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# Effect of head compactness on seed yield and quality of cabbage cv Pride of India

**H DEV**

**Department of Vegetable Science**
**Dr YS Parmar University of Horticulture and Forestry, Nauni 173230 Solan, HP**
**Email for correspondence: happydev21@yahoo.in**

## ABSTRACT

The 45 days old healthy seedlings of cabbage cv Pride of India were transplanted in mid July at Vegetable Research Station, Kalpa, district Kinnaur, HP and the heads were ready for harvesting during November. Cabbage seed production was done by head to seed method and the true to type heads were classified into five categories viz C1: 0.26-0.30, C2: 0.31-0.35, C3: 0.36-0.40, C4: 0.41-0.45 and C5: 0.46-0.50 on the basis of Z-value of head compactness as per the method of Pearson (1931). After categorization the heads were overwintered in trenches for vernalization from November to March during two consecutive years 2007-08 and 2008-09. The experiment was laid in Randomized Block Design with three replications every year, after melting of snow in the last week of March to first week of April planting done at a spacing of 45x45 cm in plot size of 2.70 x 2.25 m with a population of 30 plants per plot. Significant differences were observed for all the traits studied except days to maturity during both the years. The plants from more compact heads gave more seed yield, number of branches, number of pods, seeds per pod, pod length and height as well as seed quality measured in terms of 1,000 seed weight and germination percentage besides being early in sprouting, flowering and pod formation with low mortality. However days to maturity were not affected by the head compactness. It was concluded that for boosting quantity, quality and early seed production of cabbage more compact heads should be replanted for raising seed crop under dry temperate conditions.

**Keywords:**Cabbage; Pride of India; head compactness; Z-value; seeds; germination

## INTRODUCTION

Cabbage (*Brassica oleracea* var *capitata*) is an important leafy vegetable grown extensively throughout the world. In India it is cultivated as a winter crop. Cabbage is biennial in nature and its seed production is restricted to temperate areas concentrated at an altitude of 1,500 m to 3,000 m above mean sea level with dry weather during seed maturity and harvesting. In one season heads are produced which then require an exposure to cold treatment of 4-7$^0$C for 6-8 weeks or more for entering into reproductive phase. The dry temperate zone of North Western Himalaya is congenial for seed production of cabbage. Head to seed

method is generally followed where heads after selection along with roots are stored in trenches for overwintering and seed so produced is of high quality. Due to slow rise in temperature from March to August and prevalence of dry conditions at the time of seed maturity and ripening the seed produced in this region is of high quality and excellent vigour. Head compactness is one of the important quality characters in seed production of cabbage. However there is a wide variation with respect to head compactness which may affect the seed yield, its attributes and quality. The present studies were carried out during two consecutive years 2007-08 and 2008-09 at Vegetable Research Station, Kalpa, district Kinnaur, HP with the objective to know the influence of compactness of heads to be used on yield and quality of cabbage seed. Since it is a long duration, location specific and labour intensive seed crop efforts to maximize the seed yield per unit area would go a long way in increasing the seed yield and boosting the income of the tribal farmers.

## MATERIAL AND METHODS

The 45 days old healthy seedlings were transplanted in the mid July and the heads were ready for harvesting during November. Cabbage seed production was done by head to seed method and the true to type heads were classified into five categories viz C1: 0.26-0.30, C2: 0.31-0.35, C3: 0.36-0.40, C4: 0.41-0.45 and C5: 0.46-0.50 on the basis of Z-value of head compactness as per the method of Pearson (1931).

Z-values were calculated by the formula:

$$Z = C/W3 \times 100$$

Where, Z = index of compactness
C = net weight of head
W = average of equatorial and polar diameter of head

Cabbage head compactness can be judged by applying pressure on head by thumb or by seeing that the uppermost wrapper leaf covers two third or more area of head or by measuring length of core inside the head by cutting longitudinal section of head or by net head weight ie more the weight higher is the compactness (Swarup 1991). Being less accurate method head compactness can be judged more accurately by Z-value formula given by Pearson (1931). After categorization the heads were overwintered in trenches for vernalization from November to March. The experiment was laid in Randomized Block Design with three replications every year after melting of snow in the last week of March to first week of April at a spacing of 45x45 cm in plot size of 2.70x2.25 m with a population of 30 plants per plot. Recommended doses of FYM and NPK were applied and all agronomic practices

were adopted timely as per package of practices for raising a normal and healthy crop. The observations were recorded from ten plants per plot on seed yield per plant (g), number of branches per plant, pods per plant, seeds per pod, pod length (cm), days to 50 per cent sprouting, flowering, pod formation, maturity, mortality (%), plant height (cm), 1,000 seed weight (g) and seed germination (%).

