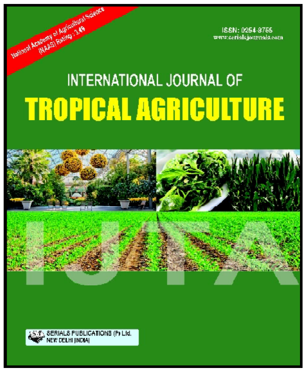

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Induction of mutations by gamma irradiation and ethyl methane sulphonate for yield attributing traits in groundnut (*Arachis hypogaea* L.)

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Abstract: An experiment was conducted during 2013-14 to induce polygenic variability for yield and its components in groundnut (*Arachis hypogaea* L.). The studies were carried out to induce mutations, in groundnut seeds by exposing the healthy and dry seeds to gamma rays *viz.*, 20, 30 and 40 Kr doses and ethyl methane sulphonate (EMS) *viz.*, 40 mM and 60 mM. In both treatments, superior mutants were isolated from gamma rays 20 kR and 40 mM treatment, indicating effectiveness of the mutagen in obtaining the desired traits. The nine mutants from M2 generation comprising three each for earliness and high pod yield, two for plant height and one for late maturity over the different checks. Magnitude of induced variation was found to be depending upon the mutagen used, characters under study and the genotypic background of the genotype. These promising mutant lines would need to be further tested for their better adaptability and stability. Also these can be further utilized in recombination breeding with other mutants and/or cultivars to derive the best distinct lines with improved quality and agronomic traits.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is grown in majority of countries of the world and plays an important role in world's economy. It is also known by several vernaculars as peanut, monkey-nut or goober nut etc. (Reddy, 1988). It is the single largest source of edible oils and constitutes roughly about 50 per cent of the total oil seeds production. Artificially induced mutation is one of the methods to enhance genetic variability within the very short period of time. Earlier experiments in this field have indicated that ionizing radiation could cause permanent genetical effects, lethal or beneficial mutations, morphological modifications and others effects in plants. The genetic variability is highly desirable for developing new cultivars, which is induced by mutagen treatments and natural spontaneous changes. The spontaneous mutation rate is pretty low and can't be exploited for breeding; therefore, artificial mutations are induced with physical and chemical mutagen treatments. Quite many useful genetic changes have been induced by mutagen treatments including high yield, flower color, disease resistance, early maturation etc. in different crop plants, vegetables, medicinal herbs, fruit plants and ornamental plants.

MATERIALS AND METHODS

Material

Groundnut genotype CTMG-6-1 was used for mutagenic treatments.

Mutagen treatments

Seeds of groundnut genotype CTMG-6-14 were treated with γ-radiation and ethyl methane sulphonate (EMS). Uniform size seeds of each cultivar were used for treatment. Treatments (200 seeds per treatment) consisted of three different doses of γ-radiation (200,300 and 400 Kr) and EMS (40 and 60 mM). Untreated seed stock of the respective genotype was used as control. Seeds were irradiated with γ-radiation at Bhabha Atomic Research Center (BARC) Mumbai, India. EMS solution was prepared in 0.1 M phosphate buffer (pH = 7.0). Seeds were presoaked in distilled water for eight hours to allow uptake of EMS. Presoaked seeds were then treated with EMS for two hours at room temperature in cloth bags. Treated seeds were then rinsed in running tap water for four hours and sown in the field plots along with untreated control seeds. The seeds were sown in a randomized complete block design (RCBD) in four replications with spacing of 30 cm between the rows and between plants. The recommended packages of practices for the crop were followed during the whole crop period. The M_1 plants were harvested on a single plant basis. In M_2, 9 mutant lines/progenies, yielding more than respective controls *viz.,* CTMG-6-1 for high yield per plant, earliness and plant height were selected and further evaluated to access the performance over different generations.

Oil content (%)

The seed sample from the thirty randomly selected plants from each treatment was subjected for estimation of oil content by nuclear magnetic resonance (NMR) method at Instrumentation cell, Bidhan Chandra Krishi Vishwavidyalaya, West Bengal, India and presented as per cent oil content.

RESULTS AND DISCUSSION

In the present investigation, different types of mutants desirable for traits of interests viz., earliness, height, yield etc., were identified and isolated from M_2 population on the basis of field evaluation and were given in Table 1. The selected nine mutants were evaluated to assess their performance and identify high-yielding mutants on important yield attributing characters, plant height (cm), number of branches, number of pods, pod yield (g), kernel yield (g), pod yield/plot, shelling percent and sound mature kernel percentage. Early maturing mutants were found among the population obtained by treatment of 60 mM Ethyl Methane Sulphonate. These selected mutants matured 10-12 days earlier than the control. Three mutants were selected and isolated and designated as EM_1, EM_2 and EM_3. On the basis of plant height, two tall mutants were identified and isolated from population grown after

Table 1
Showing useful mutants induced in groundnut genotype CTMG-6-1 and their salient features

Identifiedfor	*Treatment*		*Mutant Code*	*Plant height (cm)*	*Number of branches per plant*	*Days to fifty per cent flowering*	*Day to maturity*	*Matured pods per plant*	*Seed yield per plant (g)*	*Oil content (%)*
Early maturing mutants	EMS	(60 mM)	(EM1)	44.9	7	28	112	17	13.10	49.67
	EMS	(60 mM)	(EM2)	42.1	6	27	111	23	16.47	49.73
	EMS	(60 mM)	(EM3)	32.1	8	27	111	29	20.33	49.89
Plant height mutants	EMS	(60 mM)	(PH1)	51.7	6	33	123	24	13.02	49.77
	EMS	(60 mM)	(PH2)	46.9	7	34	123	30	16.82	49.66
Late maturing mutants	EMS	(40 mM)	(LM)	34.3	8	33	127	27	14.97	49.33
High yielding mutants	EMS	(40 mM)	(HY1)	30.4	7	33	123	39	23.78	49.47
	EMS	(40 mM)	(HY2)	33.4	8	34	123	38	23.17	49.27
	EMS	(40 mM)	(HY3)	32.4	11	33	123	42	30.21	49.21
CTMG-6-1			Control	28.1	7	34	123	24	14.67	48.84

treatment of 60 mM Ethyl Methane Sulphonate treatment having increased plant height than the control where designated as PH1 and PH2. The PH1 and PH2 showed increased 23.6 cm and 18.6 cm over average the control height. In M2 population of 40 mM Ethyl Methane Sulphonate treated seed one mutant shown late maturity. These mutants matured 4-5 days later than the control. Late maturing mutant designated as (LM). Yield is a prime trait in any crop improvement programme. The plants having maximum pods per plant than the control were identified and isolated from M2 population of 40 mM Ethyl Methane Sulphonate treatment as shown in Plate 7 to 9. These mutants were designated as HY1, HY2 and HY3. The matured pods were directly associated with the seed yield. The maximum number of matured pods per plant of was observed 42, 39 and 38 in HY3, HY1 and HY2 respectively. Whereas, the subsequent maximum seed yield per plant of 30.21g, 23.78g and 23.27g in HY3, HY1 and HY2 respectively.

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