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EFFECT OF BORON FOLIAR APPLICATION AND DIFFERENT COMBINATIONS OF MINERAL AND ORGANIC NITROGEN FERTILIZATION ON GROWTH, CHEMICAL COMPOSITION AND YIELD OF SWEET PEPPER (*Capsicum annuum* L.*).*

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ABSTRACT

Two field experiments were performed at El-Baramon, Experimental Station, Dakahlia Governorate, Egypt, during the successive seasons of 2007 and 2008 to study the effect of boron foliar nutrition and different combinations of mineral and organic nitrogen fertilization on growth, chemical composition and yield of sweet pepper cv. California wonder.

The main results could be summarized that:

1- Foliar application of boron at 100 ppm and fertilization with 75% mineral nitrogen fertilizer + 25% organic nitrogen resulted significasnt increase of plant height, number of branches, fresh and dry weight.

2-The highest significant values of A, B, total chlorophyll and carotene as well as N, P, K and Ca contents in sweet pepper plant leaves were obtained with foliar addition of boron at 100 ppm and fertilization with 75% mineral nitrogen + 25% organic nitrogen.

3- Fruit sitting percentage, number of fruits per plant, average fruit weight, fruit yield per plant and total yield per feddan were significantly increased as a result of foliar addition with boron at 100 ppm and fertilization at level of 75% mineral nitrogen fertilizers + 25% organic nitrogen.

4- Foliar nutrition of boron at 100 ppm and fertilization by 75% mineral nitrogen + 25% organic nitrogen significantly increased fruit length, fruit diameter, fruit flesh thickness, fruit dry weigh and TSS as well as vit C.

In general, this study demonstrated that it is possible to produce highest growth, yield and quality of sweet pepper fruits by foliar application with boron at 100 ppm and fertilization using 75% from the recommended dose as mineral nitrogen plus 25% from the recommended dose as organic nitrogen.

INTRODUCTION

Sweet pepper (*Capsicum annuum* L.) is one of the most important vegetable crops grown in Egypt for local utilization and export. Boron is one of the essential micronutrients required for plant growth and productivity. It plays a very important role in cell wall synthesis, RNA metabolism, and root elongation as well as phenols metabolism, also boron involved in pollen and tube growth as mentioned by Srivastava and Gupta, 1996). Moreover, favorable boron nutrition is important for good plant growth and yield (Ashour and El-Fouly, 1970) on tomato; (Abd El-Maksoud *et al.,* 1974) on sweet pepper, (Amer; 1981, Agwah and Mahmoud, 1994) on tomato; (Sharma, 1999) on pepper. Nitrogen plays a major role in plant growth and development, its shortage within plant tissue resulted in reduction in foliage

and roots expansion, loss in photosynthetic efficiency and disturbance of all metabolitic functions (Marschner, 1995). Excess addition of mineral nitrogen fertilizers causes a major series problem for environment and contamination the underground water as well as led to an accumulation the edible parts (Al-Gosaibi, 1994;Badiane *et al.,* 1994). Many investigators noticed that mineral nitrogen had an important role for enhancing growth characters of sweet pepper plants (Qawasmi *et al*., 1999; Palada *et al*., 1999 and Byoung Ryong., 1999), chlorophyll content, N, P and K contents in plant foliage (Simonne *et al*., 1998), flowering, fruit characters and quality (Maya *et al*., 1997), number of fruits (Palada *et al*., 1999) and total yield (Palada *et al*., 1999). Furthermore, NPK fertilizers play a significant role in successful tomato production (Jack *et al*., 2006). Increasing interest in utilization of organic vegetables increased the using of various organic wastes in agriculture. Chicken or poultry manures are a by-product of chicken farms in Egypt, the superior effect of applied amendments of chicken manure compared with NPK on enhancing plant growth parameters and yield are mainly due to the relatively high contents of organic matter, essential macro and micro nutrients of chicken manure (EI-Sayed *et al., 2002).* Poultry manure contains high contents of all the mineral nutrients needed by the plants, moreover, application of poultry manure increased plant height, leaf area and number of branches of pepper (Alabi, 1995). El-Banna and Abd El-Salam ,(2000) reported that organic manure such as chicken manure or poultry manure enhanced potato plant vegetative growth through their effect on physical, chemical and biological properties of soils. Alabi, (2006) showed that poultry manure is a cheap organic source to obtain and enhances pepper fruit length and diameter, number of fruits per plant, yield per plant and yield/ha. Moreover, Abd-Alla *et al*., (2001) found that fertilization of eggplant with chicken manure at rate 15 ton / feddan in combination with 80 kg N /feddan resulted in the highest fruit weight and total yield.

This study was carried out to evaluate the response of sweet pepper to boron foliar nutrition and different combinations between mineral and organic nitrogen fertilization on growth, chemical composition and yield.

MATERIALS AND METHODS

Two field experiments were conducted at El-Baramon, Experimental Station, Dakahlia Governorate, Egypt, during the two successive seasons of 2007 and 2008. Some physical and chemical properties of the experimental soil at depth of 0-30 cm are shown in Table1.

Table 1: Physical and chemical properties of the experimental soil during 2007 and 2008 seasons.

Parameters / Seasons	Texture%			Texture type	O.M. %	E.C. dsm	pH	N (ppm)	P (ppm)	K (ppm)
	Sand	Silt	Clay							
1st season	23.73	24.65	50.85	Clay	1.32	1.07	7.6	36.50	7.10	126
2nd seasons	22.90	23.87	52.40	Clay	1.41	1.11	7.7	39.80	6.80	142

A split plot design with three replicates was used. The main plots were assigned for boron foliar applications levels, meanwhile, the sub plots were divided to mineral and organic nitrogen fertilizers treatments and their combination. Each experimental unit was 12.25 m^2 consisted of five ridges each of 3.5 m long and 70 cm wide.

The experiment included 15 treatments, which were the combinations between three boron foliar application, *i.e*., 0, 50 and 100 ppm ($H_3BO_{3;\ 16}$ % B) and five mineral and organic nitrogen fertilization treatments as follows:

1- Organic nitrogen (N) fertilizer (100 % N from RD)
2- Mineral nitrogen (25% form RD+ organic nitrogen (75% form RD) fertilization.
3- Mineral nitrogen (50 % from RD + organic nitrogen (50%from RD) fertilization.
4- Mineral nitrogen (75% from RD + organic nitrogen (25% from RD) fertilization.
5- Mineral nitrogen (100% recommended N rate) as control.

