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Response of chemical sprays and date of sowing on growth and yield of sunflower

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Abstract
Sunflower has made significant contribution to increase edible oil production in the country as well as world. As this crop is day neutral and thermo insensitive can be grown throughout the year. Area under this crop is gradually decreasing due to inherent problems like improper seed filling, low seed yield per hectare and non-availability of quality seed for seed production. hybrid seed production in sunflower crop to confirm the usefulness of pre-flowering chemical sprays for yield maximization with better seed quality during different seasons and sowing dates as well as storability study by using the insecticides, botanicals and halogens, under the transitional agro-climatic conditions of Maharashtra. Under this back scenario, the present studies were conducted to know the effect of growing seasons, dates of planting in each season and chemical sprays (Boron and TIBA) at ray floret initiation stage on crop growth, seed yield and seed quality of parental line of sunflower hybrid (Phule Raviraj) and the mid storage seed treatments with insecticides, botanicals, halogens and accelerated ageing on storability of the seeds harvested from three different seasons in hybrid sunflower. The two experiments were conducted during 2009-10 to 2010-11 years at the Post Graduate Institute Research Farm, Department of Agricultural Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri (Maharashtra) with split plot design in three replications for field study. The significant increase the number of filled seeds per capitulum, seed weight and seed recovery percentage was also recorded due to the TIBA spray in all the seasons as compared to control. The significant increase the number of filled seeds per capitulum, seed weight and seed recovery percentage was also recorded due to the TIBA spray in all the seasons as compared to control.

Keywords: Growth, regulator, sowing, sunflower, quality and yield

Introduction
Sunflower is one of the most important oilseed crop grown in the world being rich source of oil with high linoleic acid, linolenic acid and oleic acid content, proteins, vitamin and micronutrient (Weiss, 1983) [1] apart from playing a role in correcting the heart diseases. Several varieties and hybrids are available in sunflower for commercial cultivation but its average productivity has remained stagnant in India in recent years due to lack of suitable seed production technology, inefficient harvest and post-harvest operations, improper storage management practices, *etc.* Seed invigoration implies an improvement in seed vigour by any post-harvest treatment resulting in improved germinability, greater storability and better field performance than the corresponding untreated seed (Basu, 1990) [1]. There is a need to produce and preserve high quality seeds of sunflower by growing the crop in the suitable season with optimum sowing date, mother plant nutrition, manipulation of the growth habit of the plants and modifying the microenvironment of the seeds in storage. It can be brought about by applications of micronutrients and the growth retardants at transition of vegetative to reproductive growth phase of the plants and seed conditioning and controlling storage pests and pathogens that tend to deteriorate the seed by using suitable chemical insecticides, botanicals and halogens (Delouche, 1973) [4]. The important consideration in hybrid seed production is to maximize the yield of high quality seed. The seed yield and quality in a crop is determined by synthesis, accumulation, translocation and distribution of photosynthates. Developing seeds are the strong sinks in which the assimilates are accumulated and hence any improvement in seed yield and quality could be achieved by increasing the sink capacity. Several environmental, nutritional, physiological processes influence the seed yield and quality. The possibilities to manipulate source sink relationship for getting the better seed yield. The source-sink relationship must be proper throughout the plant cycle to realize the higher seed yield and seed quality. Deterioration of high quality seed, can render seed worthless for planting although its germination per cent remains relatively high (Christiansen

and Presley, 1967) [2]. Seed deterioration is a progressive process from the time of physiological maturity until the seed is dead (Delouche, 1963) [5]. With this background and keeping foregoing points in view, the present investigation was therefore, planned and carried out to study the influence of physical seed enhancement techniques such as seed treatment with fungicides, plant products and halogenations on storability of sunflower hybrid seed.

