https://doi.org/10.29321/MAJ.10.A02639

*Madras agric. J.* 70. (7) : 421 426 July 1983



# EFFECT OF MUTAGENIC TREATMENTS ON CHARACTER ASSOCIATION IN GROUNDNUT (*Arachis hypogaea* L.)

. RAMANATHAN[1] and M. RATHINAM[2]

The effect of mutagenic treatments on the character association was studied in the M3 generation of two varieties of groundnut. Negative association between height of main stem and pod yield in TMV 9 and between number of branches and number of pods in Ah 7911 was observed in the combination treatment against the positive association in the respective parent populations. The positive association between number of flowers on one hand and number of pods and pod yield on the other which existed in the control population of TMV 9 was not observed in 80 m*M* of EMS treatment. The possibility of selection for yield with improved plant architecture from mutagen treated populations was indicated by the altered character association.

Mutagenic treatments result in genetic changes leading to altered character expression. Association of characters, the expression of which is governed by the closely linked genes in the parent material, has been reported to be altered in certain cases due to mutagenic treatments. Induced mutations could therefore, be used as a valuable tool in breaking, the linkage of undesirable traits with useful productive traits. Information on the effects of mutagenic treatments on character association in groundnut is meagre. Alteration of character association in the population derived from gamma irradiation of groundnut has been reported (Sathiamoorthy *et al.*, 1978). In the present study, the effect of mutagenic treatments on the character association was studied in two varieties of groundnut and the results are presented here.

## MATERIAL AND METHODS

Two improved cultivars of bunch groundnut TMV 9 and Ah 7911 were chosen for the study. Two hundred seeds retained by 21/64 inch sieve having a moisture content of 5.5 percent were treated in each dose as detailed below:-

| Particulars | Mutagen | | |
|---|---|---|---|
| | Gamma rays (Krad) | EMS (m*M*) | Combination Gamma rays + EMS |
| Dose/concentration | 20, 30, 40 | 40, 60, 80 | 20 krad 40 m*M* |
| Pretreatment of seed | Dryseeds | Presoaked in deionized water for 12 hours | Irradiation of dry seeds followed by presoaking for 12 hours |
| Control | Dryseeds | Soaked seeds | Dry seeds |
| Duration of treatment (hours) | — | Four (with intermittant shaking) | Four (with intermittant shaking) |

1. Associate Professor and Head, Coconut Research Station, Veppankulam-614 906.
2. Professor and Head, Forestry Research Station, Mettupalayam.

The pretreatment conditions of pH, temperature and RH were maintained at 7.5, 24°C and 75% respectively in chemical & combination treatments The seeds subjected to single and combination treatments were immediately sown in the field in March, 1975 along with controls to raise M1 generation in randomised block design with five replications. Seeds harvested from fifty randomly selected M1 plants in each treatment were advanced to raise M2 generation in April, 1976 in randomised blocks with three replications. Control lines were raised from seeds obtained from randomly chosen plants in the parent varieties.

Seeds obtained from 24 normal plants chosen from 24 families containing not less than 60 seeds per plant in each treatment in the M2 generation were advanced to raise the M3 generation. Similar selection of plants was made in the parent varieties to form control lines. Materials were sown in April, 1977 in randomised block design with three replications. Correlation coefficients were worked out between yield and its components and also between pairs of yield components in the M3 generation. The components utilised in the association stuides with yield were, height of the main stem, length of primary branch, number of branches, number of flowers and number of pods/plant.

## RESULTS AND DISCUSSION

In TMV 9, the height of main stem was associated with the poo yield, the correlation coefficient being 0.277 in the control population (Table.1). Such a correlation was notobserved in the populations of 60m*M* and 80 m*M* of EMS treatments. In the combination treatment, the correlation coefficient between height of main stem and pod yield was -0.328 In the control population number of flowers were seen to be associated with pod yield, ther value being, 0.526 However, this association was not observed at 40 krad of gamma rays and 80 m*M* of EMS treatments.

In Ah 7911, height of main stem was not correlated with the pod yield in the control population (Table 2). Height of main stem was associated with the pod yield at 40 krad of gamma rays, 60 m*M* and 80 m*M* of EMS and combination treatments, the r values being 0,707. 0.983, 0 372 and 0.663 respectively There was association between the number of branches and the pod yield in the control, the r value being 0 269. Such association was not observed at 20 krad of gamma rays and combination treatments. There was correlation between the number of flowers and the pod yield in the control population, the r value being 0.411. Such an association was not observed at 20 krad and 30 krad of gamma rays and combination treatments Height of main stem was not associated with the number of pods in the control population of Ah 7911. There was positive association between these two characters at 30 krad, 40 krad of gamma irradiation 80 m*M* of EMS and combination treatment. The correlation, coefficient of 0.343 was observed between the number of branches and the number of pods in the control population. The correlation coefficient between these two characters in the combination treatment was —0.802.

In the control population of the two varieties there was significant positive association between pod yield on one hand and number of branches, number of flowers and number of pods on the other. However, genetic differences between the two varieties may be evident from the differences in the association of characters of these genotypes. Height of main stem was found to be positively associated with number of pods and pod yield in TMV 9 which they were uncorrelated in Ah 7911. Significant positive association between length of primary branch and pod yield was observed in Ah 7911 and not in TMV 9.

