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EFFECT OF FERTILIZER RATES AND PLANT SPACING ON SEED PRODUCTION OF SELECTED CABBAGE BALADY PLANTS

BY

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ABSTRACT

The work was carried out at Sids Horticulture Research Station, Beni-Sueif Governorate during the two successive winter seasons of 2002/2003 and 2003/2004 to study the effect of NPK rates viz., 20 N+15 P_2O_5+24 K_2O, 40 N + 30 P_2O_5 + 48 K_2O and 60 N + 45 P_2O_5 + 72 K_2O Kg/fed and three plant spacing between stems, i.e., 60, 70 and 80 cm on ridges on plant growth, chemical constituents and seed yield and its components of cabbage cv. "Balady Selected".

The results indicated that number of branches and leaves, peduncle length, number of peduncles, mineral contents of leaves i.e., N, P and K, number of pods per peduncle, pod length, number of seeds per pod, weight of 1000-seeds, seed yield per plant and seed yield per fed were significantly increased by NPK fertilization at the rate of 60 N + 45 P_2O_5 + 72 K_2O Kg/fed.

The plant spacing between stems, 80 cm apart, significantly increased mean values of the previous characters, except total seed yield/ fed, which was increased with reducing plant spacing (increasing plant density). Highest value of total seed yield/fed was obtained from stems spaced at 60 cm apart.

The results indicated that it may be recommended to fertilize cabbage cv: "Balady Selected" with NPK at the rate of 60 N + 45 P_2O_2 + 72 K_2O Kg/fed and planting stems in hills at 60 cm apart, to produce high seed yield and good seed quality under conditions of Sids Experiment Station.

INTRODUCTION

Cabbage (*Brassica oleracea var. capitata* L..) is considered one of the important winter vegetable crops grown in Egypt. Fertilization and plant spacing have been reported to have great effect on vegetative growth, chemical constituents and good quality and quantity of seeds. Application of N, P and K were reported to have a considerable increase in vegetative growth of grown stems expressed as number of leaves and branches, leaf area and plant spread (Vik, 1992; Halim *et al.*, 1994; Singh *et al.*, 2001; Amreesh *et al.*, 2002 and Wang *et al.*, 2003) on cabbage plants grown from stems. Halim *et al.* (1994) indicated that stem growth was highest with 150 kg N + 100 kg P_2O_5 + 150 kg

K_2O/ha of cabbage plants. Singh *et al.* (2001) reported that application of 50 kg N + 100 kg P_2O_5 /ha significantly increased number of leaves, leaf area and plant spread of stem cabbage plants. Sajjad *et al.* (2003) stated that number of leaves at flowering and peduncle initiation, peduncle height, number of floral branches at flowering were highest with 150 kg P/ha in combination with EM. Recently, Zanao *et al.* (2005) declared that fresh and dry mass of the aerial parts and number of leaves of stem per cabbage plants were increased by applying nitrogen fertilizer at the rate of 210 kg/ ha.

Regarding the effect of plant spacing on plant growth, Stofella and Fleming (1988); Jaiswal *et al.* (1992) and Abdel-Ati *et al.* (1993) they found that plant growth characters were increased with widest spacing between plants of cabbage plants. Mannana *et al.* (1999) declared that the maximum vegetative growth and dry matter of leaves were recorded for the widest spacing 60 x 50 cm, whereas the lowest values were obtained from the spacing of 50 x 40cm of cabbage plants. Moreover, Ferreira *et al.* (2002) indicated that leaf area, dry matter mass and absolute growth rate of cabbage were highest in the greater spacing 30 x 30cm. Application of nitrogen at the rate of 187.5 kg/ha with wider spacing at 75 x 45 cm resulted in the best vegetative growth of cabbage plants (Sandhu *et al.*, 1999).

