	5.180lm	5.259lm	6.570fg	8.014c	7.284de	8.412b	8.869a
CR	3.140r	3.759q	4.242p	4.756n	4.385p	5.168lm	5.615k
Ah	3.330q	3.687q	4.475op	5.385l	4.699no	5.858j	6.210h
Bal.	3.785q	4.313p	4.733n	5.963ij	5.199lm	6.158hi	6.729f

Values having the same alphabetical letter(s) did not significantly differ at the 0.05 level of significance, according to Duncan's multiple range test.

\*, 1; 180 Kg N/fed., 2, 40 m<sup>3</sup> FYM/fed.; 3, 40m<sup>3</sup> FYM.+6m<sup>3</sup> Ch.M/fed.; 4, 40m<sup>3</sup> FYM+12m<sup>3</sup> Ch.M /fed.; 5, 40m<sup>3</sup> FYM + 60 KgN / fed. ; 6, 40m<sup>3</sup> FYM + 120 KgN/fed. and 7, 40m<sup>3</sup> FYM + 180 KgN/fed.

(FYM = Farmyard manure, Ch.M. = Chicken manure)

\*\* , CW=California Wonder, Mar.=Marconi, CR= Cayenne Large Red Thick, Ah= Anaheim M., and Bal.= Balady.

by cv California Wonder when fertilized with 40m<sup>3</sup> FYM + 60 or 120 kg N / feddan, while, the lowest values were obtained by Cayenne Large Red Thick fertilized with all fertilizer treatments.

For fruit number/plant (Tables 11 and 12), results showed that the cvs Anaheim M and Cayenne Large Red Thick produced the highest fruit number, both with 40m<sup>3</sup> FYM + 120 kgN or 180 kgN/feddan, while, cv California Wonder, with all fertilizers treatment, produced the lowest number of fruits/plant.

Regarding total yield/plant and per feddan (Tables 11 and 12), cv Marconi gave the highest values of total yield/plant and per feddan, in both seasons, when fertilized with 40m<sup>3</sup> FYM + 180 kgN/feddan, followed by fertilization with 40m<sup>3</sup> FYM + 120 kg N/feddan, for the same cultivar.

For all the studied cultivars, 40m<sup>3</sup> FYM + 180 kgN gave the maximum total yield of each. This result could be exploited in pepper production, according to the purpose of growing pepper.

Midan (1995), under clay loam soil conditions, found that the pepper genotype 25-2 out yielded the other genotypes in total yield

when fertilized with 50 m<sup>3</sup> FYM + 120 kgN/feddan.

It could be concluded from this study that application of 40m<sup>3</sup> FYM + 120 kgN/feddan gave the highest total dry weight, total NPK uptake/plant and early and total yield per feddan. Anaheim M cv gave the highest total dry weight/plant and total uptake of NPK/plant. Marconi cv recorded the highest early and total yield per feddan. Application of 40m<sup>3</sup> FYM + 120 kgN/feddan was the most favourable interaction treatment for increasing dry weight and yield of all studied pepper cultivars.

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## استجابة بعض أصناف الفلفل للأسمدة النتروجينية العضوية والمعدنية

### تحت ظروف الأراضي الرملية

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أجريت هذه الدراسة خلال موسمی صیف ١٩٩٨، ١٩٩٩ لدراسة تأثير الأسمدة النتروجينية العضوية والمعدنية (١٨٠ كجم ن، و ٣٤٠ سماد بلدی، و ٣٤٠ سماد بلدی + ٣٦ سماد الدواجن، و ٤٠ سماد بلدی + ٣١٢ سماد الدواجن، و ٤٠ سماد بلدی + ٦٠ كجم ن، و ٤٠ سماد بلدی + ١٢٠ كجم ن و ٤٠ سماد بلدی + ١٨٠ كجم ن / فدان)، على الوزن الجاف الكلي، والممتص الكلي من عناصر النتروجين والفوسفور والبوتاسيوم، والمحصول المبكر، والمحصول الكلي لخمس أصناف من الفلفل (كاليفورنيا وندر، وماركوني، وكابين لارج رد ثيك، و أناهايم إم، والبلدي)، تحت ظروف الأراضي الرملية بمزرعة التجارب الزراعية بالخطارة، التابعة لكلية الزراعة - جامعة الزقازيق، ويمكن تلخيص النتائج في الآتي:

أعطت معاملة ٣٤٠ سماد بلدی + ١٢٠ أو ١٨٠ كجم نتروجين / فدان أعلى وزن جاف كلى للنبات، والممتص الكلي من النيتروجين والفوسفور والبوتاسيوم بواسطة نباتات الفلفل، والمحصول المبكر، والكلي للنبات وللقدان، ومتوسط عدد الثمار المبكر، والكلي على النبات، ومتوسط وزن الثمرة المبكر والكلي.

سجل الصنف أناهايم إم أعلى وزن جاف كلى للنبات، والممتص الكلي من النتروجين والفوسفور والبوتاسيوم بواسطة النبات يليه الصنف البلدي.

أعطى الصنف ماركوني أعلى محصول مبكر وكلي للنبات وللقدان، وأعطى الصنف كابين لارج رد ثيك أعلى متوسط في عدد الثمار المبكرة والكلي للنبات، وأعطى الصنف كاليفورنيا وندر أعلى قيمة لمتوسط وزن الثمرة.

كانت أفضل معاملات التفاعل هي التسميد بمعدل ٣٤٠ سماد بلدی + ١٢٠ أو ١٨٠ كجم نتروجين / فدان، مع الصنف أناهايم إم للحصول على أعلى وزن جاف كلى للنبات.

وسجلت معاملة التفاعل بين إضافة ٣٤٠ سماد عضوی + ١٨٠ كجم نتروجين للقدان أعلى القيم للأصناف كابين لارج رد ثيك، و أناهايم إم وماركوني لكل من عدد الثمار المبكرة والكلي على النبات، وأعلى محصول مبكر وكلي للنبات والقدان على سياق ما سبق.