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Induced mutation for higher yield in groundnut (*Arachis hypogaea*)

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ABSTRACT

An experiment was conducted during 1987–91 to induce polygenic variability for yield and its components in groundnut (*Arachis hypogaea* L.). The seeds of 'JL 24' and 'KRG 1' groundnut were treated with 30 and 40 kR doses of gamma-rays. The irradiated populations showed significantly higher variability in the M_3 generation. Selection was effected for higher pod yield in M_3 and subsequent generations. A few mutant lines showing higher yield than the best control 'JL 24' were isolated in the M_3 and subsequent generations. Two mutant lines, 'GML 6' and 'GML 86', gave significantly more pod yield (2 385 and 2 382 kg/ha respectively) than the national control 'JL 24' in M_6.

Despite a wide geographic distribution and long history of groundnut (*Arachis hypogaea* L.) cultivation, the extent of desirable variability is limited in the varietal forms of its species (Gregory *et al*. 1973). Although the conventional techniques have greatly helped develop desirable types, induced mutagenesis might prove a potential tool to diversify the genetic variability, which could be valuable for selection of desirable types. Therefore an attempt was made to induce polygenic variability in groundnut and to isolate mutant genotypes with improved yields.

MATERIALS AND METHODS

Two improved varieties of spanish-bunch groundnut (*Arachis hypogaea* L. subsp *fastigiata* Waldron var *vulgaris* Hartz), 'JL 24' (high yielding, national control) and 'KRG 1' (locally adapted variety), were selected. Two hundred seeds of each variety were treated with 30 and 40 kR doses of gamma-rays. In all the 4 treatments the plants were grown for M_1 generation during winter (*rabi*)–summer season of 1987–88 and the seeds from the surviving M_1 plants were used for M_2 generation during the rainy season 1988. No selection was effected in M_2. Four M_3 populations and the untreated controls were grown in randomized complete-block design with 2 replications during winter–summer season 1988–89. Each population was grown in a plot of 5.0 m x 2.1 m with a spacing of 30 cm x 10 cm. From each treatment 100 plants were selected for recording observations on important yield-attributing characters, viz plant height (cm), number of branches, number of pods, pod yield (g), kernel yield (g) and shelling (%). The means and variances were computed for these characters. Induced mutations in quantitative characters were detected through comparison of means and variances in M_3. A total of 34 promising plants showing

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higher yield than 'JL 24' were selected and advanced to next generations. In M_4 (rainy season 1989) and M_5 (rainy season 1990) generations the selected progenies were advanced on the basis of superiority of their yield performance over the best control 'JL 24'.

Six mutant families were advanced to M_6. The selected mutant families along with the controls, 'JL 24', 'KRG 1' and 'TMV 2' were evaluated under irrigated conditions in randomized complete-block design with 3 replications during rainy season 1991. Each entry was grown in a plot of 5.0 m x 2.1 m. Pod yield/plot was recorded for all the entries and data were statistically analysed (Panse and Sukhatme 1985) to test superiority of selected mutants.

RESULTS AND DISCUSSION

The treated populations showed significantly higher variance than parents, indicating the induced variability for these characters (Table 1). Gamma-rays induced more variability for important economic characters in 'JL 24' at 30 kR, whereas in 'KRG 1' a dose of 40 kR was found appropriate, indicating different response of genotypes to gamma-rays. Ramanathan (1983) reported such increased variability for economic characters in M_3 in groundnut.

Screening of plants in M_3 resulted in the identification of 34 mutant plants from all the treatments, showing higher or equal yield compared with the best control ('JL 24'). However, the true breeding nature of the groundnut mutants could be established only in M_5. The result confirms the finding of Chandra Mouli *et al.* (1987). A total of 8 progenies in M_4 and 6 in M_5 generations showed higher yield than 'JL 24' (Table 2). In M_6 the mutant 'GML 6' (2 385 kg/ha) recorded the highest pod yield, followed by 'GML 86' (2 283 kg/ha) and 'GML 98' (2 340 kg/ha). Among the 6 mutants identified, 3

Table 1 Effect of mutagenic treatments on yield and its components in M_3 generation in groundnut

Variety	Treatment	Plant height		Branches/plant		Pods/plant		Pod yield/ plant (g)		Kernel yield (g/plant)		Shelling (%)	
		Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance
'JL 24'	0 kR	28.0	12.1	4.6	1.5	23.5	69.3	17.7	78.2	11.2	34.1	63.3	104.3
'JL 24'	30 kR	26.4	16.6*	4.7	2.0*	24.7	105.0*	18.8	108.6*	10.8	57.0*	57.5	161.0*
'JL 24'	40 kR	26.1	14.9	4.8	1.9*	25.1	89.5	17.9	88.5	10.6	58.0*	59.0	160.5*
'KRG 1'	0 kR	27.7	30.5	3.8	0.6	22.6	65.6	14.6	34.7	9.2	23.1	63.5	93.5
'KRG 1'	30 kR	27.0	41.0*	3.7	0.9*	21.2	98.5*	14.0	50.9*	9.6	31.7*	68.2	143.4*
'KRG 1'	40 kR	25.4	45.5*	3.7	1.0*	21.5	116.3*	11.7	56.0*	7.8	35.9*	66.8	158.7*

$^{*}P = 0.05$

Table 2 Pod yield of promising mutants in M_4 (1989; kg/5 m row), M_5 (1990; kg/ha) and M_6 (1991; kg/ha) generations of groundnut

Variety	Treatment	Progeny*	Pod yield M_4	Pod yield M_5	Pod yield M_6
Parent					
'JL 24'	30 kR	'GML 51'	0.505	2 589	2 079
'JL 24'	30 kR	'GML 6'	0.530	2 673	2 385
'JL 24'	30 kR	'GML 60'	0.560	2 549	2 108
'JL 24'	30 kR	'GML 98'	0.630	2 607	2 340
'JL 24'	30 kR	'GML 86'	0.510	2 582	2 382
'JL 24'	30 kR	'GML 79'	0.490	2 533	2 162
'JL 24'	30 kR	'GML 66'	0.470	2 329	
'JL 24'	30 kR	'GML 84'	0.510	2 311	
'JL 24'	30 kR	'GML 58'	0.490	2 273	
'JL 24'	30 kR	'GML 99'	0.600	2 149	
'JL 24'	30 kR	'GML 63'	0.510	2 089	
Control					
'JL 24'			0.490	2 407	2 191
'KRG 1'			0.465	2 000	2 134
'TMV 2'			0.450	1 911	1 937
CD (P = 0.05)				111	186

*All the GML progenies were isolated from 'JL 24' irradiated with 30 kR gamma-rays, except 'GML 79' which was induced by 40 kR gamma-rays

showed significantly superior pod yield to local control varieties 'KRG 1' (2 134 kg/ha) and 'TMV 2' (1 937 kg/ha). However, only 2 mutants recorded significantly higher pod yield than the national control (2 191 kg/ha). There was no difference between these mutants and 'JL 24' for number of days to maturity. Prasad *et al.* (1984), Ramanathan (1984) and Chandra Mouli *et al.* (1987) also reported such high-yielding mutants of groundnut in different generations. A striking increase in the pod yield in the mutants indicates positive role of induced mutations in the development of superior genotypes, leading to increase in groundnut productivity. However, all the mutants giving higher yield in M_4 and succeeding generations were derived from high-yielding 'JL 24' only and not from local 'KRG 1' (Table 2). Thus mutation does not alter the yield of a variety, but can greatly improve the high-yielding groundnut varieties, at 30 kR by inducing polygenic variability.

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