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STUDY ON SEED PRODUCTION OF ORNAMENTAL WINTER ANNUALS UNDER AGRO-CLIMATIC CONDITIONS OF PRAYAGRAJ INDIA

Prakriti Singh* and Urfi Fatmi
Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj – 211007, U.P., India
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ABSTRACT

The present investigation "Studies on seed production of ornamental winter annuals under agro-climatic conditions of Prayagraj" was carried out in the Horticultural Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during rabi season of 2024 - 2025. The experiment was laid out in Randomized Block Design (RBD) with seed production of 15 ornamental winter annuals and replicated thrice. The result obtained showed that A_8 (annual chrysanthemum) recorded taller, calendula (A_2) recorded lesser number of days for 50% flowering, candytuft (A_7) recorded more number of flowers per plant and number of fruits per plant, antirrhinum (A_{10}) recorded more number of seeds per fruit, annual chrysanthemum (A_8) recorded more seed yield per plant.
Keywords: Investigation, ornamental winter annuals and seed production.

Introduction

Ornamental winter annuals play a vital role in enhancing landscape aesthetics during the colder months. These plants, including species like antirrhinum, calendula, and petunia, are valued for their vibrant blooms and adaptability to low temperatures. Seed is the primary mode of propagation, and its quality significantly affects plant performance (Kumar *et al.*, 2011 and Kumar *et al.*, 2020). However, challenges in seed availability, quality, and preservation persist, especially under varying agro-climatic conditions. Ornamental flower seed production seems one of the viable options to explore with great export potential and the Indian climatic conditions are favorable for their cultivation (Chawla, 2004). n. Effective pollination leading to higher seed set depends on environmental factors, particularly temperature and relative humidity (Dasgupta *et al.*, 1995 and 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). The value of flower seeds and other propagates exported from India was to the tune of Rs.188 million during 1993-94. Out of this amount, flower seeds alone worth Rs.30 million were exported (Dasgupta *et. al.*, 1995) flower seeds worth RS. 30 million and Rs.60 million are sold annually from Indo-American Hybrid seeds and the state of Punjab respectively (Raghava, 2002)

Materials and Methods

Studies on seed production of ornamental winter annuals under agro-climatic condition of Prayagraj was carried out in Horticultural Research Fam, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj (Uttar Pradesh), during rabi season 2024 - 2025. The experimental site is located at a latitude of 25.41^{o} North and longitude of 81.84^{o} East with an altitude of 98 meters above the mean sea level (MSL). The area of Prayagraj comes under humid sub-tropical climate, which experiences warm humid monsoon, hot dry summer and cold dry winter. The annual mean temperature is 26.1^{o}C while monthly mean temperatures are 18-29^{o}C. The daily average maximum temperature is about 22^{o}C, and the minimum temperature is 9°C. The average annual rainfall received is 1042.2 mm. At this location, the temperature reaches up to 46°C-48°C and the minimum temperature recorded was 4°C-5°C. The relative humidity ranges in this location ranges between 20-94%. Seeds of all the winter annuals were raised in individual plots following standard agronomic practices and intercultural operations. Randomised Block Design with three replications was followed. The seeds were sown in the experimental plots following a spacing of 30 x 30 and 60 x 30 cm (lupin and larkspur). Each plot was of 2m length and 2m breadth and gross cultivated area was 180 m^2.

The cultivation of ornamental winter annuals was conducted systematically, starting with nursery raising. Nursery beds were well-prepared to a fine tilth by incorporating 5–6 kg/m² of well-rotted FYM. Seeds were sown in rows and lightly covered with soil. Beds were regularly watered, and uniform seedling emergence was observed. To prevent soil-borne diseases like damping-off, a fungicide solution (SAAF at 5 g/l) was applied after sowing. For field preparation, the land was ploughed 2–3 times, followed by harrowing and leveling. Weeds, stones, and residues were removed. A basal application of FYM (20 t/ha), phosphorus (100 kg/ha), and potassium (100 kg/ha) was done using urea, single super phosphate, and muriate of potash. Nitrogen (300 kg/ha) was applied in two splits half at transplanting and half 30 days later. Transplanting was done 28 days after sowing when seedlings had 3–4 true leaves. Seedlings were transplanted into moist soil at proper spacing, followed by light irrigation. Irrigation continued daily until establishment, then every 10–15 days as needed.

