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Influence of gamma rays induced mutagenesis on the frequency of viable mutants in turmeric

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ABSTRACT

Investigations were carried out during the year 2000-2003 in the Department of Spices and Plantation Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore to assess the impact of gamma rays on the frequency of viable mutants. The experiment was laid out in Factorial Randomized Block Design with two replications. Three genotypes namely Salem local - G_1 (CL144), Alleppy finger turmeric - G_2 (CL146) and PTS 43 - G_3 (CL147) were treated with seven doses of gamma rays(1.0,1.5,2.0,2.5,3.0,3.5 and 4.0 kR) along with a control. The viable mutation frequency was higher (2.40 per cent) at 2.0 kR in G_1 (CL144). Six types of viable mutants *viz.*, plant stature (tall and dwarf), number of tillers (more and less), maturity (early and late), yield (high and low), curcumin content (high and low) and oleoresin content (high and low) were obtained.

Key words : Gamma rays, Mutagenesis, Viable mutants, Turmeric.

Turmeric being an asexually propagated crop with no seed production under Tamil Nadu conditions, the plant horticulture breeder has to rely upon clonal selection which is the major mode for its crop improvement. The first step in the improvement of this clonally propagated crop is to exploit the variability existing among the land races, create more variability through mutation and somaclonal variation. Being a polyploid (amphidiploid), the use of mutagens for inducing variability assumes greater significance. The success of mutation breeding largely depends on understanding of the process of induction and recovery of mutants and of the screening methods for evaluating the desired mutants. In turmeric, systematic attempts on induction of mutations are scanty and the methodologies for induction and recovery of the mutants are yet to be standardized. An attempt was therefore made to induce variability by irradiation with gamma rays with the following objectives.

1. To identify high yielding superior performing mutants.
2. To isolate short duration mutants.
3. To screen mutants with high curcumin and oleoresin contents.

MATERIALS AND METHODS

The present investigation was carried out during May 2001 (vM_0 generation) and May 2002 (vM_1 generation) in the Department of Spices and Plantation Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. Three genotypes namely, Salem local (CL 144) which is a promising cultivar under Salem conditions with fresh rhizome yield and dry recovery, Alleppy finger turmeric (CL 146) with higher curcumin content and high dry recovery and PTS 43 (CL147) with higher curcumin content, high fresh rhizome yield and dry recovery were chosen for the experimental purpose. Physical mutagen (gamma ray) was employed in the present investigation. Gamma ray source was cobalt - 60 in 1000 Ci, emitting 5000 rads per minute at the time of irradiation. Based on the earlier studies conducted at the Department of Spices and Plantation crops using, Salem local (CL 144), Alleppy finger turmeric (CL 146) and PTS 43 (CL 147) to identify the optimum dosage of treatment, 2.5 kR was fixed as the LD_{50} value (the dosage which resulted in a 50 per cent survival rate). Dosages higher (3.0, 3.5 and 4.0 kR) and lower (1.0, 1.5 and 2.0 kR) were chosen for the irradiation purpose. Uniform sized finger rhizomes (approximately 10g) were selected and cut into pieces having 3 nodes per cutting. These rhizome bits subjected to gamma irradiation were used as planting material for the present investigation. The viable mutants in vM_1 plants were periodically observed from sprouting to crop maturity and viable mutations were scored as deviation from normal plants, labelled and harvested separately. The viable macromutations isolated in vM_1 were classified as tall mutants, dwarf mutants, tiller mutants and early maturing mutants. The economic mutants were scored as deviation from normal plants, labelled and harvested separately. The economic mutants isolated in vM_1 were classified as high yield mutants, mutants with high curcumin content and mutants with high oleoresin content.