Malathion in 0·05%, 0·1% and 0·15% concentrations was sprayed on paddy @ 1000 litres/hectare to study its residual effect. It revealed that the reduction in the toxicity of malathion was 68–87% even on 2nd day of spraying. It reached below 8 ppm within 3 days in all the concentrations. Hence it is not worthwhile to spray malathion on paddy plants.

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EMS INDUCED MUTATION IN *AMARANTHUS TRICOLOR* L.

Most of the species of *Amaranthus* L. are cultivated as pot herbs or for their grains. Some of these are polymorphic in nature and certain horticultural varieties have been developed which are of ornamental value. *Amaranthus tricolor* L. is a highly polymorphic one with number of varieties recognised under it. The most variable character in this group of plants is the development of anthocyanin. The pigment develops in various parts of the plants such as stems, petioles, leaves and inflorescences. In the leaves it may develop on the margin or as patches on the lamina giving ornamentations. In some varieties the whole plant is red. As no chromosomal variation was noticed in these forms it was suggested[1] that the development of anthocyanin is under genic control though seasonal variations also affect the development of the pigment within a variety or a species. In a recent attempt to test the mutability in different species of *Amaranthus* L., a fully red coloured variety of *A. tricolor* L. was selected at the first instance.

The seeds were treated with 0·1%, 0·2% and 0·4% of EMS (Ethyl Methane Sulphonate) by soaking for 4 hours in each with a presoaking of 2 hours in distilled water. Then the seeds were thoroughly washed with water and were grown in earthenware pots as well as in petri dishes. A control set was maintained in soaking the seeds in distilled water for 6 hours. Initially the percentage of germination in each concentration was determined and it was found to be 61·0% in 0·1%, 16·0% in 0·2% and 2·2% in 0·4% of EMS as a contrast to 81·1% in control. Thus 0·2% and 0·4% EMS were highly lethal for these seeds. Of the total of 421 seedlings, 5 plants were mutants in M_1 generation which could be distinguished by the complete suppression of anthocyanin development. These seedlings were appearing fully green as a contrast to the complete red colour in normal seedlings. Of these two were from the group treated with 0·1%, 2 from those treated with 0·2% and 1 from those treated with 0·4% EMS but the last one did not survive. However, there were as many as 138 seedlings which showed partial greenness which soon turned red probably due to the recovery of the anthocyanin development. But the complete green seedlings remained green for a pretty long time and though later they developed anthocyanin they could not compete with the normal ones as noticed visually and through spectrophotometric analysis[1]. The anthocyanin was extracted with cold 0·1 N HCl for 24 hours. The amount of anthocyanin present in the leaves was estimated by measuring the absorption of the extract at 510 nm (Table I). Thus like chlorophyll mutations[3-6], anthocyanin development seems to be affected by mutagenic treatment. The four mutants were also marked out from rest of the plants as well as from the control in various other morphological characters (Table II).

Table I

Relative anthocyanin content of the leaves of normal and mutant plants

Sl. No.	Type	Amount of anthocyanin*	% of control	% decrease
1.	Normal	0·29 (range 0·32 0·26)	100	..
2.	Mutant-1	0·16	55	45
3.	Mutant 2	0·14	48	52
4.	Mutant-3	0·10	34	66

* O.D. at 510 nm per 10 mg fresh weight of leaf.

The cytological analysis of the mutants made through the study of the pollen mother cells also revealed the formation of multivalents in all the mutant plants. While quadrivalents were frequently

TABLE II

Comparative morphological data of the mutant and normal plants

Characters		Mutant	Normal
Branching	..	Number of equally developed branches from the base	One main shoot with lateral branches less developed
Leaf lamina (length/breadth)	..	small (3·2/2·2 cm)	Large (7·3/4·5 cm)
Flowering (days from soaking)	..	Early (45 days)	Late (70 days)
Seed sterility	..	High (69·79 %)	Low (40·19%)

noticed in the EMS induced mutant of *Amaranthus dubius* Mart. ex Thell.[2] higher multivalent associations involving 2–7 bivalents have been met with in different cells in these mutants. Such types of meiotic irregularities, however, have been reported[5] to be rare in EMS treatments and more predominant in MES and myleran treatments. The meiotic irregularities might be responsible for the high seed sterility observed in the mutants.

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RADIATION INDUCED VARIABILITY IN QUANTITATIVE TRAITS OF JOWAR (*SORGHUM VULGARE*, · SNOW.)

MUTAGEN treatment generally induces and increases genetic variability in population. Oka[1] observed significant changes in the means and variability of quantitative traits due to irradiation in rice. Radiation induced variability of several polygenic traits in wheat has also been observed[2]. The increased genetic variability due to induced mutation may permit selection for desirable traits[3]. With most of the sorghum hybrdis having reached grain yield stagnation and others being susceptible to diseases like mildew, leaf blight, leaf spot, and rusts, it is imperative to induce variability in polygenic traits in desirable direction through mutation breeding so as to break the ceiling of yield and improve ideotype in this crop. The present note reports the response of gamma-irradiation in shifting the mean values of several quantitative traits in M_1 generation.

Dry seeds of seven inbreds (CS 3541, 2219 B, IS 3691 B, IS 84, R-16-3,2077 B and Swarna) and five recently released hybrids (CSH-1, CSH-2, CSH-3, CSH-4 and CSH-5) were treated with gamma-irradiation from C_{60} source at IARI, New Delhi, with 10 Kr, 20 Kr, and 35 Kr doses. The treated seeds were sown in the field within twenty-four hours of treatment. The observations were made on twenty-five randomly selected plants for each treatment. The height of the plant is reduced due to gamma-irradiation in all the varieties as compared to control, the pronounced reduction in height appeared at 20 Kr and 35 Kr doses. The number of effective tillers per plant was also decreased, the 35 Kr dose reduced the tiller number markedly (30%). There was not much effect of irradiation on the leaf number per plant. The peduncle length in M_1 generation exhibited a decreasing trend in all the varieties excepting Inbred 2219 B and hybrid CSH-2, where no change in peduncle length was noticed. The variety IS 3691 B seemed more sensitive to 20 Kr and 35 Kr doses in comparison to other varieties where flag leaf was just attached to the panicle. All the three doses of gamma irradiation appeared to induce late blooming. The pollen viability and seed fertility data are presented in Table I and these factors decreased significantly in M_1 plants in all the varieties. The 35 Kr dose, however, showed marked effect in hybrid and inbred backgrounds.