NPK fertilizers application increases chemical constituents as concentration of N, P and K of cabbage plants and the uptake values, too as reported by Montenegro *et al.* (1991); Vinay *et al.* (1994) and Yang *et al.* (2001). Guo *et al.* (2004) concluded that application of N-P_2O_5-K_2O at the rate of 350-60-300 kg/ha significantly increased N, P and K uptake in cabbage plants. Zanao *et al.* (2005) added that the accumulation of N, P, K, Mn and Zn were increased by nitrogen application at the rate of 210 kg N/ha of cabbage.

The seed production and seed quality depend on many factors of which the most important are the used varieties, fertilization and plant spacing. Fertilization with N, P and K which may have an important role on seed production has been studied by many investigators, Vik (1992) and Verma *et al.* (1997) on cabbage plants; Sharma (1995) and Sharma (2001) on chinese cabbage plants, mentioned that application of N, P and K fertilizers increased seed yield and its components. Vik (1992) reported that application at 1% solution of 15P-14K-12N increased seed yield of cabbage plants. Sharma (2001) found that seeds per siliqua and seed yield significantly increased with NPK at the rate of 93.7 + 77.8 + 27.5kg/ha of chinese cabbage. Moreover, Lal (2003) reported that application of N + P + K at the rate of 100 + 120 + 120 kg /ha respectively gave the highest seed yield per plant and seed yield q/ha of cauliflower plants. Sajjad *et al.* (2003) indicated that phosphorus application at the rate of 150 kg P_2O_5/ha in combination with EM resulted in highest number of pods per plant (1177) and seed yield (653.1 kg/ha) of cabbage plants.

The significant effect of plant spacing on seed yield and its components reported by Orlowski *et al.* (1992) and Singh *et al.* (2000) on cabbage plants; Sharma *et al.* (1996) on sprouting broccoli and Sharma (2001) on chinese

cabbage, found that the seed yield was increased with increasing plant density. Singh *et al.* (2000) found that seed yield was increased with increasing plant density (60 x 75 cm) of cabbage plants. Bhole *et al.* (2004) reported that number of pod-bearing branches, pods per plant and seed yield per plant were highest under 60 x 60 cm spacing. Whereas plant spacing 60 x 15 cm increased seed yield/ha of radish plants. Recently, Hossain and Mian (2005) found that close plant spacing 40 x 40cm recorded maximum seed yield in cabbage.

The aim of the present study was to investigate the effect of NPK fertilizer levels and plant spacing between stems on growth, chemical constituents of leaves, seed yield and quality of cabbage cv. "Balady Selected".

MATERIALS AND METHODS

This investigation was conducted at Sids Horticulture Research Station Beni Sueif governorate during the in two successive winter seasons of 2002/2003 and 2003/2004 on cabbage cv. "Balady Selected", to study the influence of NPK levels and plant spacing between plants, i.e., 60, 70 and 80cm on growth, chemical constituents of leaves and seed yield and its components.

Soil of the experimental site was clay loam in texture. Chemical analysis of the soil was carried out at the laboratories of soil Research Institute, Agriculture Research Center at Sids by the official methods of Jackson (1958) as shown from Table (A).

Table (A): Chemical analysis of the experimental soil.

Seasons	Available (PPm)			Organic matter %	PH
	N	P	K		
2002/2003	25.7	15.6	434.2	2.5	7.5
2003/2004	23.3	14.1	412.5	2.1	7.4

Three NPK levels, i.e., (Low: 20 N +15 P2O2 +24 K_2O, Medium: 40 N + 30 P_2O_5 + 48 K_2O and High: 60 N + 45 P2 O5 + 72 K_2O) Kg/fed. and plant spacing between stems, i.e., 60, 70 and 80cm. Nitrogen (N) was applied in the form of ammonium sulfate (20.5%N), phosphorus (P) was applied in the form of calcium superphosphate (15.5% P_2O_5) and potassium (K) was applied in the form of potassium sulfate (48% K_2O). Phosphorus was applied once before planting, nitrogen and potassium fertilizers were splitted into two equal doses and applied 20 and 45 days after planting. The experimental layout was split-plot design with four replications. The main plots allocated for NPK levels, whereas plant spacing were randomly distributed in the sub-plots. Each experimental plot consisted of three beds 5.0 m long and 0.8m wide. Area of plot was 12.0 m^2.

