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Response of fertility and spacing to seed production of Chinese cabbage (*Brassica campestris* subsp *pekinensis*) under north-western Himalayas*

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Chinese cabbage [*Brassica campestris* L. ssp *pekinensis* (Lour.) Olson], a new vegetable in India, is valuable source of calcium, crude fibres and vitamin C. The genetic potential of any variety cannot be fully explored without proper agronomic management practices. Plant density and NPK fertilization play an important role in successful seed production of vegetable crops (Hawthorn and Pollard 1954). However, there is no information based on research findings in relation to fertility and spacing in Chinese cabbage. Hence an investigation was planned to determine the optimum level of fertility and spacing on seed production of newly released variety of Chinese cabbage 'Palampur Green'.

The field experiment was conducted during the winter season (*rabi*) of 1998–99 and 1999–2000 at the research farm of the Regional Research Station, Bajaura (1 090 m, mean sea-level). The soil was sandy loam in texture and neutral in reaction (*p*H 6.8). The available nutrients, viz nitrogen, phosphorus and potassium, in soil were 253, 18.5 and 227 kg/ha respectively. Three levels of fertility N, P and K @ 56.2, 46.6 and 16.5 kg/ha (F_1); 75, 62.2 and 22 kg/ha (F_2) and 93.7, 77.8 and 27.5 kg/ha (F_3), respectively, and 3 plant spacings between rows and plants, viz 30 cm × 45 cm (S_1), 45 cm × 45 cm (S_2), and 60 cm × 45 cm (S_3), were tested in randomized block design with 3 replications. Thirty-day-old seedlings were transplanted in the first week of October during both the years. The entire dose of P and K and half dose of N as per treatments were applied at transplanting, while rest of N were side-dressed in 2 equal splits at 30 and 60 days after transplanting. Observations were recorded on 10 random plants for height (cm), siliquae/plant, siliqua length (cm), seeds/siliqua, seed yield (kg/ha) and 1 000-seed weight (g). The mean values pooled over years were used for analysis of variance.

Various growth, yield and yield attributes of Chinese cabbage were significantly influenced by different levels of fertility except length of siliqua (Table 1). There was an increasing trend in the plant height with the every ascending level of fertility applied and the maximum values were recorded at F_3 having significant superiority to F_1. Similar trend was observed in seeds/siliqua.

Seed yield of Chinese cabbage increased significantly with a successive increment in fertility level from F_1 to F_3. The highest seed yield was obtained at highest fertility level (F_3), followed by F_2. An increase of 36.95 % in seed yield was observed with the application of F_3 over F_1. The highest level of fertility (F_3) while remaining at par with F_2 recorded significantly maximum 1 000-seed weight (1.88 g) than F_1(1.78 g). The improvement in growth yield and its attributes

Table 1 Effect of plant spacing and fertility levels on 'Palampur Green' Chinese cabbage

Treatment	Plant height (cm)	Siliquae/ plant	Seeds/ siliqua	Seed yield (kg/ha)	1 000-seed (g) weight
Spacing (S)					
S_1 (30 cm × 45 cm)	133.41	805.77	18.37	1034	1.82
S_2 (45 cm × 45 cm)	135.27	850.50	19.28	969	1.84
S_3 (60 cm × 45 cm)	137.67	863.72	19.72	782	1.87
CD(*P*=0.05)	NS	54.54	NS	62	NS
Fertility (F) (N : P : K kg/ha)					
F_1 (56.2:46.6:16.5	130.17	714.17	17.28	763	1.78
F_2 (75.0:62.2:22.0)	136.45	862.11	19.51	976	1.87
F_3 (93.7:77.8:27.5)	139.71	943.72	20.57	1045	1.88
CD(*P*=0.05)	4.60	54.54	2.27	62	0.08

Interaction (F × S)	
$F_1 + S_1$	801
$F_1 + S_2$	817
$F_1 + S_3$	671
$F_2 + S_1$	1 020
$F_2 + S_2$	1 018
$F_2 + S_3$	887
$F_3 + S_1$	1 279
$F_3 + S_2$	1 072
$F_3 + S_3$	784
CD(*P*=0.05)	134

* Short note

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due to NPK fertilization could be attributed to their promotive effects in plant growth , photosynthesis, synthesis of proteins and translocation of carbohydrates. Similar observations were also made by Pandey *et al.* (1985) in cauliflower (*Brassica oleracea* L. var *botrytis* L. subvar *cauliflora* DC.)

The effect of spacing on various ancillary characters was significant only for siliquae/plant and seed yield/ha (Table 1). Wider spacing (60 cm × 45 cm) gave significantly maximum siliquae/plant compared with the closer spacing 30 cm × 45 cm. However, the difference between S_3 and S_2 were not significant.

The highest seed yield was obtained when the plants were spaced at 30 cm × 45 cm, followed by 45 cm × 45 cm and minimum in 60 cm × 45 cm. This is mainly owing to more plant population/unit area. The results confirm the findings of Singh *et al.* (2000) in cabbage (*Brassica oleracea* L. var *capitata* L.f.).

The interaction effect of fertility × plant spacing was significant only for seed yield of chinese cabbage (Table 1). A combination of F_3 and S_1 gave the highest seed yield, which was significantly superior to the rest of the treatment combinations.

Thus it can be concluded that an application of N, P and K @ 93.7, 77.8 and 27.5 kg/ha in plant spacing of 30 cm × 45 cm was suitable for seed production of Chinese cabbage under mid-hill conditions of north-western Himalayas.

SUMMARY

A field experiment was conducted during the winter season (*rabi*) of 1998–99 and 1999–2000 under mid-hill conditions of Himachal Pradesh, to determine the optimum level of fertility and spacing on seed production of 'Palampur Green' Chinese cabbage [*Brassica campestris* L. ssp *pekinensis* (Lour.) Olson]. A significant difference in growth and yield of Chinese cabbage was observed due to fertility and spacing. An increase of 36.95 % in seed yield was noted with the application of 93.7, 77.8 and 27.5 kg N, P and K/ha over 56.2, 46.6 and 16.5 kg N, P and K/ha. The seed yield was significantly maximum (1 034 kg/ha) at closer spacing (30 cm × 45 cm) compared with other treatments. The interaction effect of fertility and spacing was significant only for seed yield.

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