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Study on Effect of Gamma Rays in M1 Generations of Sunflower (Helianthus Annuus L.)

Botany

KEYWORDS : Gamma ray, Induced variability, Sunflower

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ABSTRACT

The experiment was carried out to induce variability in the sunflower inbreds by physical mutagen, i.e., Gamma rays. Progressive decreases in germination and survival with increase in of Gamma ray doses were recorded in M1 generation. The different mutagenic treatments showed an inconsistent relationship with respect to mean and variability. However, considerable increase in variability in days to 50 % flowering, plant height, head diameter, days to maturity, seed yield per plant and oil content was observed.

Introduction:

Sunflower (*Helianthus annuus* L.) is an important oil seed crop after groundnut and rape seed mustard with wide adaptation due to its wide tolerance to temperature and moisture variations. Although it is an introduced crop to India, in recent years it has become an important oil seed crop of India and cultivated on an area of 2.06 m.ha with production of 1.13 m.tons. The present study was undertaken in order to create variability for the improvement of sunflower through mutation breeding. The mean, variability, coefficient of variability, heritability and genetic advance were studied.

Materials and methods:

The base material for the present study comprised of both the parental (B and R) lines of popular sunflower hybrid RSFH-130 hybrids (CMS-104B and R630), and maintainer lines of RFSH-1hybrid (CMS-103B) and KBSH-44 hybrid (CMS-17B). Selfed seeds of the above mentioned lines were obtained from sunflower scheme, Main Agricultural Research Station, Raichur. Bold and viable dry seeds of uniform size, weighing 100gm each with 12 per cent moisture content were irradiated with 10, 15 and 20 kR doses of gamma rays from ^{60}CO source at the gamma chamber of Bhabha Atomic Research Centre, Trombay, Mumbai for the required duration. A total of 100 seeds were sown in each treatment. All plants in the first generation, in each treatment, were observed for the following parameters: germination on the 30th day, survival on the 45th day, pollen fertility, days to 50 % flowering, plant height, head diameter, days to maturity, seed yield per plant and oil content. Seeds obtained from M_1 plants by selfing in each treatment were advanced to raise the M_2 generation as progeny rows. Each plant was raised in one row with the spacing of 60 × 30 cm during Rabi/summer, season 2010-2011. The above biometric characters were recorded and individual plant data were used for statistical analysis. Data for each character in all treatments were analyzed separately by an appropriate analysis.

Results and discussion:

In the present study, biological effects of the mutagenic treatments were determined from observations made on germination and survival percentages in the M_1 generation. Progressive decrease in germination with increase in gamma ray dose was observed in all genotypes (Table 1). The reduction was more pronounced at higher doses of gamma rays. Increasing doses of mutagen causing a progressive increase in biological damage measured in terms of reduction in germination and plant survival in the M_1 generation have been reported in some leguminous crops also (Sjodin, 1962; Gregory, 1968; Nerkar, 1976). Similar dose-dependent relationship in reducing germination has been observed in the irradiated material of sunflower (Vranceanu and Iuoras, 1990; Jambhulkar and Joshua, 1999, Jagadeesan *et al.,* 2008) with regard to morphological traits. Reduction in the fertility of pollen grains from irradiated population is one of the parameters to assess the radiosensitivity and mutagenic effectiveness and efficiency. Reduction was observed in fertility of the pollen grains from irradiated population, as has been reported earlier in many studies (Johanson, 1936 in sunflower). There was no linear relationship between the dose administered and reduction in fertility. Similar irregularity in the linear trend was observed by Anderson *et al.* (1949) and Beard *et al.* (1957).

The characters plant height, days to 50% flowering, head diameter, days to maturity and seed yield/plant showed a negative shift from the control to all the doses in all the four genotypes except 10 and 15kR doses in days to maturity of R630 genotype in M_1 generation and such an inhibitory effects were more pronounced in higher doses. Such an inhibitory effects in quantitative characters have been reported in sunflower (Deshapande, 1997), groundnut (Dorairaj, 1979). Hence the population treated with mutagen at higher dose of 20kR dose in all the genotypes can be subjected for selection to obtain desired plant types, high seed yield and oil content progenies. The selected mutants with increased mean values, high heritability and genetic advance for various traits studied in all the genotypes studied may be used for crop improvement programmes.

Genotypes	Dose (kR)	Percent germination		Percent survival		Percent pollen fertility		Days to 50% flowering	Plant height	Head diametre	Days to maturity	Seed yield / plant
		Actual	% over control	Actual	% over control	Actual	% over control					
CMS-104B	0	90.00	100.00	98.89	100.00	98.00	100.00	65	125.1	15.45	103.77	18.12
	10	72.42	80.41	80.73	81.63	90.32	92.16	60	92.2	12.40	100.72	13.74
	15	56.15	62.34	79.20	80.09	91.75	93.62	62	85.4	11.88	95.19	13.58
	20	32.32	35.90	47.26	47.79	90.39	92.23	62	78.7	11.45	94.49	14.12
CMS-103B	0	87.00	100.00	100.00	100.00	99.20	100.00	55	95.8	14.47	92.44	17.80
	10	45.90	52.81	70.09	70.09	85.44	86.12	50	72.0	11.31	91.54	12.74
	15	42.73	49.06	70.18	70.18	88.23	88.94	52	68.6	11.47	90.26	10.49
	20	26.85	30.85	34.65	34.65	87.17	87.87	53	54.8	10.75	90.02	8.36
CMS-17B	0	89.00	100.00	98.88	100.00	94.50	100.00	56	88.3	14.42	103.25	17.04
	10	8.62	9.68	89.29	90.30	83.46	88.31	52	68.0	11.18	98.27	10.92
	15	2.41	2.66	87.50	88.49	84.94	89.88	54	71.1	10.66	94.00	9.83
	20	1.55	1.67	60.00	60.68	85.58	90.56	55	49.0	8.13	92.33	9.01
R630	0	88.00	100.00	97.73	100.00	98.35	100.00	54	85.3	9.01	95.39	12.75
	10	47.00	53.42	81.51	83.40	81.72	83.09	49	65.0	8.31	97.54	9.80
	15	47.50	54.03	85.33	87.31	83.91	85.31	50	55.2	7.13	96.10	8.60
	20	41.61	47.24	84.48	86.44	79.12	80.44	52	68.8	7.02	94.08	9.14

Table 1. effect of gamma rays on germination, survival, pollen fertility and Mean values of various characters in M_1 generation.

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