Seeds were sown on the 1st and 3 rd of July, 2002 and 2003 seasons, respectively. Seedlings were transplanted 40 days after seed sowing in both

growing seasons. Selected mature heading plants on basis of good characters, i.e., big size of heads, wrapper and compacted leaves, short stem and free diseases and pests infection. Then, selected plant stems had been pulled out with their roots and planted. Common agricultural practices known for cabbage commercial seed production other than the mentioned treatments were followed.

Ten representative plants chosen at random in each plot after 65 days from planting stems were used for recording the following data:

A- Vegetative growth:

1- Average number of branches / plant. 2- Average number of leaves/ plant.

Ten plants were taken at random after flowering from sub-plot to record the following data:

1- Average peduncle length (cm.). 2- Average number of peduncles/plant.

B-Chemical constituents:

Leaf samples were collected randomly from five plants from each experimental plot, 60 days after planting and dried at 70C° till a constant weight to determine the N, P and K on the basis of dry weight. Total nitrogen was determined by using the Micro-Kjeldahl method, phosphorus was determined colorimetrically. (A.O.A.C. 1970) and potassium was determined by using unicam SP1900 Atomic Absorption Spectrophtometer (Ranganna, 1978).

C- Seed yield and its components:

Harvesting of dry pods was started on the 20th April in 2003 and the 25th of April in 2004. Two harvests were obtained and their total weights were used to calculate the yield per fed. The mean number of pods for the peduncles of five plants from each experimental plot which were chosen at random to determine the number of pods/ peduncle. The pod length was measured from 20 pods were chosen at random from each experimental unit. Number of seeds/pod was calculated from 20 pods were chosen at random and also the weight of 1000-seeds was recorded for each experimental unit. The following data were recorded:

1- Average number of pods / peduncle. 2- Average pod length (cm.).
3- Average number of seeds per pod. 4-Weight of 1000-seeds (gm.)
5-Seed yield/ plant (gm.). 6-Total seed yield (Kg/fed.).

D- Germination percentage:

One hundred seeds as a random sample from each plot was placed on a filter paper in a petri dish and placed in an incubator at a temperature of 26 C° and the germinated seeds were counted daily starting 4 days after the beginning the experiment which terminated 3 weeks later. Seed germination percentage was recorded. Seed germination percent (S.G.%): was calculated according formuls of Bartlett (1937) as follows:

$$S.G\% = \frac{\text{Number of germinated seeds after 4 days} \times 100}{\text{Total number of tested seeds}}$$

Data were subjected to the analysis of variance procedures and treatment means were compared by the L. S. D. test described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

1- Vegetative growth characteristics:

Data of vegetative growth characters such as average leaves and branches number per plant, peduncle length and number of peduncles per plant are shown in Table (1). Data showed that application of the highest rate of fertilizers at (60 N + 45 P_2O_5 + 72 K_2O Kg/fed) produced significantly high values of plant growth characters as compared to low and medium rates, in both growing seasons. The increases in the mentioned growth characters may be attributed to high mineral fertilizer rates. The increase in plant growth due to the increase in mineral fertilizer was previously reported by Vik (1992); Halim *et al.* (1994); Singh *et al.* (2001); Amreesh *et al.* (2002); Sajjad *et al.* (2003) and wang *et al.* (2003) on cabbage plants. Zanao *et al.* (2005) on cabbage mentioned that application of mineral fertilizers gave best growth characters of plant.

Table (1): Effect of NPK fertilizers and plant spacing on number of branches and leaves, peduncle length and number of peduncles of cabbage in 2002/2003 and 2003/2004 seasons.