On 1st March during the two seasons of study, pepper seedlings were transplanted in the open field into one side ridges at spacing 50 cm. Pepper plant were sprayed with boron solutions at 50 ,65 and 80 days after transplanting. The untreated plants (control) were sprayed with tap water. Chicken manure was incorporated into the soil during soil its preparation, as a source of organic nitrogen and added at 15 ton/ feddan (calculated based on nitrogen percent in the used chicken manure). Chemical properties of organic manure used in the experiment are tabulated in Table 2.

Table (2): Chemical properties of organic manure used in the experiment.

Parameters	Chicken manure	
	2007	2008
Organic manure (%)	45.3	44.0
Total C (%)	28.1	26.4
Total N (%)	2.0	2.11
C / N ratio	12.2	11.1
Total P (%)	0.53	0.50
Total K (%)	1.95	1.92

Mineral nitrogen fertilizer was added at 140 Kg / fed. as recommended rate in source of ammonium nitrate (33.5%N) was added as the three equal sub rate after 3,5 and 7 weeks from transplanting date.

Superphosphate (15.5% P_2O_5) was added as only one addition during soil preparation with rate of 60 kg P_2O_5 / feddan.

Potassium sulphate (48% K_2O)was added after 5 and 7 weeks from transplanting date with rate at 50 kg K_2O / feddan .

Other normal cultural practices for pepper were followed according to the instruction laid down by Egyptian Ministry of Agriculture.

Data recorded

Vegetative parameters

A representative sample of 5 plants from each sub plot were taken randomly at 80 days after transplanting to determined plant fresh weight(g),dry weight(g), number of branches and plant height (cm) .

Chemical composition

The chlorophyll A, B and total chlorophyll contents. and Carotene (the forth upper leaves) using spectrophotometer method as described by Mackinny,(1941).

Dry weight of leaves was used to determine nitrogen % according to the methods described by Bremner and Mulvaney, (1982). Meanwhile, phosphorus was estimated calorimetrically according to Olsen and Sommers (1982) and potassium was also determined by flame photometrically as described by Jackson ,(1967). Calcium was determined by atomic absorption SP method (A.O.A.C, 1990).

Yield and its components

Five uniform plants of each sub plot were randomly chosen, labeled to determinate fruit setting percentage. All harvested fruits after 50 day from each plot all over the season, were used to determine number of fruits per plant, average fruit weight, yield per plant and total yield per feddan. A representative sample of 10 marketable fruits from each experimental plot were taken at the picking number 4 for determination of fruit length, diameter and shape index (L/D) as well as fruit flesh thickness, fruit dry matter %, TSS % and vit C fresh fruit weight according to the methods of A.O.A.C. (1990).

The data were statistically analyzed using the procedure outlined by Snedecor and Cochran, (1980). The treatment means were compared using Duncan's multiple range tests as described by Duncan, (1958).

RESULTS AND DISCUSSION

1. Vegetative growth characteristics:

1.1. Effect of boron

Data presented in Table 3 show the effect of boron foliar application on growth characteristics of pepper plants during seasons of 2007 and 2008. Such data indicate clearly that there were differences between the used foliar boron treatments on the studied growth aspects expressed as plant height, plant fresh, dry weight and number of branches, the differences reached the highest level of significant in all the studied growth parameters with the addition 100 ppm compared with control plants during the two seasons.

The results are in agreement with those obtained by Ashour and El-Fouly,(1970) they indicated that spraying tomato with 0.01% of borax improved plant height, leaf area and dry weight per plant. Sharma ,(1999) obtained that fertilization of pepper plants with boron increased vegetative growth characters.

Abd El-Maksoud *et al*., (1974) on sweet pepper found that foliar nutrition of boron increased plant height and number of branches. Similar

results are confirmed by Amer, (1981) and Agwah and Mahmoud, (1994) on tomato they showed that three foliar sprayers with borax (10.6% B) at 0.25% increased tomato leaf dry matter.

Table 3: Effect of foliar application with boron on growth characteristics of sweet pepper plants during 2007 and 2008 seasons.

Boron (ppm)	Plant height (cm)		No. branches/ plant		Fresh weight/plant (g)		Dry weight/plant (g)	
	2007	2008	2007	2008	2007	2008	2007	2008
0 (control)	54.05 c	57.08c	9.80c	10.77c	827.5 b	839.3 b	139.0 b	142.9 b
50	56.88 b	59.95b	10.10b	11.19b	842.8 ab	861.6 a	141.2 ab	143.1 b
100	60.03a	62.64a	10.66a	11.64a	853.8 a	893.6 a	145.7 a	151.2 a

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.

1.2. Effect of mineral and organic N-fertilizers.

Data in Table 4 show the effect of mineral and organic nitrogen fertilizers treatments on growth characters of pepper plants, it is evident clear that plant height, number of branches,fresh and dry weight were reached the highest significant increase due to fertilization of pepper plants with 75% mineral nitrogen + 25% organic nitrogen compared with 100 % of mineral nitrogen (control). These results were true during both seasons.

Table 4: Effect of mineral and organic nitrogen fertilization on vegetative growth characteristics of sweet pepper during 2007 and 2008 seasons

Fertilizer combinations (% of RD*)	Plant height (cm)		No. branches/ plant		Fresh weight/plant(g)		Dry weight/plant (g)	
	2007	2008	2007	2008	2007	2008	2007	2008
**ON (100%)	51.99 d	55.01 d	8.42 d	10.03 c	772.4 d	796.0 e	132.6 c	133.0 d
MN(25%)+ON(75%)	53.22 d	57.34 c	9.67 c	11.18 b	809.8 c	820.1 d	135.9 c	143.3 c
MN(50%)+ON(50%)	57.69 c	61.54 b	10.33 bc	11.48b	854.5 b	875.8 c	145.8 b	147.2 b
MN(75%)+ON(25%)	62.11 a	64.55 a	11.72 a	11.90a	903.1 a	927.3 a	153.1 a	158.3 a
***MN (100%	59.92 b	61.00 b	10.80 b	11.41b	867.2 b	905.1 b	142.4 bc	151.1 b

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
*** RD: Recommended dose.**
****ON: Organic nitrogen.**
*****MN: Mneral nitrogen**

Similar results were reported by Hsieh and Hsu, (1994) working on sweet pepper showed that plant height significantly increased with fertilizers of chicken manure than with the mineral nitrogen fertilization. EI-Kassas *et al.,* (1997) reported that chicken manure was the most effective organic source in improving growth and dry weight of sweet pepper. On eggplant, Abd-Alla *et al*., (2001) studied the effect of mineral N, chicken manure and farmyard manure they found that plant height, fresh and dry weight were increased due to fertilization with chicken manure at the rate 15 ton/ feddan in combination with 80 kg N /feddan. Moreover,

Alabi,(2006) found that poultry manure significantly enhanced plant height, number of leaves, number of branches and leaf area of pepper plants.