Materials and Methods

The present studies were conducted to know the effect of growing seasons, dates of planting in each season and chemical sprays (Boron and TIBA) at ray floret initiation stage on crop growth, seed yield and seed quality of parental line of sunflower hybrid (Phule Raviraj) The research work was carried out for field investigation at Post Graduate Research Farm, Department of Botany and for quality parameters and storage study at Seed Technology Research Unit, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahamednagar during 2010-11. The data collected in respect of various parameters was analysed statistically as described by Sundarraj *et al*., (1972) [9] and Panse and Sukhatme (1978) [6]. The field observation data of experiment was analysed in split-plot design with pooled data analysis. The critical difference (CD) value were calculated at 5 per cent probability level wherever 'F' test was significant. The data in percentage were transformed into arcsine root percentage and transformed data was used for the statistical analysis (Snedecor and Cochran, 1967) [8].

Results and Discussion

The important consideration in hybrid seed production is to maximize the yield of high quality seed. The seed yield and quality in a crop is determined by synthesis, accumulation, translocation and distribution of photosynthates. Developing seeds are the strong sinks in which the assimilates are accumulated and hence any improvement in seed yield and quality could be achieved by increasing the sink capacity. Several environmental, nutritional, physiological processes influence the seed yield and quality. The possibilities to manipulate source sink relationship for getting the better seed yield and quality have been tried by various means *viz*., optimization of planting dates, mother plant nutrition, cultural practices and hormonal regulation which are connected with efficient translocation system in plant. The source-sink relationship must be proper throughout the plant cycle to realize the higher seed yield and seed quality.

Influence of date of sowing

Data on number of filled seeds per head as influenced by seasons, dates of sowing and chemical sprays are presented in Table 1. The significant differences for total number of filled seeds per head. D_1 (1060.58) date of planting showed significantly the higher number of filled seeds per capitulum followed by D_2 (877.31) and D_3 (780.21). Results obtained due to different dates of sowing indicated that D_2 and D_3 were at par with each other. Dates of planting showed the significant differences for the filled seed percentage. D_1 (81.76%) planting showed significantly the higher percentage of filled seed followed by D_2 (78.81%) and D_3 (76.58%) dates of sowing. Dates of planting showed the significant differences for total number of seeds per head. D_1 (1296.56) planting showed significantly higher total number of seeds per head followed by D_2 (1110.25) and D_3 (938.78). The significant differences for 100 seed weight. D_1 (6.19 g) planting showed significantly the higher weight of 100 seeds followed by D_2 (6.04 g) and D_3 (5.89 g). Dates of planting showed the significant differences in seed recovery percentage. D_1 (85.14%) date of planting showed significantly higher seed recovery percentage followed by D_2 (82.91%) and D_3 (80.81%) dates of planting. Seed yield per plant, dates of planting showed the significant difference. D_1 (56.67 g) planting showed significantly the higher seed yield per plant followed by D_2 (45.04 g) and D_3 (35.11 g). Dates of planting showed significant difference for processed seed yield per hectare. D_1 (2238.21 kg) planting harvested significantly the higher processed seed yield per hectare followed by D_2 (1755.68 kg) and D_3 (1371.71 kg) planting dates. The increased processed seed yield in regular planting due to the higher values of yield attributes such as number of filled seeds and seed yield. These results are in accordance with the reports of Vyakarnahal (1998) [10], Vyakarnahal *et al*. (2001) [11] and (Shelake *et al.,* 2024) [7]. Number of filled seeds obtained during early planting as compared to late and extra late planting has helped in accommodation of more number of filled seeds per capitulum which resulted in an increased sink strength might have allowed more translocation of photosynthates.