Treatments	Number of branches/ plant		Number of leaves/ plant		Peduncle length (cm.)		Number of peduncles/ plant	
	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004
NPK rates (kg/fed)								
Low	4.33	4.10	34.40	29.91	82.50	81.60	7.20	7.30
Medium	5.52	5.85	49.14	45.55	86.10	86.20	8.55	8.33
High	6.39	6.29	60.48	59.78	88.10	91.10	9.77	9.43
L.S.D.5%	0.56	0.32	4.86	3.19	1.80	3.40	0.58	0.39
Plant spacing								
60 cm	4.89	4.78	40.47	38.39	82.90	83.20	7.88	7.94
70 cm	5.31	5.30	48.40	44.42	85.70	86.60	8.52	8.29
80 cm	6.04	6.06	55.16	52.72	88.00	89.40	9.12	8.82
L..S.D. 5%	0.21	0.28	3.39	2.53	1.10	1.40	0.18	0.14

Data in Table (1) also, indicated that average branches and leaves number/plant, peduncle length and number of peduncles/plant significantly increased by wider spacing in both growing seasons. Wider spacing 80cm produced significantly high vegetative growth characters. These results agree with the findings reported by Stofella and Fleming (1988); Jaiswal *et al.* (1992); Abdel-Ati *et al.* (1993); Mannana *et al.* (1999) and Ferreira *et al.* (2002) who reported that wider spacing 30 x 30 cm increased leaf area, dry matter mass and growth rate of cabbage.

The effect of interaction between NPK fertilizer rates and plant spacing was significantly increased vegetative growth characters (Table 2) in both growing seasons. It was clear that, applying high rate at 60 N + 45 P_2O_5 + 72 K_2O kg/fed combined with wide spacing 80cm gave significantly highest values of branches and leaves number, peduncle length and number of peduncles/plant. The present results agree with Sandhu *et al.* (1999) who indicated that the interaction between N at 187.5 kg/ha with wider spacing 75x 45 cm resulted in the best vegetative growth of cabbage plants.

Table (2): Effect of interaction between NPK fertilizers and plant spacing on number of branches and leaves, peduncle length and number of peduncles of cabbage in 2002/2003 and 2003/2004 seasons.

Treatments		Number of branches/plant		Number of leaves/plant		Peduncle length (cm.)		Number of peduncles/plant	
NPK rates (kg/fed)	Plant spacing	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004
Low	60 cm	4.02	3.90	27.36	21.50	80.30	78.50	6.74	7.03
	70 cm	4.26	4.15	35.52	29.72	82.70	81.60	7.23	7.30
	80 cm	4.72	4.25	40.34	38.50	84.50	84.80	7.63	7.57
Medium	60 cm	4.87	4.95	43.52	40.19	83.50	83.70	8.01	7.91
	70 cm	5.36	5.67	49.07	45.90	85.90	86.90	8.58	8.25
	80 cm	6.34	6.93	54.83	50.57	88.80	88.00	9.05	8.83
High	60 cm	5.78	5.60	50.52	53.50	85.10	87.40	8.89	8.90
	70 cm	6.32	6.28	60.62	56.73	88.60	90.50	9.74	9.33
	80 cm	7.07	6.99	70.31	69.11	90.70	95.40	10.68	10.05
L.S.D.5%		0.36	0.57	7.07	5.05	1.70	2.10	0.31	0.23

2- Chemical constituents:

Data of nitrogen, phosphorus and potassium contents in cabbage leaves as affected by NPK fertilizer rates are presented in Table (3) indicated that the higher fertilizer rate at (60 N + 45 P_2O_5 + 72 K_2O kg/fed) from NPK increased leaves mineral contents of N, P and K as compared to the low and medium rates in both growing seasons. Such response to NPK fertilizer was reported by many investigators, i.e. Montenegro *et al.* (1991); Vinay *et al.* (1994); Yang *et al.* (2001); Guo *et al.* (2004) and Zanao *et al.* (2005) as they mentioned that mineral fertilization increased N,P,K contents and their uptake of cabbage plants. Also wide spacing between plants 80 cm gave higher N,P and K contents in leaves as compared to the 60 cm and 70 cm spacing in both growing seasons. For the interaction, data in Table (4) showed that NPK fertilizer at level of (60 N + 45 P_2O_5 + 72 K_2O kg/fed) and plant spacing 80 cm apart gave significant increase in the N, P and K contents in leaves in both growing seasons.