The superiority of chicken manure on growth characters may be due to its high N content which related with the increases of the carbohydrates and protein synthesis and this in turn enhances dry matter accumulation and plant growth (Edmond *et al.,* 1981). Chicken manure, also enhanced plant growth through improving the physical and chemical soil characteristics, *i.e.,* bulk density, hydraulic conductivity, soil strength, water holding, pH value, organic matter content as well as increasing the available nutrients which in turn extends to plant growth enhancement (EI-Sayed *et al.,* 2002, Alabi 2006 and Hati *et al.,* 2006).

1.3The effect of interaction between boron and mineral and organic-N fertilizers.

Data in Table 5 show the effect of the interaction treatments between boron foliar applications, mineral and organic nitrogen fertilization treatments on growth characters of pepper plants. It is obviously clear that all studied vegetative characters of pepper plants were significantly affected due to the interaction treatments. In this respect, the highest values of pepper plant height, number of branches, fresh and dry weight were recorded with foliar addition of boron at 100 ppm and fertilization with 75% mineral nitrogen + 25% organic nitrogen, in both seasons.

Table 5: Effect of interaction between boron foliar application and fertilizer combinations on vegetative growth characteristics of sweet pepper during 2007 and 2008 seasons.

Boron (ppm)	Fertilizer combinations (% of RD*)	Plant height (cm)		No. branches/ plant		Fresh weight/plant (g)		Dry weight /plant(g)	
		2007	2008	2007	2008	2007	2008	2007	2008
0 (control)	**ON (100%)	49.61h	53.08 f	8.11 h	9.23g	754.3 e	769.6h	127.2 d	130.0 d
	MN(25%)+ON(75%)	51.33gh	55.67 e	9.13 g	10.54f	781.0 de	787.3g	132.7 cd	139.8 cd
	MN(50%)+ON(50%)	53.67fg	57.67 de	10.00 f	11.11e	839.0 cd	859.0cde	144.6 bc	144.0 bc
	MN(75%)+ON(25%)	57.67cdef	58.64 cde	11.42 c	11.33cde	886.3 b	883.2bc	149.6 b	151.1 bc
	***MN(100%)	58.00cde	60.34 cd	10.38 de	11.67bcd	877.3 bc	898.0bc	141.1 bc	149.6 bc
50	**ON(100%)	52.04gh	55.44 ef	8.21 h	10.37f	769.3 de	798.1fg	131.7 cd	132.6 cd
	MN(25%)+ON(75%)	53.30fgh	57.33 de	9.57 f	11.17de	811.6 d	829.6defg	134.9 cd	142.0 c
	MN(50%)+ON(50%)	57.08def	62.33 bc	10.33 e	11.33cde	852.3 c	873.6bcd	146.8 bc	147.5 bc
	MN(75%)+ON(25%)	61.33bc	64.33 b	11.74 b	11.83bc	880.7 bc	908.9b	150.7 ab	155.5 b
	***MN(100%)	60.67bcd	60.33 cd	10.67 de	11.25de	900.4 b	898.0bc	142.0 bc	150.6 bc
100	**ON(100%)	54.34efg	56.51 de	8.95 g	10.50f	793.6 d	820.4efg	139.0 c	136.4 cd
	MN(25%)+ON(75%)	55.04efg	59.04 cd	10.33 e	11.83bc	837.0 cd	843.4cdef	140.2 bc	148.3 bc
	MN(50%)+ON(50%)	62.33b	64.64 b	10.67 d	12.00b	872.3 bc	895.0bc	146.2 bc	150.1 bc
	MN(75%)+ON(25%)	67.33a	70.69 a	12.00 a	12.54a	942.3 a	990.0a	159.1 a	168.3 a
	***MN (100%)	61.11bc	62.33 bc	11.35 c	11.33cde	824.0 cd	919.3b	144.2 bc	153.2 b

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.

*** RD: Recommended dose. **ON: Organic nitrogen. ***MN: Mineral nitrogen**

2. Chemical composition of plant foliage:

2.1. Effect of boron.

Concerning the effect of foliar application with boron on chemical composition of pepper plant foliage, data in Table 6 clear that increasing foliar application of boron at dose 100 ppm resulted in the highest significant chlorophyll A, B total chlorophyll (A+ B) and carotene as well as N, P, K and Ca contents in the leaves of pepper plant over the control which showed the lowest values in this respect; the two seasons had the same trend. Similar results were reported by Amer,(1981) and El-Behidei *et al.*,(1988) working on tomato reported that using boron as foliar application at 100 ppm increased leaves content of P and K. Moreover, Prabha and Singaram, (1996) found that foliar application of boric acid at 0.3% resulted in the highest P, Mg, K and Ca contents.

Table 6: Effect of foliar application of boron on chlorophyll contents and chemical components of sweet pepper leaves during 2007 and 2008 seasons.

Boron (ppm)	Chlorophyll A mg/100g (FW)		Chlorophyll B mg/100g FW		Total Chlorophyll mg/100g FW		Carotene mg/100g FW		N (%)		P (%)		K (%)		Ca (%)	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
0 (control)	104.3 b	105.0 b	49.68 b	50.15 b	154.0 b	154.7 c	55.34 b	55.24 c	2.34 c	2.42 c	0.175 c	0.184 c	2.59 b	2.62 c	2.33 c	2.36 c
50	107.64 b	112.1 ab	52.12 ab	51.89 ab	159.7 b	164.0 b	57.73 b	58.83 b	2.43 b	2.53 b	0.182 b	0.193 b	2.72 ab	2.69 b	2.43 b	2.47 b
100	112.04 a	113.8 a	54.32 a	54.06 a	166.4 a	367.9 a	60.37 a	60.59 a	2.52 a	2.64 a	0.195 a	0.202 a	2.77 a	2.81 a	2.54 a	2.58 a

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.