Gap filling was carried out within 14 days after transplanting using healthy seedlings to replace weak or dead ones. Fertilizer was applied as per the recommended dose. Intercultural operations included weeding, hoeing, and pinching (done 30 days after transplanting to promote branching). A total of five weddings were done during the crop cycle. Harvesting was done based on crop-specific maturity indices. Seed heads or pods were collected early morning or late evening. Shade drying was carried out in a well-ventilated shady area. Finally, winnowing was done to remove chaff and obtain clean seeds. This ensured quality seed production for the ornamental winter annuals.

Table 1 : List of ornamental winter annuals

Notation	Ornamental	Botanical name	Fruit type
A_1	Nasturtium	*Tropaeolum majus*	Pod
A_2	Calendula	*Calendula officinalis*	Achene
A_3	Acroclinium	*Acroclinium roseum*	Achene
A_4	Dahlia	*Dahlia pinnata*	Achene
A_5	Californian Poppy	*Eschscholzia californica*	Capsule
A_6	Larkspur	*Delphinium elatum*	Follicle
A_7	Candytuft	*Iberis amara*	Silicle
A_8	Annual chrysanthemum	*Dendranthema grandiflorum*	Achene
A_9	Cineraria	*Pericallis hybrida*	Achene
A_{10}	Antirrhinum	*Antirrhinum majus*	Capsule
A_{11}	Lupin	*Lupinus angustifolius*	Pod
A_{12}	Hollyhock	*Althea rosea*	Schizocarp
A_{13}	Cosmos	*Cosmos sulphureous*	Achene
A_{14}	Marigold	*Tagetes erecta*	Achene
A_{15}	Salvia	*Salvia officinalis*	Nutlet

Result and Discussion

The data of different parameters of ornamental winter annuals are presented in the Table 2.

(A) Plant height (cm)

Among all the ornamental winter annuals, taller plant height (81.493 cm) was observed in annual chrysanthemum (A_8) followed by dahlia (A_4, 74.55 cm) whereas shorter plant height (18.2 cm) was observed in cineraria (A_9) and recorded 60 days after planting. Variance in number of primary branches among the annuals is driven by variation in the rate of vegetative growth among the crops, which can be related to genetic makeup as they belong to different families and might have also been influenced by existing agro-climatic conditions. Similar results in variation in number of primary branches in different winter annuals were also observed by Kumari *et al.* (2016).

(B) Days taken to 50% flowering

Lesser days taken for 50% flowering (58 days) were observed in calendula (A_2) followed by nasturtium (A_1, 59 days) whereas more days taken for 50% flowering (107 days) were observed in hollyhock (A_{12}). Variation in number of days for 50% flowering in different winter annuals are mostly attributed to the genetic makeup of different annuals as they belong to different families and species. Calendula is fast growing annual with a naturally short vegetative phase, enabling early transition to reproductive stage. The annuals adapting well to the given agro-climatic conditions might have performed better while other annuals struggling to adapt might have performed poorly. This result in conformity with the finding of McDonald *et al.* (2004), Rahmani *et al.* (2009), Sharma *et al.* (2017) and Shrivastava *et al.* (2021) on ornamental winter annuals.

(C) Number of flowers per plant

More number of flowers per plant (715) were observed in candytuft (A_7) followed by annuals chrysanthemum (A_8, 365) whereas lesser number of flowers per plant (19) were observed in dahlia (A_4).

(D) Number of fruits per plant

Greater number of fruits per plant (670) were observed in candytuft (A_7) followed by annual chrysanthemum (A_8, 329) whereas lesser number of fruits per plant (14) were observed in lupin (A_{11}).