Table (3): Effect of NPK fertilizers and plant spacing on N, P and K uptake in leaves of cabbage in 2002/2003 and 2003/2004 seasons.

Treatments	N –uptake mg/100g DW		P -uptake mg/100g DW		K- uptake mg/100g DW	
	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004
NPK rates (kg/fed)						
Low	138.23	134.48	10.64	10.98	62.28	60.84
Medium	144.12	141.37	12.11	12.73	77.54	74.55
High	151.27	155.04	12.92	13.97	81.95	81.57
L.S.D.5%	3.30	4.53	0.73	1.16	3.85	2.82
Plant spacing						
60 cm	140.73	139.80	11.47	11.99	73.01	69.57
70 cm	144.38	143.43	11.86	12.42	73.81	72.51
80 cm	148.30	147.66	12.02	13.26	74.95	74.87
L.S.D.5%	**1.09**	**1.14**	**0.11**	**0.14**	**0.56**	**0.63**

Table (4): Effect of interaction between NPK fertilizers and plant spacing on N, P and K uptake in leaves of cabbage in 2002/2003 and 2003 and 2004 seasons.

Treatments		N –uptake mg /100g DW		P -uptake mg/100g DW		K- uptake mg/100g DW	
NPK rates (kg/fed)	Plant spacing	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004
Low	60 cm	136.11	130.50	10.17	10.36	61.50	59.70
	70 cm	138.05	133.05	10.70	10.89	62.20	60.32
	80 cm	140.53	139.90	11.05	11.71	63.15	62.50
Medium	60 cm	139.73	138.70	11.61	11.77	76.90	69.37
	70 cm	145.59	141.50	11.98	12.50	77.17	75.10
	80 cm	147.06	143.93	12.75	13.93	78.55	79.18
High	60 cm	146.35	150.20	12.63	13.86	80.63	79.65
	70 cm	150.11	155.75	12.90	13.89	82.08	82.13
	80 cm	157.36	159.17	13.25	14.16	83.15	82.93
L.S.D. 5%		**2.12**	**2.96**	**0.16**	**0.19**	**1.07**	**1.11**

3- Seed yield and its components:

Results on seed yield and its components as average number of pods per peduncle, pod length, number of seeds per pod, weight of 1000-seeds, seeds yield per plant and seeds yield per fed are shown in Table (5).

It is clear that seed yield and its components were significantly increased by NPK fertilizer. Seed yield and its components were increased from applying the high rate of fertilizers at (60 N + 45 P_2O_5 + 72 K_2O kg/fed), in both growing seasons. These results are quite similar to those reported by Vik (1992) and

Verma *et al.* (1997) on cabbage plants; Sharma (1995) and Sharma (2001) on chinese cabbage and Lal (2003) on cauliflower as they concluded that the highest seed yield and its components were recorded with applying compound mineral fertilizer of N,P and K. Sajjad *et al.* (2003) stated that number of pods per plant and seed yield were increased with applying phosphorus at the rate of 150 Kg P_2O_5 /ha in presence of EM in cabbage plants. The effect of mineral fertilizer on increasing seed yield/fed could be a result of effect of mineral fertilizers on enhancing the vegetative growth parameters and more absorption of minerals by plant roots, which in turn, resulted in a good seed yield parameter with the best seed quality.

It is also obvious from the data in Table (5) indicated that plant spacing significantly increased seed yield and its components in both growing seasons. Plants spaced at 80cm apart gave the highest values of average number of pods/peduncle, pod length, number of seeds per pod, weight of 1000-seeds and seeds yield per plant. Whereas seeds yield per fed. was significantly increased by closest spacing, narrow plant spacing, i.e., at 60 cm produced the best seed yield/fed. The results were in accordance with those mentioned by Orlowski *et al.* (1992) and Singh *et al.* (2000) on cabbage; Sharma *et al.* (1996) on sprouting broccoli and Sharma (2001) on chinese cabbage as they reported that closest plant spacing produced higher seed yield per unit area than wide plant spacing. Singh *et al.* (2000) concluded that seed yield was increased with increasing plant density (60 x 75cm) of cabbage plants. Bhole *et al.* (2004) declared that wide spacing 60 x 60 cm increased pod-bearing branches, pods per plant and seed yield per plant. However close plant spacing 60 x 15cm increased seed yield/ha of radish plants. Hossain and Mian (2005) reported that seed yield was increased with close plant spacing 40 x40cm.

