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Effect of different planting dates and climatic conditions on growth, flowering and seed production of candytuft (*Iberis amara*)

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ABSTRACT

The effect of climatic conditions and planting dates on growth, flowering and seed production of candytuft (*Iberis amara* L.) under mid hill conditions of Himachal Pradesh during 2010-11 and 2011-12 were investigated. Six plantings were done at an interval of 15 days starting from September 17 in both the years with planting dates as; September 17, October 2, October 17, November 1, November 16 and December 1. The maximum plant height (34.81 cm), plant spread (33.23 cm), number of side stems/plant (6.25), earliest visible flower bud formation (55.43 days), flowering (77.80 days), duration of flowering (41.80 days), number of flower clusters/stem (15.46), number of siliquae/plant (3467.72), seed yield/plant (10.25 g) and 1 000 seed weight (2.18 g) were recorded with September 17 planting. However, earliest siliqua formation (157.58 days) was observed in December 1 planted crop.

Key words: Candytuft, Flowering, *Iberis amara,* Planting dates, Seed yield

Candytuft (*Iberis amara* L.), is a genus of flowering plant belonging to family Brassicaceae. It comprises annuals, evergreen perennials and sub shrubs. Candytuft is a cold hardy, fast-growing annual with lance shaped green leaves. Pure white scented inflorescence is in compact cluster shape with numerous small dense flowers. These are grown in flower beds and also as ground covers. Seeds of appropriate characteristics are required to meet the demand of diverse agroclimatic conditions and intensive cropping systems. Flower seed production seems one of the viable options to explore with the great export potential. The climatic conditions prevailing in North India are favourable for cultivation of winter annuals. Farmers have already entered into flower seed production and have reported 2.5 to 3 times more profit than traditionally grown wheat crop in Punjab (Chawla 2004, Singh *et al*. 2009). In Himachal Pradesh, the existing climatic conditions also favour the flower seed production. Effective pollination leading to higher seed set depends on environmental factors, particularly temperature and relative humidity (Gupta *et al*. 1995, Hall 2001) high temperature coupled with the drying effects of low relative humidity affect female floral structures causing reduction in the duration of stigma receptivity, pollen germination on the stigmatic surface, and initial pollen tube growth (Prasad *et al*. 2001).

In winter annuals, the seed yield of good quality is greatly influenced by the planting time (Kumar and Kaur 2000). Planting dates depend upon the environmental factors and the geographical location of the area affecting growth and flowering. There is great variation in plant growth and flowering dates due to natural environmental conditions, therefore planting time cannot be standardised on national scale. Environmental conditions vary from one location to other which brings the necessity to work out the planting time for the particular zone to get the best growth, flowering and seed yield of different annuals. Therefore, keeping in view the importance of plant scheduling, attempts were made to examine an applied possibility of plant scheduling of candytuft by planting it at different dates to find out the optimum date of planting for flower and seed production.

MATERIALS AND METHODS

The experiment was conducted at the experimental farm of the Department of Floriculture and Landscaping of Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during 2010-2011 and 2011-12 (altitude of 1270 m amsl and latitude of 32°51'0" North). Open pollinated seeds of candytuft used for raising plants were procured from the experimental farm of the Department of Floriculture and Landscaping. Nursery raising was done one month before transplanting. Stocky seedlings, with four leaves were planted after basal application of

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farmyard manure 5 kg/m^2 and fertilizers 30 g/m^2 each of nitrogen, phosphorus and potassium. Remaining half dose of nitrogen was applied after 30 days of transplanting. The transplanting of uniform sized seedlings was done at a spacing of 25 cm × 25 cm from plant to plant and row to row accommodating sixteen plants per square meter area. Transplanting was done on six different dates from September 17 to December 1 at an interval of 15 days during 2010 and 2011. Planting dates were six, viz. September 17, October 2, October 17, November 1, November 16 and December 1. The observations recorded on various growth and flowering parameters were subjected to analysis of variance (ANOVA) randomized block design (Gomez and Gomez 1984) keeping planting dates as treatments with four replications. Monthly weather parameters for growing season were taken from the meteorological observatory, Department of Environment Science, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (HP).

RESULTS AND DISCUSSION

Vegetative growth parameter

Planting dates significantly influenced the vegetative growth of candytuft (Fig 1). September 17 planting resulted in tallest plants (34.81 cm) with maximum spread (33.23 cm) and number of side stems per plant (6.25). Growth parameters decreased significantly with delay in planting dates (Table 1). However, number of side stems were found to be at par with October 2 planted crop. More plant height may be attributed to the fact that plant requirement of temperature, i.e. prevalence of warmer temperature regime for growth was fulfilled which resulted in luxuriant vegetative growth of the plants when planted in September. Moreover, this might have resulted in more number of nodes and elongation of nodes. Similar results of more plant height with earlier planting have been reported by Singh *et al.* (2002) in *Brassica carinata* and tallest plants with more number of branches per plant by Kaur and Sidhu (2004) in *Brassica carinata*. These findings are in conformity with the results of Blanchard and Runkle (2008), who reported decrease in plant height of snapdragon and dianthus with decrease in temperature. More plant spread could be attributed to fact that during early plantings more number