2.2. Effect of mineral and organic N-fertilizers.

Data presented in Table 7 show the effect of mineral and organic nitrogen combination treatments on the chemical composition of sweet pepper plants foliage expressed as chlorophyll A,B, total chlorophyll and carotene as well as percentage of N,P,K and Ca contents. It is clear that all used fertilization treatments affected a significantly on chlorophyll A, B, total chlorophyll (A+ B) and carotene as well as N, P, K and Ca contents in sweet pepper plant leaves. The same data showed also that applying 75% mineral nitrogen + 25% organic nitrogen resulted in the highest significant values in this respect compared with the control treatment (100% mineral nitrogen) and other treatments.

The superiority of addition chicken manure with mineral nitrogen may be due to the fast complete decomposition of organic matter in chicken manure and release nutrients in the available form (Awad *et al.,* 2003). Chicken manures, also enhanced chemical composition plant growth through increasing the available nutrients, *i.e.,* N, P, K, Fe, Mn and Zn, which in turn extends to plant contents of these nutrients and chlorophyll (EI-Sayed *et al.,* 2002, Alabi 2006 and Hati *et al.,* 2006). Additionally, the observed increase in mineral composition in leaf tissue with organic manure treatments in general and chicken manure in particular is in agreement with EI-Kassas *et al.* (1997) on sweet pepper.

2.3. The effect of interaction between boron and mineral as well as organic N-fertilizers.

Data in Table 8 show the effect of interaction between boron foliar applications, mineral and organic nitrogen fertilization on chemical composition of pepper plants. It is clear that all used combination treatments significantly affected chemical composition of pepper plants. It is clear that the highest values of chlorophyll A,B total chlorophyll (A+ B) and carotene as well as percentage of N, P, K and Ca contents were obtained with foliar addition of boron at dose of 100 ppm and fertilization with 75% mineral nitrogen + 25% organic nitrogen.

3. Yield and its components:

3.1. Effect of boron:

Considering the effect of boron foliar application on fruit yield and yield components of pepper, data presented in Table 9 reveal that increasing boron foliar addition to the highest used rate at (100 ppm) significantly increased fruit sitting percentage, number of fruits per plant, average fruit weight, fruit yield per plant and total yield per feddan comparing with control.

Table 9: Effect of foliar application with boron on yield and yield components of sweet sweet pepper during 2007 and 2008 seasons.

Boron (pm)	Fruit sitting %		Average fruit weight (g)		No. fruit / plant		Yield /plant (g)		Yield /feddan (ton)	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2007
0(control)	66.53 c	69.27 c	38.54 b	40.01 b	21.00 c	22.13 c	815.48 c	888.2 C	10.59c	11.54c
50	73.93 b	77.00 b	41.04 a	42.10 a	22.80 b	24.27 b	940.30 b	1019.2 b	12.21b	13.24b
100	77.67 a	80.47 a	41.99 a	43.19 a	25.00 a	26.20 a	1051.1 a	1132.0 a	13.66a	14.71a

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.

Similar results were obtained by Emmert,(1961) who found that applying boron at 100 or 150 ppm increased number of fruits and total yield of tomato. Moreover, Doss *et al*., (1992) showed that foliar spray with boron at 50 ppm improved pollen grain viability, flowers fertility and fruit setting as well as total yield, number of fruits and average fruit weight per plant of pepper. Meanwhile, Agwah and Mahmoud, (1994) reported that foliar sprayers of 0.25% borax (10.6% B) increased tomato early and total yields. In similar, Prasad *et al.,* 1997) on tomato and Sharma on pepper, (1999) indicated that fertilization of plants with boron increased total fruit yield.

The simulative effect of boron foliar application on fruit yield of pepper may be due to its enhancing effect on vegetative growth characters (Table 3) and chemical components of plant foliage (Table 6) since boron is thought to have a direct effect on synthesis of sugar, protein and soluble nitrogenous compounds (Marchener, 1995), boron, also regulates auxin supply in plants by protecting the indole acetic acid (IAA), it is important for membrane functions which affects the transport of all metabolites required for normal growth and development (Barker and Pilbeam, 2007).

3.2. Effect of mineral and organic N-fertilization treatments.

Data in Table 10 show the effect of mineral and organic nitrogen fertilization treatments on sweet pepper fruit yield and quality, it is clear that, addition of 75% mineral nitrogen + 25% organic nitrogen fertilizer significantly enhanced fruit sitting percentage, number of fruits per plant, average fruit weight, fruit yield per plant and total yield per feddan compared with the control treatment (100% mineral nitrogen) and other treatments.

Table 10: Effect of mineral and organic nitrogen fertilization application on yield and yield components of sweet pepper fruits during 2007 and 2008 seasons.

Fertilizer combinations (% of RD*)	Fruit sitting %		Average fruit weight (g)		No. fruit / plant		Yield /plant (g)		Yield / feddan (ton)	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
**ON (100%)	65.11 d	69.20 d	37.75 d	39.36 d	20.22 d	21.89 d	771.1 d	863.6 e	10.02 d	11.22 e
MN(25%)+ON(75%)	69.56 c	71.89 c	39.13 c	40.61 c	21.78 c	23.44 c	857.5 c	955.9 d	11.14 c	12.42 d
MN(50%)+ON(50%)	74.78 b	78.78 b	41.34 b	42.85 b	23.78 b	25.22 a	984.7 b	1083.2 b	12.79 b	14.08 b
MN(75%)+ON(25%)	78.67 a	81.00 a	42.82 a	43.75 a	25.22 a	25.89 a	1080.8 a	1133.2 a	14.04a	14.72 a
***MN (100%)	75.44 ab	77.00 b	41.56 ab	42.27 b	23.67 b	24.56 b	983.9 b	1029.7 c	12.78 b	13.38 c

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
*** RD: Recommended dose.**
****ON: Organic nitrogen.**
*****MN: Mineral nitrogen**
*****MN: Menial nitrogen**

These results agree with those reported by Hsieh *et al* (1994) who mentioned that fruit number and yield of sweet pepper were significantly higher with fertilization by organic nitrogen than with the mineral nitrogen alone. Ouda (2000) demonstrated that chicken manure at rate 15 m^3 feddan increased early and total yield of tomato comparing with 100% mineral nitrogen. Moreover, Youssef *et al* (2001) showed that addition of 25 % organic manure + 75 % mineral NPK fertilizers gave the best treatment for producing early and total yield, while 75% organic manure + 25 % mineral fertilizers gave heavier fruit weight of tomato. Additionally, Malak *et al* (2007) reported that the highest tomato yield was recorded with 25% chicken manure plus 75% mineral fertilizers than with 75% chicken manure plus 25% mineral fertilizers.