## RESULTS AND DISCUSSION

Seed yield, yield components and traits like morphological, maturity and seed quality under different head compactness were statistically analyzed and the mean values for two years along with the pooled means are presented in Table 1.

Significant differences were observed for all the traits studied except days to maturity during both the years. The highest seed yield of 33.95 g per plant was obtained by replanting the most compact heads with Z-value 0.46-0.50 (C5) however it was at par with those having Z-value 0.41-0.45 (C4). The performance of heads below Z-value 0.40 was significantly poor in individual years as well as under pooled performance. Almost similar trend was observed for branches per plant, pods per plant and seeds per pod. Pod length and plant height were also highest with Z-value 0.46-0.50 (C5) but these were at par with those having Z-value more than 0.31. The maximum number of pods per plant (1332.53), seeds per pod (29.04), pod length (9.03 cm) and plant height (149.06 cm) were observed in plants from the heads with Z-value 0.46-0.50 (C5). Similarly the maximum number of branches per plant (23.27) were recorded in Z-value 0.41-0.45 (C4) but the performance of loose heads was poor. It is indicated that seed yield per plant, branches per plant, pods per plant, seeds per pod, pod length and plant height increased proportionately with the degree of compactness of cabbage heads. Kanwar et al (2000) also observed higher seed yield, number of branches per plant and plant height from more compact heads.

The heads with Z-value more than 0.41 sprouted, flowered and came into pod formation stage significantly earlier than those with Z-value less than 0.40 and their mortality percentage was also low. The cabbage seed plants from heads with Z-value 0.41-0.45 (C4) sprouted at the earliest (15.50 days) followed by those with Z-value 0.46-0.50 (C5) whereas those from Z-value 0.46-0.50 (C5) flowered at the earliest (34.67 days) and came into pod formation stage (42.33 days) at the earliest followed by those with Z-value 0.41-0.45 (C4). The minimum mortality (5.40%) was observed in the plants from heads with Z-value 0.46-0.50 (C5) which was statistically at par with those having Z-value 0.41-0.45 (C4). The trend was in chronological order depending upon the degree of compactness

Table 1. Effect of head compactness on seed yield, its attributes and quality of cabbage cv Pride of India