Table 1 Growth response of candytuft on different planting dates

Planting dates	Plant height (cm)	Plant spread (cm)	Number of side stems/plant
September, 17	34.81	33.23	6.25
October, 2	32.18	31.69	6.01
October, 17	31.65	29.85	5.73
November, 1	30.01	29.65	5.60
November, 16	28.85	28.34	5.43
December, 1	25.65	22.38	5.09
CD (P=0.05)	1.33	2.30	0.34

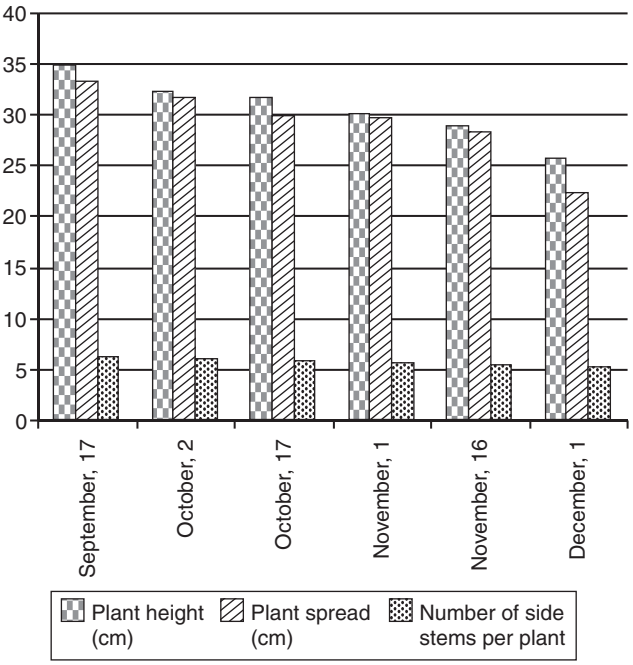

Fig 1 Effect of planting dates on plant height, plant spread and number of side stems per plant of candytuft.

of side stems were produced which resulted in increased lateral growth and ultimately increase in plant spread. More plant spread in earlier plantings has also been reported by Kumar and Kaur (2000) in phlox, Dhatt and Kumar (2007) in coreopsis and Dhatt and Kumar (2010) in larkspur.

Flowering parameters

Minimum number of days taken for visible bud formation (55.43 days) and flowering (77.80 days) observed with September 17 planting which was at par with October 2 planted crop (Fig 2). Longer duration of flowering (41.80 days) was observed in September 17 planted crop with maximum number of flower clusters per stem (15.46) which was at par with October 2 planted crop (Table 2). Earliest visible bud formation and flowering with early planting could be attributed to the fact that plant requirement of temperature for formation of flower buds and flowering was fulfilled early and plants might have attained the juvenile phase required for flower bud formation. Comparatively higher temperature prevailing during earlier planting dates might have resulted in earliest flower bud formation and ultimately flowering. Earlier flowering with early planting have been reported by Kumar and Kaur (2000) in phlox, Dhatt and Kumar (2010) in larkspur and Sharma (2012) in pansy. These findings are in consonance with the results of Adams *et al.* (1998) who observed that rate of progress to first flowering in petunia was hastened under high temperature and sowing later in the season. Longer duration of flowering with early plantings, i.e. September 17 and October 2 may be attributed to climatic conditions prevailing at the time of flowering which resulted in prolonged growth of reproductive parts, i.e. flowers. These results are in conformity with Dhatt and Kumar (2010) in larkspur. More number of flower clusters per stem might be

due to favourable environmental conditions at the time of flowering and luxuriant vegetative growth before flowering which ultimately resulted in increased photosynthesis. More accumulation of photosynthates as a result of increased photosynthesis might have resulted in better plant growth and subsequently longer flowering duration with maximum number of flower clusters per stem. More number of flowers per plant in China aster when planted in August and September as compared to other months of the year has also been reported by Sharma *et al.* (2003). Further, these results are also in line with the findings of Kumar and Kaur (2000) in phlox, Kumar and Kaur (2001) in coreopsis and Sharma (2012) in pansy.

Seed yield

Earlier siliqua formation (157.58 days) was observed in December 1 planted crop which was found to be at par

Table 2 Flowering parameters of candytuft influenced by planting dates

Planting dates	Days taken for visible bud formation	Days taken for flowering	Duration of flowering (days)	Number of flowers clusters / stem
September, 17	55.43	77.80	41.80	15.46
October, 2	56.65	79.53	41.78	14.93
October, 17	71.28	103.08	40.73	13.55
November, 1	76.30	101.63	38.58	12.19
November, 16	73.18	98.90	36.06	10.21
December, 1	69.58	95.10	35.00	9.39
CD (P=0.05)	2.50	3.71	1.23	0.59