(E) Number of seeds per flower

Greater number of seeds obtained per flower (456) were observed in antirrhinum (A_{10}) followed by acroclinium (A_3, 127) whereas lesser number of seeds obtained per flower (1) were observed in candytuft (A_7). Variation in number of seeds per flower among the crops might be attributed to the fact that their genetic character varied as they belonged to different families. Members of asteraceae family, such as annual chrysanthemum and acroclinium produced higher number of seeds due to their special inflorescence 'capitulum' containing many bisexuals and pistillate flowers. Similar findings were reported by Kumari *et al.* (2016).

(F) Seed yield per plant

More seed yield per plant (42.68 g) were observed in annual chrysanthemum (A_8) followed by nasturtium (A_1, 19.76 g) whereas lesser seed yield per plant (1 g) were observed in salvia (A_{15}).

(G) Seed recovery

More seed recovery (97.6 %) was observed in nasturtium (A_1) followed by hollyhock (A_{12}, 95.8 %) whereas lesser seed recovery (22 %) was observed in lupin (A_{11}).

Variation in seed yield is mostly attributed to the genetic makeup of crops as they belong to different classes, orders, families, genus and species. The annuals adapting well to the given agro-climatic conditions might have performed better while other annuals struggling to adapt might have performed poorly. This result in conformity with the finding of Dasgupta *et al.,* (1995), Hall, (2001) and Sharma *et al.* (2015) and Kumari *et al.* (2016).

Table 2 : Different parameters of ornamental winter annuals

Notation	Winter annual	Plant height (60 days)	Days taken for 50% flowering	No. of flowers per plant	No. of fruits per plant	No. of seeds per flower	Seed yield per plant (g)
A_1	Nasturtium	34.9	59	54	46	3	19.76
A_2	Calendula	49.9	58	86	76	27	12.46
A_3	Acroclinium	54.2	84	28	25	127	2.31
A_4	Dahlia	74.5	77	19	15	26	5.61
A_5	Californian poppy	18.6	82	76	67	45	3.61
A_6	Larkspur	55.5	85	124	84	14	2.65
A_7	Candytuft	38.5	61	715	670	1	1.52
A_8	Annual chrysanthemum	81.4	78	365	329	67	42.68
A_9	Cineraria	18.2	-	-	-	-	-
A_{10}	Antirrhinum	73.8	83	169	154	456	12.92
A_{11}	Lupin	59	66	35	14	2	-
A_{12}	Hollyhock	54.5	107	30	25	33	8.76

A_{13}	Cosmos	49.3	70	66	56	22	13.24
A_{14}	Marigold	50.2	68	44	38	66	2.79
A_{15}	Salvia	48.8	69	146	130	4	1.00
	F-Test	S	S	S	**S**	**S**	**S**
	SE(d)±	2.422	1.514	8.340	6.274	1.147	0.013
	$CD_{0.05}$	4.986	3.129	17.238	12.968	2.372	0.028
	CV (%)	5.839	2.494	7.280	6.198	2.185	0.164