Influence of Chemical Spray

In spray treatments, the highest number of filled seeds per head was observed in S_3 (973.41) followed by S_2 (960.20) and S_1 (924.50). The S_0 (766.03) showed the lowest number of filled seeds per head in all the sowing dates. The highest filled seed percentage was observed in S_2 (82.67%) followed by S_3 (80.77%) and S_1 (78.87%). The S_0 (73.88%) spray treatment recorded lowest filled seed percentage in all the sowing dates. The highest total number of seeds per head was observed with S_3 (1174.00) followed by S_1 (1142.24) and S_2 (1130.30) spray treatments while the lowest number of seeds per head was observed in S_0 (1014.25) spray treatment. The highest 100 seed weight was observed in S_2 (6.14 g) followed by S_1 (6.08 g) and S_3 (6.03 g). Whereas, S_0 (5.89 g) recorded the lowest 100 seed weight in all the sowing dates. Amongst spray treatments, the highest seed recovery percentage was observed in S_2 (87.93%) followed by S_1 (85.84%) and S_3 (85.24%). The S_0 (72.79%) showed the lowest seed recovery percentage in all the sowing dates. The highest seed yield per plant was observed in S_2 (51.37g) followed by S_3 (48.74 g) and S_1 (47.97 g) spray treatments. Among the spray treatments, S_3 and S_1 were found at par with each other. The lowest seed yield per plant was recorded by S_0 (34.35 g). The highest processed seed yield per hectare was observed by S_2 (2021.45 kg) spray treatment followed by S_3 (1917.28 kg) and S_1 (1883.56 kg). In the plots of control (S_0) the lowest processed seed yield per hectare was obtained in all the sowing dates. The interaction between spray treatments and dates of sowing showed the non-significant differences. TIBA seemed to enhance seed yield components like number of filled seeds per capitulum and seed weight per capitulum which probably due to more number of green leaves at harvest which increasing the leaf senescence period pertaining to increased duration for photosynthesis that provide photosynthate during late seed development and maturation phase and also due to inhibition of basipetal movement of auxins from the capitulum resulting in the proper utilization of auxins for the development of capitulum and sink by achieving proper mobilization of nutrients from source to sink (Vyakarnahal, 1998; Vyakarnahal *et al*., 2001) [10, 11]. TIBA spray at ray floret initiation stage in rabi season with regular

date of sowing for better seed yield and seed quality and seed treatment with halogens and botanicals for better storability appeared to be promising techniques in seed production of hybrid sunflower (Shelake, *et al.*, 2024) [7]. Further it can be seen that increased number of filled seeds per capitulum and 100 seed weight might be due to the cause of TIBA that increased the appreciable movement of metabolites in to the capitulum. As a result of these, seed yield per plant and per hectare was increased.

Table 1: Pooled growth and seed quality, yield attributes and yield as influenced by date of sowing and chemical sprays of sunflower.

Treatment	Number of filled seed head^{-1}	Filled seed percentage (%)	Total number of seeds head^{-1}	100 seed weight (g)	Seed recovery percentage (%)	Seed yield Plant^{-1} (g)	Seed yield ha^{-1} (kg)
A) Dates of sowing							
D_1 (Regular sowing)	1060.58	81.76	1296.56	6.19	85.14	56.67	2238.21
D_2 (Late sowing)	877.31	78.81	1110.25	6.04	82.91	45.04	1755.68
D_3 (Extra late sowing)	780.21	76.58	938.78	5.89	80.81	35.11	1371.71
S.E.+	40.29	0.38	55.88	0.02	0.21	1.92	70.37
C.D. at 5%	158.20	1.47	219.40	0.07	0.83	7.52	276.32
B) Chemical sprays							
S_0 (Water spray)	766.03	73.88	1014.25	5.89	72.79	34.35	1331.84
S_1 (TIBA 25 ppm)	924.50	78.87	1142.24	6.08	85.84	47.97	1883.56
S_2 (TIBA 50 ppm)	960.20	82.67	1130.30	6.14	87.93	51.37	2021.45
S_3 (Boron 0.1%)	973.41	80.77	1174.00	6.03	85.24	48.74	1917.28
S.E.+	8.99	0.28	10.03	0.03	0.39	0.73	30.56
C.D. at 5%	26.71	0.84	29.81	0.09	1.15	2.18	90.80
C) Interaction							
S.E.+	42.19	0.57	17.38	0.05	0.67	2.21	52.93
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS
General mean	906.03	79.05	1115.20	6.04	82.95	45.61	1788.53

Conclusion

Early planting showed significant increase in number of filled seeds per head, filled seed percentage, total number of seeds per head, 100 seed weight as well as seed yield per hectare compared to late and extra late planting dates. Thus, TIBA spray gave better result than the other treatment in seed production of hybrid sunflower

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