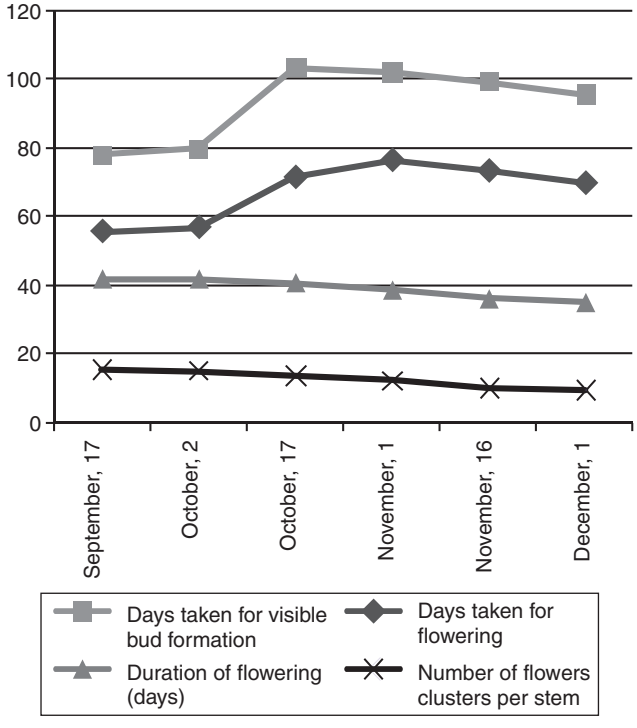

Fig 2 Effect of planting dates on flowering parameters of candytuft.

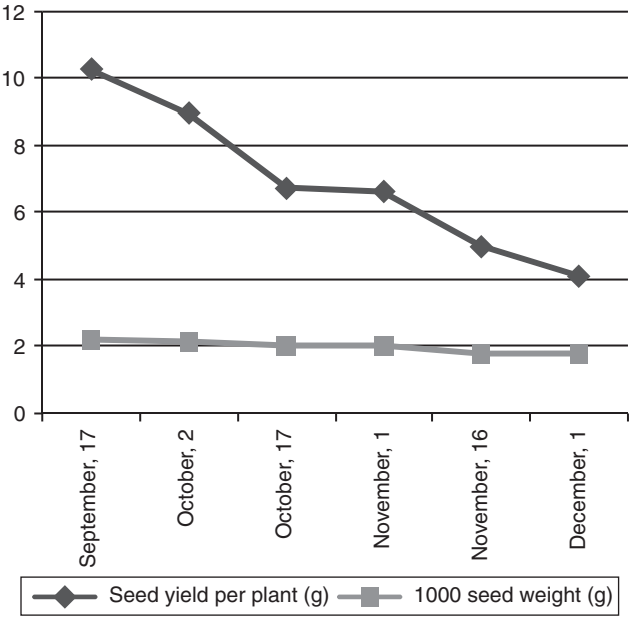

Fig 3 Effect of planting dates on seed yield per plant (g) and 1000 seed weight (g) of candytuft.

with November 16 planted crop (Table 3). However, the quality and quantity of these plantings was not good enough. September 17 planting resulted in maximum number of siliquae per plant (3467.72), seed yield per plant (10.25 g) and 1 000 seed weight (2.18 g) (Fig 3). 1 000 seed weight was found to be at par with October 2 planted crop. Late planting, i.e. December 1 and November 16 favours the early siliqua formation. This could be attributed to warmer temperature and low relative humidity prevailing at the time of siliqua formation which resulted in faster maturation of siliqua which resulted in low-grade quality and quantity of seeds. More number of siliquae/plant obtained in September 17 planted crop may be attributed to more side stems per plant and number of flower clusters per plant on account of early favourable warm temperature. Moreover the high amounts of photosynthates accumulated as a result of increased photosynthesis ultimately resulting in increased siliquae production. The results obtained are in confirmation with the findings of Singh *et al.* (2002) in *Brassica carinata*. Maximum seed yield produced in September 17 planted crop

Table 3 Effect of planting dates on seed characters of candytuft

Planting dates	Days taken for siliqua formation	Number of siliquae / plant	Seed yield / plant (g)	1000 seed weight (g)
September, 17	164.85	3467.72	10.25	2.18
October, 2	164.95	3181.83	8.94	2.14
October, 17	161.83	2488.97	6.69	1.99
November, 1	161.03	1830.61	6.60	1.99
November, 16	158.13	1425.41	4.95	1.80
December, 1	157.58	1177.63	4.07	1.78
CD (P=0.05)	2.45	NS	0.66	0.10

is due to the fact that early planting resulted in more number of siliquae per plant which ultimately produced more seed yield. Bold seeds produced in case of September 17 planted crop might be due to favourable temperature prevailing at the time of flowering and seed maturity, and increased pollination by pollinating agents which resulted in better seed setting ultimately resulting in better seed filling. Moreover the time required for seed formation after flowering was also more which resulted in better development of seeds. More seed yield per plant, siliquae per plant and 1000 seed weight with planting on October 10 has also been reported by Singh *et al.* (2002) in *Brassica carinata*.

In conclusion, our results and those of previous workers clearly indicate that early planting, i.e. September 17 and October 2, resulted in more luxuriant vegetative growth which ultimately resulted in better-quality flowering and seed production than late plantings. Thus, to get maximum quality flower and seed yields in candytuft, mid September to early October is an optimum planting time.

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