Significantly interaction effects were detected between NPK fertilizer and spacing between plants on all recorded characters, except seed yield/fed in (Table 6). The combined treatment (60 N + 45 P_2O_5 + 72 K_2O kg/fed) from NPK and the widest spacing of 80 cm apart was the most effective treatment, since it recorded the highest values from number of pods per peduncle, pod length, number of seed per pod, weight of 1000- seeds and seeds yield per plant.

4- Germination percentage:

Data of germination percentage presented in Tables (5 and 6), indicated that NPK fertilizer, plant spacing and their interaction had insignificant effect on this character in both growing seasons.

Accordingly, from the foregoing results, it could be concluded that fertilization of cabbage to seed production cv. "Balady Selected" with NPK fertilizer at the rate of 60 N + 45 P_2O_5 + 72 K_2O kg/fed and plant spacing 60 cm wide may be recommended.

Table (5): Effect of NPK fertilizer and plant spacing on average number of pods/peduncle, pod length, number of seeds/pod, weight of 1000-seeds, seed yield/plant, seed yield/fed and germination percentage of cabbage in 2002/2003 and 2003/2004 seasons.

Treatments	Number of pods/ peduncle		Pod length (cm.)		Number of seeds/ pod		Weight of 1000-seeds (gm.)		Seed yield/plant (gm.)		Seed yield/ fed (kg.)		Germination percentage	
	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004
NPK rates (kg/fed)														
Low	83.87	80.92	7.9	7.5	15.48	10.76	7.09	6.57	29.0	25.8	268.002	237.602	84.54	83.00
Medium	118.21	113.53	9.4	9.0	17.71	17.64	8.04	7.68	46.7	38.6	428.237	357.758	85.10	83.94
High	139.56	142.33	10.5	10.1	19.26	18.96	8.18	8.20	61.8	57.0	567.592	523.355	86.44	84.28
L.S.D.5%	8.50	9.14	0.50	0.70	1.39	1.53	0.23	0.29	13.8	11.6	35.768	20.556	N.S	N.S
Plant pacing														
60 cm	89.35	99.11	8.5	8.1	16.51	15.70	7.43	7.05	39.1	35.4	444.984	403.560	84.97	83.43
70 cm	108.80	108.86	9.2	8.8	17.59	16.92	7.76	7.48	46.9	40.5	427.955	369.354	85.41	83.79
80 cm	134.49	128.85	10.0	9.5	18.72	18.08	8.13	7.93	51.6	45.5	390.892	345.800	85.94	84.00
L.S.D.5%	4.43	6.50	0.20	0.30	0.29	0.41	0.14	0.16	2.10	2.70	38.407	28.777	N.S	N.S

Table (6): Effect of the interaction between NPK fertilizer and plant spacing on average number of pods/peduncle, pod length, number of seeds/pod, weight of 1000-seeds, seeds yield/plant, seeds yield/fed. and germination percentage of cabbage in 2002/ 2003 and 2003/2004 seasons.