The simulative effect of chicken manure application on fruit yield of pepper may be due to its enhancing effect on vegetative growth characters (Table 4) and chemical components of plant foliage (Table 7), since the decomposition of organic manures due to the microorganisms enhances the release of nutrients slowly to the soil, then nutrients can be adsorbed on the adsorptive sites of organic matter and soil colloids and that protect the nutrients from leaching which in turn extends to fruit yield enhancement (Yassen *et al.,* 2004).

3.3. The effect of interaction between boron and mineral as well as organic N-fertilizers.

Data concerned with the effect of interaction between boron foliar application, mineral and organic nitrogen fertilization on fruit yield and quality of pepper is shown in Table 11. It is clear that foliar addition of boron at 100 ppm and fertilization with 75% mineral nitrogen + 25% organic nitrogen significantly increased fruit sitting percentage, number of fruits per plant, average fruit weight, fruit yield per plant and total yield per feddan compared with other treatments during both seasons.

4. Physical and chemical fruit characters.

4.1. Effect of boron.

Data in Table 12 show the effect of foliar application with boron on quality of pepper fruit characters. It is evident clear that increasing boron foliar additions to the highest used rate at (100 ppm) significantly increased fruit length, fruit diameter, fruit flesh thickness, fruit dry weigh and TSS as well as vit C. The same data showed also that foliar addition of boron at 50 or 100 ppm did not significantly affected pepper fruit shape index in comparing with to control. Those results were in harmony with those obtained by Amer, (1981) who reported that boron foliar application at 100 ppm increased vitamin C in tomato fruits and in conformity with those obtained by El-Behidei *et al*., (1988) who found that foliar nutrition with boron has increased TSS of tomato fruits. Moreover, Doss *et al*., (1992) showed that foliar application of boron at 50 ppm improved vitamin C on pepper fruits.

Obtained results can be explained in the light of facts that boron is thought to have a direct effect on sugar transport, lignifications, cell wall structure, carbohydrates metabolism and tissue differentiation (Marchener, 1995 and Srivastava and Gupta, 1996) and consequently enhanced fruit quality characters.

Table12: Effect of foliar application with boron on some physical and chemical fruit characters of sweet pepper plants during 2007 and 2008 seasons.

Boron (ppm)	Fruit length (cm)		Fruit diameter (cm)		Shape index (L/D)		Fruit flesh Thickness (mm)		Fruit dry weight (%)		TSS %		Vit C mg/100g FW	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
0 (control)	9.54 b	9.78 b	8.23 c	8.43 c	1.16 a	1.16 a	2.24 b	2.29 b	8.61 b	7.62 b	6.00 c	6.03 c	129.3 b	132.8 b
50	10.37 ab	10.54 a	8.73 b	8.85 b	1.19 a	1.19 a	2.36ab	2.41 ab	8.77ab	8.10 ab	6.51b	6.34 b	134.1 ab	138.0 ab
100	10.61 a	10.85 a	9.20 a	9.19 a	1.15 a	1.18 a	2.50 a	2.53 a	8.91 a	8.17 a	6.70 a	6.65 a	140.0 a	144.22 a

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.

4.2. Effect of mineral and organic N-fertilizers.

Data presented in Table 13 show the effect of mineral and organic nitrogen combination treatments on some physical and chemical pepper fruit characters. It is evident clear that addition chicken manure at rate of 75% mineral nitrogen + 25% organic nitrogen significantly enhanced fruit length, fruit diameter, fruit flesh thickness, fruit dry weigh and TSS as well as vit C. on the other hand, pepper fruit shape index did not significantly affected by all used combination treatments during both seasons of this work.

These results agree with those reported by Hsieh *et al.,* (1994) who reported that pepper fruit size was significantly higher with fertilization by chicken manure than with the mineral nitrogen alone. Youssef *et al.,* (2001) showed that using 25 % organic manure + 75 % mineral NPK fertilizer was the best treatment for producing highest fruit TSS, while 75% organic manure + 25 % mineral fertilizers gave highest fruit length, fruit diameter and fruit flesh thickness of tomato.

Table 13: Effect of mineral and organic nitrogen fertilization on some physical and chemical fruit characters of sweet pepper plants during 2007 and 2008 seasons.

Fertilizer combinations (% of RD*)	Fruit length (cm)		Fruit diameter (cm)		Shape index (L/D)		Fruit flesh Thickness (mm)		Fruit dry weight (%)		TSS %		Vit C mg /100g FW	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
**ON (100%)	9.08 e	9.36 e	8.01 e	8.20 d	1.13 a	1.14 a	2.18 e	2.18 d	8.05 e	7.15 e	5.73 d	5.72 d	126.1d	127.5 d
MN(25%)+ON(75%)	9.50 d	9.77 d	8.36 d	8.57 c	1.14a	1.13 a	2.25 d	2.26 d	8.28 d	7.39 d	6.02 c	5.97 c	131.3 c	132.7 c
MN(50%)+ON(50%)	10.43 c	10.57 c	8.69 C	8.82 b	1.20 a	1.20 a	2.31 c	2.46 c	8.66 c	7.98 c	6.37 b	6.48 b	135.0 bc	137.3 c
MN(75%)+ON(25%)	11.11 a	11.39 a	9.43 a	9.29 a	1.18 a	1.22 a	2.58 a	2.62 a	9.40 a	8.64 a	6.90 a	6.90 a	142.1 a	148.9 a
***MN (100%)	10.76 b	10.88 b	9.12 b	9.24 a	1.18 a	1.17 a	2.49 b	2.52 b	9.18 b	8.25 b	7.01 a	6.63 ab	136.2 b	143.2 b

