Table 1 *Artificial selfing in Santalum album*

Tree no.	Pollination value (%) 1985	1986
452	85	25
393	50	26
4203	50	50
398	20	–
A1	71	–
392	–	28
GPB-1	–	100

Table 2 *Natural outcrossing in Santalum album*

Tree no.	Pollination value (%) 1985	1986
452	87	80
393	97	92
4203	83	90
398	89	–
A1	60	–
GPB-2	–	75
190-S	–	89
392	–	93

inbreeding as well as outbreeding species like any other tropical tree[2].

Tables 1 and 2 show pollination values of nine trees in 1985 and 1986 for artificial selfing and natural outcrossing respectively. The overall pollination value in artificial selfing for 1985 and 1986 is 54% and 26% respectively. In natural outcrossing, the overall pollination value is 88% and 98%.

From the pollination values, it can be concluded that *S. album* is a partially inbreeding species. Here all the genotypes showed success in both artificial selfing and natural outcrossing, suggesting that both mechanisms are operating in the population. It can also be noted that the frequency of fertilization is high in both cases, but in a separate experiment, when 500 flowers were bagged, only four fruits were formed, suggesting the involvement of pollinating agents. The variation in pollination value is significantly different for different genotypes, indicating some genetic control.

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INCREASED MYCORRHIZAL COLONIZATION IN GAMMA RAY-INDUCED GREENGRAM MICROMUTANTS

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VESICULAR-ARBUSCULAR mycorrhizae (VAM) occur on a wide variety of crop plants and their beneficial role in plant nutrition is well established[1,2]. It is recognized that this symbiosis can be harnessed by manipulating the three major components, viz. the plant, the mycorrhizal fungus and the soil environment. Krishna *et al*[3] reported host genotype dependence for mycorrhizal colonization in 30 genotypes of pearl millet. The objective of the present study was to determine the extent of root colonization and its relation to phosphorus uptake in four gamma ray-induced advanced micromutants of greengram at M_7 generation under field conditions.

Two cultivars of greengram, viz. LGG 127 and ML–26–10–3 were subjected to gamma irradiation at 30 kR and 40 kR (source ^{60}Co, IARI, New Delhi). At M_6 generation, four micromutants were selected on the basis of their superior performance in yield over the parents. The pedigree of the material is shown below.

Micromutant	Pedigree
LGG 403	LGG–127–40 kR–2
LGG 405	ML–26–10–3–30 kR–39
LGG 407	ML–26–10–3–40 kR–25
LGG 410	ML–26–10–3–40 kR–48.

These four advanced micromutants and their parents were tested in an experimental plot to study the extent of mycorrhizal colonization. The plants were raised in a red laterite soil in the university botanical garden, which is known to harbour a high population of VAM fungi.

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Table 1 *Mean per cent VAM colonization and spores on roots, and phosphorus content, dry weight of shoot and yield of gamma ray-induced micromutants of greengram*

Micromutant/ parent	External root colonization			Internal root colonization			Average number of spores/vesicles per cm of root			P content at anthesis (%)	Dry wt of shoot at maturity (g)	Yield per plant (g)
	30*	45*	60*	30	45	60	30	45	60			
LGG 403	30.75	63.50	90.50	42.50	67.00	93.75	41.25	125.75	459.50	0.45	24.51	9.63
LGG 405	19.75	51.25	67.50	30.00	50.00	73.75	20.25	70.25	215.75	0.42	19.45	8.45
LGG 407	25.00	38.25	65.00	23.75	47.50	68.25	13.25	39.50	115.50	0.39	21.03	8.58
LGG 410	23.75	63.25	83.75	38.50	63.25	83.00	25.50	87.75	228.00	0.44	25.70	10.18
LGG 127 (P_1)	12.50	22.50	47.50	14.75	30.00	54.25	8.25	15.25	65.00	0.34	16.42	6.20
ML 26–10–3 (P_2)	15.75	36.75	50.00	20.50	45.00	61.50	16.00	23.75	81.00	0.36	19.00	6.85
SE of mean	1.11	1.40	2.00	1.84	1.43	1.05	1.41	1.63	2.73	0.004	0.78	0.16
CD at 5%	2.35	2.99	4.26	3.92	3.05	2.23	3.00	3.47	5.82	0.01	1.66	0.34

*Days after sowing.

Seeds were sown in a randomized block design with four replicates in the rainy season (August 1986). Roots were sampled at 15-day intervals up to 60 days (harvest). The roots of each plant were dug out carefully, washed gently, and cut to one cm segments. These were cleared and stained by the method of Phillips and Hayman[4] and 20 segments were examined for each replication. External and internal colonization by VAM fungi and presence of vesicles/spores were recorded. Phosphorus content of the plant was analysed at the time of flowering by the standard method[5]. The dry weight of the plant was recorded at the time of harvest. All the observations were made on five randomly selected plants of each replication and the pooled data were subjected to ANOVA test.

There is significant variation in the mycorrhizal colonization among the six genotypes of greengram by the VAM fungi indigenous to the botanical garden soil. The mean mycorrhizal colonization was highest in LGG 403 (90%), followed by LGG 410, LGG 405, LGG 407, ML–26–10–3 and LGG 127 in decreasing order. The progeny showed more colonization than either of the parents (table 1).

There was no VAM colonization in the first sampling (15 days after sowing) but after 30 days all the features of colonization such as entry points, external hyphae with vesicles, internal mycelium with arbuscules and vesicles were observed. The amount of external mycelium and the number of vesicles/spores were also greater in 403 than in others. Most of the spores observed belong to the species of *Glomus* while a cluster of crenulate spores were also noticed in the root bits of LGG 410.

The variation in mycorrhizal colonization between the genotypes was clearly evident in all the samplings. Analysis of variance showed that phosphorus content of the six genotypes differed significantly. Dry weight of shoot and yield per plant were also higher in the micromutants than in the parents. There was a correlation between mycorrhizal colonization, phosphorus uptake and yield (table 1).

Thus in addition to the fact that mycorrhizal efficiency is largely under the influence of soil characters, other factors such as host plant species[2] or the genotype of the host[3] are also likely to influence VAM colonization.

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ON THE PHYSIOLOGY OF FERN GAMETOPHYTE PRECEDING SEX ORGAN INITIATION

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THE gametophyte of ferns passes through several distinct morphological stages before the reproductive