Treatments		Number of pods/ peduncle		Pod length (cm.)		Number of seeds/ pod		Weight of 1000- seeds (gm.)		Seeds yield/ plant (gm.)		Seeds yield/ fed (kg)		Germination Percentage	
NPK rates (kg/ fed)	Plant spacing	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004	2002/ 2003	2003/ 2004
Low	60 cm	72.05	70.43	7.6	6.9	14.59	12.90	6.85	5.99	25.5	22.3	290.701	254.220	84.20	82.90
	70 cm	84.52	81.50	7.9	7.5	15.52	13.75	7.05	6.50	29.7	25.7	270.864	234.384	84.52	83.00
	80 cm	95.06	90.82	8.2	8.0	16.35	15.65	7.37	7.21	31.9	29.5	242.440	224.200	84.90	83.11
Medium	60 cm	100.89	96.79	8.5	8.2	16.46	16.03	7.85	7.25	39.6	35.4	451.450	403.561	84.93	83.50
	70 cm	106.97	107.45	9.3	8.9	18.02	18.00	7.91	7.76	47.2	38.6	430.460	352.033	85.23	84.13
	80 cm	146.76	136.50	10.5	9.8	18.65	18.89	8.37	8.04	53.5	41.8	402.800	317.681	85.77	84.20
High	60 cm	122.11	130.12	9.5	9.4	18.74	18.17	7.58	7.91	52.3	48.5	592.801	552.901	85.79	83.90
	70 cm	134.92	137.63	10.5	10.0	19.22	19.01	8.32	8.17	63.9	57.4	582.540	521.644	86.50	84.25
	80 cm	161.66	159.25	11.4	10.8	19.82	19.71	8.65	8.53	69.4	65.2	527.435	495.520	87.15	84.70
L.S.D.5%		7.67	8.03	0.30	0.40	0.56	0.69	0.22	0.33	4.60	3.90	N.S	N.S	N.S	N.S

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تأثير المعدلات السمادية ومسافات الزراعة على انتاج تقاوى الكرنب البلدى المنتخب

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أجريت دراسة حقلية بمزرعة محطة بحوث البساتين بسدس- بنى سويف خلال الموسمين الشتويين ٢٠٠٢/ ٢٠٠٣، ٢٠٠٣/٢٠٠٤ بهدف دراسة تأثير التسميد النيتروجينى والفوسفورى والبوتاسى بمعدلات (٢٠ كجم نيتروجين + ١٥كجم فو٢ أه + ٢٤ كجم بو٢ أ ، ٤٠كجم نيتروجين + ٣٠كجم فو٢ أه + ٤٨ كجم بو٢ أ ، ٦٠كجم نيتروجين + ٤٥ كجم فو٢ أه + ٧٢كجم بو٢ أ)/الفدان وكذلك مسافة الزراعة بين السيقان على الخطوط (٦٠، ٧٠ ،٨٠ سم بين الجور) على النمو ومحتوى الأوراق من النيتروجين والفوسفور والبوتاسيوم ومحصول البذور والجودة فى صنف الكرنب "بلدى منتخب".

أوضحت نتائج الدراسة أن التسميد بالمعدل المرتفع(٦٠كجم نيتروجين + ٤٥كجم فو٢ أه + ٧٢كجم بو٢ أ)/الفدان أدى الى زيادة معنوية فى متوسط عدد الأفرع الخضرية وعدد الأوراق وطول الشمراخ الزهرى وعدد الشماريخ الزهرية بالنبات ومحتوى الأوراق من النيتروجين والفوسفور والبوتاسيوم وعدد القرون بالشمراخ الزهرى وطول القرن وعدد بذور القرن ووزن الألف بذرة ومحصول البذور/النبات ومحصول البذور/الفدان.

أوضحت نتائج الدراسة أيضا أن زراعة السيقان على خطوط فى جور على مسافة ٨٠سم أدت الى زيادة معنوية فى قيم هذه الصفات ما عدا محصول البذور / الفدان الذى زاد معنويا بتناقص مسافة الزراعة بين الجور (٦٠سم) أى زاد بزيادة الكثافة النباتية.

بناءا على نتائج هذه الدراسة يمكن التوصية بتسميد نباتات الكرنب صنف "بلدى منتخب" بالتسميد النيتروجينى والفوسفورى والبوتاسيى بمعدل ٦٠كجم نيتروجين + ٤٥ كجم فو٢ أه + ٧٢ كجم بو٢ أ/ الفدان على أن تكون الزراعة فى الجور على ابعاد ٦٠سم من بعضها وذلك لانتاج محصول عالى من البذور مع جودة بذور جيدة تحت ظروف محطة بحوث سدس