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
*** RD: Recommended dose.**
****ON: Organic nitrogen.**
*****MN: Mineral nitrogen**

4.3. The effect of interaction between boron and mineral as well as organic N-fertilizer.

Data in Table 14 show the effect of the interaction treatments between boron foliar applications, mineral and organic nitrogen fertilization treatments on some physical and chemical pepper fruit characters. It is clear from such data that foliar addition of boron at 100 ppm and fertilization with 75% mineral nitrogen + 25% organic nitrogen significantly increased fruit length, fruit diameter, fruit flesh thickness, fruit dry weigh and TSS as well as vit C.

the same data showed also that fruit shape index did significantly affected by foliar addition of boron at 100 ppm and fertilization with 75% mineral nitrogen + 25% organic nitrogen or fertilization with 100% mineral nitrogen(control).

Finally, from the previous mentioned results and discussion, it could be concluded that it is possible to produce vigor growth, highest fruit and best yield and quality of sweet pepper plants by foliar application of boron at dose of 100 ppm and fertilization with 75% of the recommended rate of mineral nitrogen fertilizer with 25% of the recommended rate from organic nitrogen.

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تأثير الرش الورقي بالبورون و توليفات مختلفة من التسميد النيتروجيني المعدني و العضوي علي النمو و التركيب الكيماوي و محصول الفلفل الحلو.

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أجريت تجربتان حقليتان خلال الموسمين ٢٠٠٧ و ٢٠٠٨ و ذلك بالمحطة البحثية بالبرامون، محافظه الدقهلية، مصر، وذلك لدراسة تأثير الرش الورقي بالبورون و توليفات مختلفة من التسميد النيتروجيني المعدني و العضوي و ذلك علي النمو و التركيب الكيماوي و محصول و صفات الجودة لنباتات الفلفل الحلو صنف كاليفورنيا وندر.

وكانت أهم النتائج ما يلي :

١- أدي الرش الورقي بالبورون بتركيز ١٠٠ جزء بالمليون و التسميد الكيماوي بنسبة ٧٥% من عنصر النيتروجين من الموصي به بالإضافة إلي ٢٥% من هذا العنصر من سماد الدواجن العضوي إلي الحصول علي أفضل طول للنبات و عدد الافرع و أفضل وزن غض و جاف للنبات.

٢- أدي الرش الورقي بالبورون بتركيز ١٠٠ جزء بالمليون و التسميد الكيماوي بنسبة ٧٥% من عنصر النيتروجين من النسبة الموصي بها بالإضافة إلي ٢٥% من هذا العنصرر من سماد الدواجن العضوي إلي الحصول على أفضل زيادة من كلوروفيل أ و ب و الكلوروفيل الكلي و الكاروتين في أوراق نباتات الفلفل و كذلك إلي الحصول أفضل تركيب كيماوي لنباتات الفلفل متمثلا في زيادة نسبه النيتروجين و الفوسفور و البوتاسيوم في النبات.

أدي الرش الورقي بالبورون بتركيز ١٠٠ جزء بالمليون و التسميد الكيماوي بنسبة ٧٥% من عنصر النيتروجين من الموصي به بالإضافة إلي ٢٥% من هذا العنصر من سماد الدواجن العضوي إلي الحصول على أفضل زيادة في نسبة عقد ثمار الفلفل و عدد الثمار للنبات ومتوسط وزن الثمرة و محصول النبات و المحصول الكلي للفدان.

٣- أدي الرش الورقي بالبورون بتركيز ١٠٠ جزء بالمليون و التسميد الكيماوي بنسبة ٧٥% من عنصر النيتروجين من النسبة الموصي بها بالإضافة إلي ٢٥% من هذا العنصر من سماد الدواجن العضوي إلي الحصول أفضل صفات جوده للثمار متمثلا في تحسين طول و قطر ثمار الفلفل و كذلك سمك اللحم و نسبة المادة الجافة و المواد الصلبة الذائبة الكليه و كذلك فيتامين ج.

و عليه توصي الدراسة بالرش الورقي لنباتات الفلفل صنف كاليفورنيا وندر بالبورون بتركيز ١٠٠ جزء بالمليون و التسميد الكيماوي بنسبة ٧٥% من عنصر النيتروجين من الموصي به بالإضافة إلي ٢٥% من هذا العناصر من سماد الدواجن العضوي و ذلك للحصول علي أفضل نمو خضري و محصول و جوده ثمار لنباتات الفلفل تحت ظروف محافظه الدقهليه.

Table 7: Effect of mineral and organic nitrogen fertilization on chlorophyll contents and chemical components of sweet pepper plants during 2007 and 2008 seasons.

Fertilizer combinations (% of RD*)	Chlorophyll A mg/100 g (FW)		Chlorophyll B mg/100 g FW		Total Chlorophyll mg/100 g FW		Carotene mg/100 g FW		N (%)		P (%)		K (%)		Ca (%)	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
**ON (100%)	105.1 a	107.2 b	48.83 b	49.59 b	153.9 b	156.8 b	56.17 b	56.03 b	2.22 c	2.37 c	0.173 b	0.178 c	2.30 c	2.38 c	2.18 d	2.31 b
MN (25%) + ON (75%)	107.4 a	107.3 b	51.65 b	51.19 b	159.0 b	159.1 b	55.72 b	57.78 b	2.30 bc	2.43 c	0.180 b	0.188 b	2.35 bc	2.44 bc	2.38 c	2.40 b
MN (50%) + ON (50%)	108.6 a	111.4 ab	53.82 ab	52.37 b	162.4 ab	163.8 ab	57.51 b	58.62 b	2.46 b	2.58 b	0.186 b	0.192 b	2.46 b	2.58 b	2.54 b	2.60 ab
MN (75%) + ON (25%)	111.3 a	116.5 a	55.74 a	55.36 a	167.0 a	171.9 a	61.69 a	60.88 a	2.67 a	2.73 a	0.199 a	0.208 a	2.60 a	2.70 a	2.65 a	2.64 a
***MN (100%)	107.1 a	108.1 b	50.65 b	51.86 b	157.7 b	160.0 b	57.97 b	57.75 b	2.44 b	2.54 b	0.180 b	0.196 b	2.44 b	2.54 b	2.41 c	2.39 ab

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
*** RD: Recommended dose.**
****ON: Organic nitrogen.**
*****MN: Mineral nitrogen**

Table 8: Effect of interaction between boron foliar application and fertilizer combinations on chlorophyll contents and chemical components of sweet pepper plants during 2007 and 2008 seasons.