(-) died due to unfavourable conditions

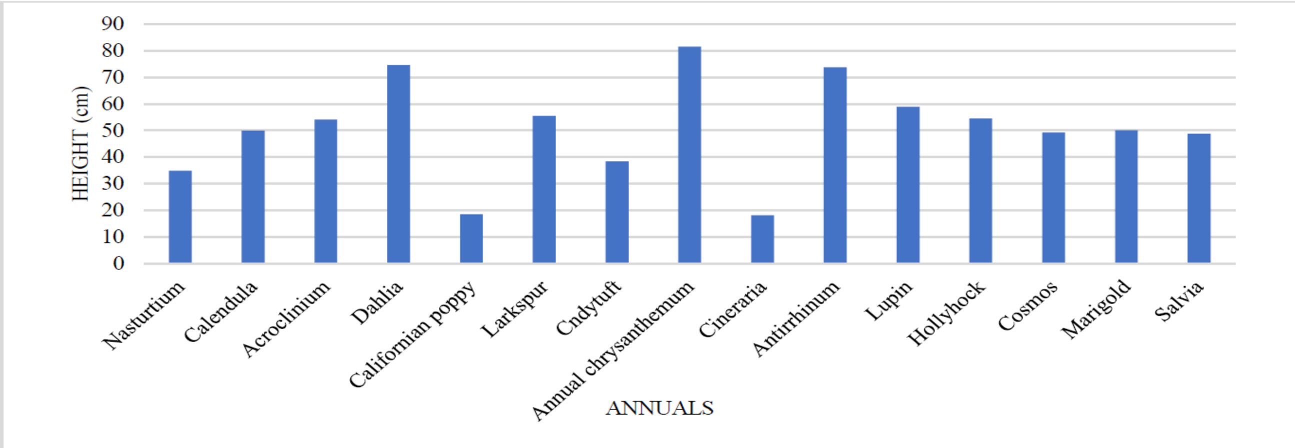

Fig. 3 : Plant height of different winter annuals

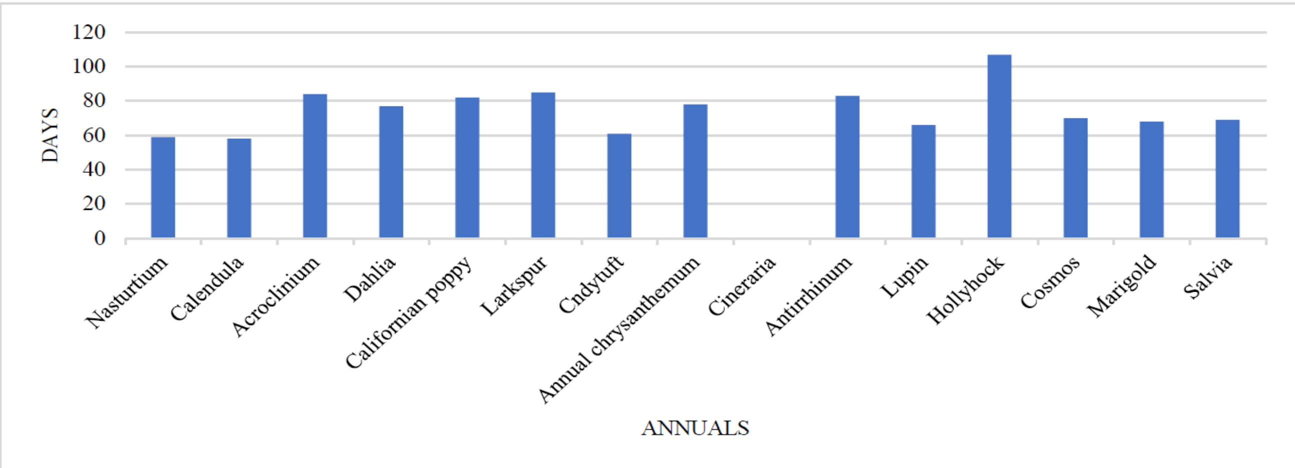

Fig. 2 : Days taken for 50% flowering in different winter annuals

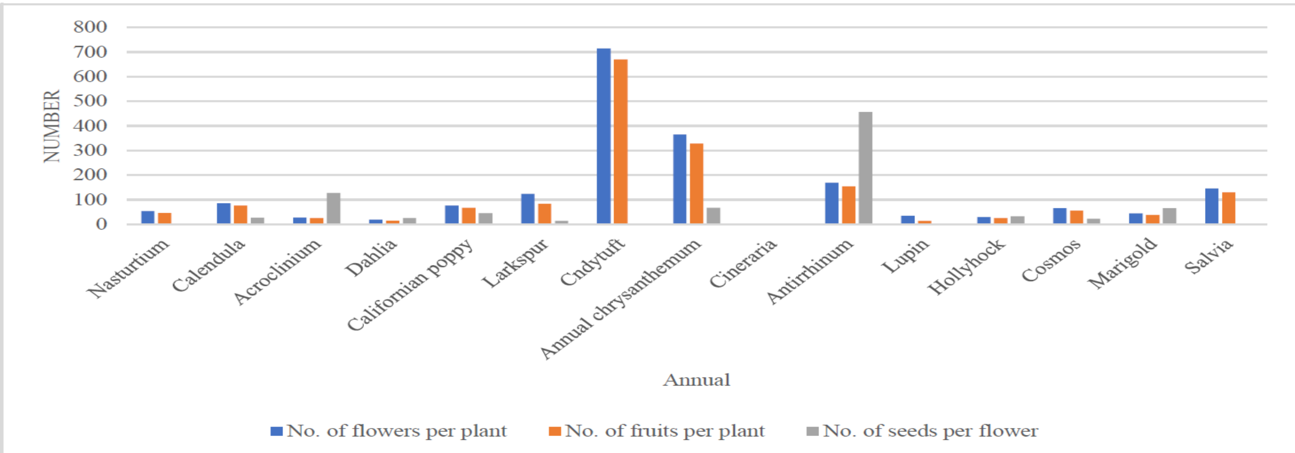

Fig. 1 : Number of flowers per plant, fruits per plant and seeds per flower in different winter annuals

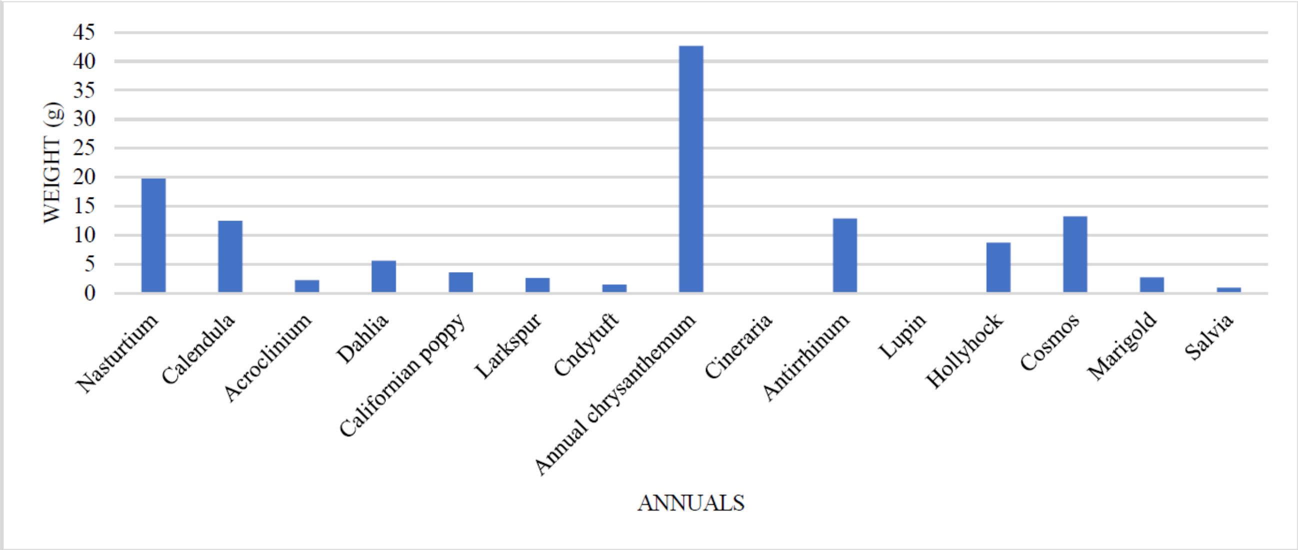

Fig. 4 : Seed yield per plant in different winter annuals

Plate 1 : Harvested seed in different winter annuals

Conclusion

It is concluded from the present study that A_8 (annual chrysanthemum) recorded taller, calendula (A_2) recorded lesser number of days for 50% flowering, candytuft (A_7) recorded more number of flowers per plant and number of fruits per plant, antirrhinum (A_{10}) recorded more number of seeds per fruit, annual chrysanthemum (A_8) recorded more seed yield. Therefore, antirrhinum (A_{10}), annual chrysanthemum (A_8) calendula (A_2) and candytuft (A_7) can be grown under Prayagraj agro-climatic conditions for seed production resulting in higher remuneration and financial upliftment of farmer.

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