| Head compactness (Z-value) | Year | C1 0.26-0.30 | C2 0.31-0.35 | C3 0.36-0.40 | C4 0.41-0.45 | C5 0.46-0.50 | Mean | $CD_{0.05}$ |
|---|---|---|---|---|---|---|---|---|
| Traits | | | | | | | | |
| Seed yield/plant (g) | 2008 | 22.14 | 24.90 | 26.11 | 32.24 | 33.91 | 27.86 | 3.22 |
| | 2009 | 24.10 | 25.79 | 28.35 | 34.71 | 33.99 | 29.39 | 3.68 |
| | Pooled | 23.12 | 25.35 | 27.23 | 33.48 | 33.95 | 28.63 | 3.45 |
| Branches/plant (no) | 2008 | 15.28 | 16.44 | 18.20 | 22.34 | 21.45 | 18.74 | 2.22 |
| | 2009 | 13.25 | 17.11 | 19.24 | 24.19 | 23.91 | 19.54 | 2.17 |
| | Pooled | 14.27 | 16.78 | 18.72 | 23.27 | 22.68 | 19.14 | 2.20 |
| Pods/plant (no) | 2008 | 491.18 | 612.79 | 899.00 | 1184.81 | 1355.29 | 908.61 | 151.11 |
| | 2009 | 629.25 | 918.75 | 1114.00 | 1225.61 | 1309.76 | 1039.47 | 126.71 |
| | Pooled | 560.22 | 765.77 | 1006.50 | 1205.21 | 1332.53 | 974.04 | 138.91 |
| Seeds/pod (no) | 2008 | 16.24 | 21.11 | 22.79 | 27.72 | 28.89 | 23.35 | 2.76 |
| | 2009 | 18.91 | 21.04 | 26.25 | 27.21 | 29.29 | 24.54 | 3.11 |
| | Pooled | 17.58 | 21.08 | 24.52 | 27.47 | 29.09 | 23.95 | 2.94 |
| Pod length (cm) | 2008 | 7.01 | 7.46 | 8.09 | 8.76 | 8.95 | 8.05 | 1.12 |
| | 2009 | 8.21 | 8.17 | 8.46 | 8.22 | 9.11 | 8.43 | 1.28 |
| | Pooled | 7.61 | 7.82 | 8.28 | 8.49 | 9.03 | 8.24 | 1.20 |
| Days to 50% sprouting | 2008 | 23.00 | 20.33 | 16.00 | 14.67 | 14.00 | 17.60 | 2.11 |
| | 2009 | 24.67 | 22.67 | 18.00 | 16.33 | 14.67 | 19.27 | 2.60 |
| | Pooled | 23.84 | 21.50 | 17.00 | 15.50 | 14.34 | 18.44 | 2.36 |
| Days to 50% flowering | 2008 | 4.67 | 41.00 | 36.33 | 35.67 | 34.00 | 38.33 | 4.02 |
| | 2009 | 47.00 | 43.33 | 42.67 | 37.00 | 35.33 | 41.07 | 4.38 |
| | Pooled | 45.84 | 42.17 | 39.50 | 36.34 | 34.67 | 39.70 | 4.20 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Days to 50% pod formation | 2008 | 57.00 | 53.67 | 46.00 | 42.33 | 41.33 | 48.07 | 4.27 |
| | 2009 | 56.33 | 52.00 | 47.67 | 45.00 | 43.33 | 48.87 | 4.76 |
| | Pooled | 56.67 | 52.84 | 46.84 | 43.67 | 42.33 | 48.47 | 4.52 |
| Mortality (%) | 2008 | 28.17 | 25.76 | 20.11 | 9.14 | 4.75 | 17.59 | 5.25 |
| | 2009 | 33.44 | 21.25 | 18.12 | 12.15 | 6.04 | 18.20 | 5.36 |
| | Pooled | 30.81 | 23.51 | 19.12 | 10.65 | 5.40 | 17.90 | 5.31 |
| Maturity (days) | 2k8&9 | 135.00 | 135.00 | 135.00 | 135.00 | 135.00 | 135.00 | NS |
| Plant height (cm) | 2008 | 135.64 | 141.19 | 143.01 | 147.61 | 146.71 | 142.83 | 9.43 |
| | 2009 | 131.10 | 137.77 | 141.15 | 145.91 | 151.40 | 141.47 | 11.24 |
| | Pooled | 133.37 | 139.48 | 142.08 | 146.76 | 149.06 | 142.15 | 10.34 |
| 1,000 seed weight (g) | 2008 | 3.41 | 3.49 | 3.63 | 3.75 | 3.92 | 3.64 | 0.35 |
| | 2009 | 3.52 | 3.69 | 3.71 | 3.77 | 3.88 | 3.71 | 0.41 |
| | Pooled | 3.47 | 3.59 | 3.67 | 3.76 | 3.90 | 3.68 | 0.38 |
| Seed germination (%) | 2008 | 72.15 | 77.35 | 81.00 | 87.50 | 93.25 | 82.25 | 3.76 |
| | 2009 | 76.00 | 80.25 | 83.00 | 87.15 | 91.25 | 83.53 | 3.16 |
| | Pooled | 74.08 | 78.80 | 82.00 | 87.33 | 92.25 | 82.89 | 3.46 |

ie more compact heads sprouted, flowered and came into pod formation earlier and loose heads were the last. Kanwar et al (2000) also observed early flowering from more compact heads. Bosewell (1929) reported that size of overwintered cabbage head is the primary cause of early bolting. The mortality in case of large sized heads was negligible perhaps due to the fact that the floral buds were covered by large number of leaves which protected them from low and sudden changes in temperature. In case of compactness it might be because of the fact that small size of core in compact heads remained under protected conditions after fulfilling their chilling requirements but reverse was the case in loose heads as the core size is large. It has also been reported that compact heads can withstand temperature as low as -15$^0$C without any freezing of core (Hawthorn and Pollard 1954).

In order to ascertain the effect of head compactness on the quality of seed 1000 seed weight and seed germination percentage were recorded and significant differences for both the traits were found during all the years. A range of 3.47-3.90 g for 1,000 seed weight and 74.08-92.25 per cent for seed germination was recorded in all the head compactness (Z-value) classes used. The 1,000 seed weight and germination percentage increased with increase in head compactness class ie from Z-value 0.26-0.30 (C1) to 0.46-0.50 (C5). Increase in 1,000 seed weight and germination percentage with increase in head compactness (Z-value) was also observed by Kanwar et al (2000). Hanumaiah and Andrews (1973) indicated that higher germination and more vigorous seedlings were observed in large seeds than small seeds expressed as 1,000 seed weight.

It is concluded that for boosting quantity, quality and early seed production of cabbage more compact heads should be replanted for raising seed crop under dry temperate conditions.

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