Boron (ppm)	Fertilizer Combinat-ions (% of RD*)	Chlorophyll A mg/100 g (FW)		Chlorophyll A mg/100 g (FW)		Total Chlorophyll mg/100 g FW		Carotene mg/100 g FW		N (%)		P (%)		K (%)		Ca (%)	
		2007	2007	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
0 (control)	**ON (100%)	101.2 d	104.6 e	47.01 d	48.25 c	148.2 d	152.9de	54.25 c	54.63 d	2.28g	2.25 f	0.165 c	0.172 c	2.40 h	2.45 d	2.14 d	2.22 f
	MN (25%) + ON (75%)	103.1 d	101.3 f	49.32 cd	49.07 c	152.4 cd	150.4 e	53.43 c	55.53 d	2.27g	2.28 f	0.174 c	0.178 c	2.51 fg	2.52 d	2.32 cd	2.33 e
	MN (50%) + ON (50%)	105.2 d	105.9 de	51.84 c	50.21 c	157.0 cd	156.2 cde	54.67 c	54.77 d	2.31fg	2.49 d	0.180 bc	0.184c	2.64 ef	2.66 cd	2.43 c	2.45 de
	MN (75%) + ON (25%)	106.8 d	109.0 cde	53.4 bc	52.84 bc	160.2 cd	161.9 bcd	58.80 bc	56.73 cd	2.52bc	2.57 cd	0.184 bc	0.191 c	2.68 ef	2.75 c	2.44 c	2.49 d
	***MN (100%)	104.1 d	101.1 f	48.21 d	51.01 bc	152.3 d	152.2 de	55.53 c	54.53 d	2.34efg	2.49 d	0.172 c	0.196 bc	2.70 de	2.71 c	2.32 cd	2.32 e
50	**ON (100%)	105.6 d	108.3 cde	48.32 d	49.54 c	153.9 cd	157.9 cde	56.87 c	55.17 d	2.33efg	2.37 e	0.174 c	0.180 c	2.45 gh	2.48 d	2.19 d	2.33 e
	MN (25%) + ON (75%)	107.4 cd	111.3 bcde	52.24 c	51.98 bc	159.6 cd	163.3 bc	55.57 c	58.50 cd	2.37defg	2.47 d	0.178 bc	0.190 bc	2.69 ef	2.65 cd	2.39 cd	2.44 de
	MN (50%) + ON (50%)	107.7 cd	113.0 bcd	53.65 bc	52.41 bc	161.3 bc	165.5 bc	58.43 bc	60.43 bc	2.50bcd	2.59 cd	0.185 bc	0.194 bc	2.79 cd	2.69 c	2.56 bc	2.65 cd
	MN (75%) + ON (25%)	108.4 cd	117.1 ab	54.84 bc	54.00 bc	163.2 bc	171.1 b	60.50 b	61.50 b	2.53bc	2.72 b	0.192 bc	0.207 b	2.84 bc	2.87 bc	2.64 bc	2.61 c
	***MN (100%)	109.1 cd	106bcde	51.54 c	51.54 bc	160.6 bc	162.2 bcd	57.30 bc	58.53 c	2.43bcdef	2.50 d	0.181 bc	0.192 bc	2.82 bc	2.74 c	2.37 cd	2.32 e
100	**ON (100%)	108.5 cd	108.6 cde	51.32 c	50.98 bc	159.8 cd	159.6 cde	57.40 bc	58.30 cd	2.31 fg	2.51 d	0.181 bc	0.184 c	2.48 g	2.52 d	2.22 d	2.38 e
	MN (25%) + ON (75%)	111.7 c	109.3 cde	53.41 bc	52.54 bc	165.1 bc	161.9 bcd	58.17 bc	59.33 bc	2.40 cdefg	2.56 cd	0.189 bc	0.197 bc	2.70 de	2.69 c	2.43 c	2.45 de
	MN (50%) + ON (50%)	113.0 b	115.3 bc	55.98 b	54.51 b	168.9 b	169.9 b	59.43 bc	60.67 bc	2.57 b	2.66 bc	0.195 b	0.198 bc	2.89 b	2.92 b	2.65 b	2.71 b
	MN (75%) + ON (25%)	118.9 a	123.4 a	58.99 a	59.24 a	177.8 a	182.7 a	65.77 a	64.43 a	2.76a	2.81 a	0.221 a	0.228 a	2.98 a	3.09 a	2.87 a	2.82 a
	***MN (100%)	108.1 cd	112.6 bcd	52.21 c	53.05 bc	160.3 bc	165.7 bc	61.10 b	60.20 bc	2.55bc	2.64 bc	0.188 bc	0.201 bc	2.81 cd	2.85 bc	2.54 bc	2.55 cd

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
*** RD: Recommended dose.**
****ON: Organic nitrogen.**
*****MN: Mineral nitrogen**

Table 11 : Effect of interaction between boron foliar application and fertilizer combinations on yield and yield components of sweet pepper fruits during 2007 and 2008 seasons.

Boron (ppm)	Fertilizer combinations (% of RD*)	Fruit sitting %		Average fruit weight (g)		No. fruit / plant		Yield /plant (g)		Yield / feddan (ton)	
		2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
0 (control)	**ON(100%)	58.67h	62.33h	34.84g	37.90h	17.67f	19.67i	615.2g	745.43j	7.99 g	9.69 i
	MN(25%)+ON(75%)	60.67h	63.67h	36.49f	38.68g	18.33ef	20.67hi	668.6g	800.2 ij	8.69 g	10.40i
	MN(50%)+ON(50%)	67.67fg	74.00ef	39.64de	40.78efg	22.00cd	23.33efg	872.0ef	951.59fg	11.33 ef	12.37 f
	MN(75%)+ON(25%)	74.33cd	75.33de	41.36bc	41.69ef	24.00bc	24.67 de	992.9bcd	1028.3def	12.90 cd	13.36 def
	***MN(100%)	71.33de	71.00fg	40.36cd	41.01f	23.00bc	22.33fg	928.4de	915.6gh	12.06 de	11.90 h
50	**ON(100%)	66.33g	70.00g	38.77e	39.00g	20.00de	22.00gh	785.9f	857.8hi	10.21 fg	11.15 hi
	MN(25%)+ON(75%)	71.33de	73.67gh	39.60de	40.54fg	22.00cd	23.67defg	870.7ef	959.2fg	11.32 ef	12.47 f
	MN(50%)+ON(50%)	76.67bc	79.00c	40.90c	42.91cd	24.33b	25.33bcd	995.3bcd	1087.0bcd	12.93 cd	14.13 cd
	MN(75%)+ON(25%)	79.67ab	83.00ab	43.76a	45.44a	24.67b	25.33cde	1079.7b	1151.2ab	14.03 b	14.96 b
	***MN(100%)	75.67c	79.33c	42.16b	42.62cde	23.00bc	25.00cde	969.7cd	1040.6cde	12.60 de	13.52 cd
100	**ON(100%)	70.33ef	75.33de	39.66de	41.17def	23.00bc	24.00def	912.3de	987.7def	11.86 de	12.84 ef
	MN(25%)+ON(75%)	76.67bc	78.33cd	41.31bc	42.62de	25.00 ab	26.00abc	1033.2bc	1108.2bc	13.43 bc	14.40 cd
	MN(50%)+ON(50%)	80.00a	83.33ab	43.48a	44.87ab	25.00ab	27.00ab	1086.8ab	1211.0a	14.12 ab	15.74 a
	MN(75%)+ON(25%)	82.00a	84.67a	43.34a	44.11ab	27.00a	27.67a	1169.7a	1220.3a	15.20 a	15.86 a
	***MN(100%)	79.33ab	80.67bc	42.15b	43.19bc	25.00ab	26.33abc	1053.8bc	1132.9b	13.69 bc	14.72 bc

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.

*** RD: Recommended dosage.**

****ON: Organic nitrogen.**

*****MN: Mineral nitrogen**

Table 14: Effect of interaction between boron foliar application and fertilizer combinations on some physical and chemical fruit characters of sweet pepper plants during 2007 and 2008 seasons.

Boron (ppm)	Fertilizer combinations (% of RD*)	Fruit length (cm)		Fruit diameter (cm)		Shape index (L/D)		Fruit flesh Thickness (mm)		Fruit dry weight (%)		TSS %		Vit C mg /100g FW	
		2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
0 (control)	**ON (100%)	8.70i	9.00h	7.80i	8.03f	1.11a	1.12a	2.06 e	2.12 i	7.90 h	6.99 g	5.51 i	5.57 h	119.4 d	121.0 e
	MN (25%) + ON (75%)	9.00gh	9.30gh	8.10gh	8.40e	1.11a	1.11a	2.13 e	2.22 h	8.18 g	7.15 g	5.70 h	5.86 g	125.1 cd	127.3 d
	MN (50%) + ON (50%)	9.50gh	9.70f	8.17gh	8.40e	1.16a	1.15a	2.23 de	2.30 g	8.69 e	7.80 de	5.96 g	6.07 f	131.3 c	134.8 cd
	MN (75%) + ON (25%)	10.40d	10.60e	8.80d	8.70cd	1.18a	1.22a	2.40 cd	2.38 f	9.09 d	8.02 d	6.40 e	6.28 e	138.8 bc	141.2 bc
	***MN (100%)	10.10fg	10.30e	8.30fg	8.60de	1.22a	1.20a	2.41 c	2.41 f	9.19 cd	8.16 d	6.44 e	6.35 e	131.9 c	140.1 c
50	**ON (100%)	9.20 h	9.40g	8.07h	8.10g	1.14a	1.16a	2.16 e	2.21 h	8.06 gh	7.16 g	5.77 h	5.78 g	127.6 cd	128.7 d
	MN (25%) + ON (75%)	9.70gh	9.87f	8.40ef	8.70cd	1.15a	1.13a	2.25 de	2.29 g	8.30	7.63 e	6.14 f	6.03 f	132.7 bc	132.6 d
	MN (50%) + ON (50%)	10.67d	10.80de	8.80d	8.97c	1.21a	1.20a	2.32 d	2.49 e	8.93 f	8.76 b	6.44 e	6.56 d	137.5 bc	138.9 cd
	MN (75%) + ON (25%)	11.30b	11.53b	9.33b	9.33b	1.21a	1.24a	2.59 b	2.65 c	9.45 b	8.81 b	6.92 c	6.98 c	136.6 bc	148.0 b
	***MN (100%)	11.00c	11.1cd	9.07c	9.17bc	1.21a	1.21a	2.51 bc	2.41 f	9.13 cd	8.16 d	7.29 b	6.35 e	136.4 bc	142.1 bc
100	**ON (100%)	9.33ij	9.67f	8.17gh	8.47e	1.14a	1.14a	2.32 d	2.21 h	8.21 fg	7.32 f	5.92 g	5.82 g	131.0 c	133.0 d
	MN (25%) + ON (75%)	9.80g	10.13def	8.57e	8.60de	1.14a	1.18a	2.37 cd	2.28 g	8.38 f	7.39 f	6.22 f	6.01 fg	136.2 bc	138.4 cd
	MN (50%) + ON (50%)	11.13bc	11.20cd	9.10c	9.10bc	1.22a	1.23a	2.51 bc	2.58 d	9.10 d	8.63 bc	6.70 d	6.80 c	141.3 b	144.6 bc
	MN (75%) + ON (25%)	11.63a	12.03a	10.17a	9.83a	1.14a	1.22a	2.76 a	2.82 a	9.66 a	9.11 a	7.37 a	7.43 a	151.0 a	157.5 a
	***MN (100%)	11.17bc	11.23c	10.00a	9.97a	1.12a	1.13a	2.57 b	2.73 b	9.23 c	8.44 c	7.29 b	7.19 b	140.5 b	147.6 bc

Means followed by the same letter(s) within each column do not significantly differ using Duncan's Multiple Range Test.
*** RD: Recommended dose.**
****ON: Organic nitrogen.**
*****MN: Mineral nitrogen**