Comparison of the correlation coefficients obtained from control and treated population has shown that in a few instances the relationship between the characters was enhanced, for example height of main stem with length of primary branch in the gamma irradiations. EMS and combination treatments in TMV 9 pointing a common effect of mutations on associated traits (i e. pleiotropic effect as observed in wheat by (Scossiroli, 1966). In certain cases as for example association between number of pods and yield in the two varieties and length of primary branch and number of pods in TMV 9 no alteration was observed. In a few instances as in the case of association between number of branches and pod yield at 20 krad and combination treatment in Ah 7911, there was absence of correlation pointing to a break of relationship which existed in the control population. Non-alteration of the positive association between pod number and pod yield in the treated populations of the present study is in conformity with the earlier observations (Sathiamoorthy *et. al.* 1978).

The negative association between a vegetative character like height of main stem and reproductive character like number of pods and pod yield in the combination treatment in TMV 9 provides opportunity for effecting selection of plants with shorter height and increased yield. Likewise, the negative correlation between number of branches and number of pods in the population derived from combination treatment in Ah 7911 indicated the possibility of selection of plants with less number of branches and more yield. Such desirable changes in plant architecture not ordinarily attainable by recombination breeding has been made possible due to mutagenic treatments. Mutagen induced alterations in character association as in the present study has been observed in other crops such as cotton (Chandramathi, 1978), tobacco (Scarascia-Mugnozza, 1968) wheat (Scossiroli *et al*, 1966)' green gram (Krishnaswamy, 1977), peas (Dudits and Sutka 1980) and rice (Rao and Siddiq, 1976).

The first author is grateful to the Tamil Nadu Agricultural University for providing part time study facilities and for permission to publish the Ph. D- thesis as this article forms a part of it.

REFERENCES

CHANDRAMATHI, P. S., 1978. Maximisation of genetic variability in intervarietal hyorids of *Gossypium hirsutum L.* Ph. D. Thesis, Tamil Nadu Agrl. Univ., Coimbatore, 1978.

DUDITS, D. and J. SUTKA, 1980. Genetic change of characters by mutations in peas. Protein growth by plant breeding .Ed. Balint, A. Akademaikiadc, Budapest.

KRISHNASWAY, S. 1977. Studies on induced mutations in green gram *Vigna radiata* (L) Wilczek, Ph. D. Thesis, Tamil Nadu Agric. Univ., Coimbatore.

RAO, M. and E. A. SIDDIQ, 1976. Studies on induced variability for amylose content with reference to yield components and protein characteristics in rice, Envtal. and *Ex)*. *Bot* 16 : 177-88.

SATHIAMOORTHY, M. R., S. T. NATARAJAN T. K. RAMACHANDRAN, and S. THANGAVELU 1978. Shift in association of metric traits in mutants of groundnut (*Arachhis hypogaea L.*) *Madras agric J.* 65 . 70-1.

SCARASCIA-MUGNOZZA, G. T. 1968. Mutation breeding in sexually propagated plants. Fifth Congress of the European Association on research in plant breeding. Milano, Pavia, 1968. 187-217.

SCOSSIROLI, R. E., O. C. PALENSONA, and S. SCOSSIROLI-PALLEGRINI 1966. Stucies on the induction of new genetic variability to quantitative traits by seed irradiation and its use for wheat improvement. Mutation in Plant Breeding (Proc. Panel, Vienna, 1966). IAEA/FAO, Vienna, 197-229.

Table 1 : Total correlation co-efficient between pod yield and its components in $M_2$ cencration of TMV 9

| Trait | Treatments | Length of primary branch | Number of branches | Number of flowers | Number of pods | Pod yield |
|---|---|---|---|---|---|---|
| Height of main stem | Control | 0.148 | 0.407* | 0.285* | 0.246* | 0.277* |
| | 20 krad | 0.622** | 0.574** | 0.371** | 0.208 | 0.688** |
| | 30 krad | 0.813** | 0.418** | 0.303** | 0.304** | 0.288* |
| | 40 krad | 0.808** | 0.469** | 0.258** | 0.157 | 0.281* |
| | 40 m*M* | 0.887** | 0.673** | 0.282* | 0.371** | 0.361** |
| | 60 m*M* | 0.757** | 0.496** | 0.111 | 0.271* | 0.174 |
| | 80 m*M* | 0.764** | 0.406** | —0.701** | 0.137 | 0.197 |
| | 20 krad+40m*M* | 0.808** | 0.526** | 0.712* | —0.357** | —0.328** |
| Length of primary branch | Control | | 0.209 | 0.150 | 0.242* | 0.204 |
| | 20 krad | | 0.682** | 0.492** | 0.488** | 0.322** |
| | 30 krad | | 0.607** | 0.249* | 0.406** | 0.375** |
| | 40 krad | | 0.523** | 0.338** | 0.306** | 0.599** |
| | 40 m*M* | | 0.711** | 0.419** | 0.526** | 0.517** |
| | 60 m*M* | | 0.577** | 0.431** | 0.636** | 0.460** |
| | 80 m*M* | | 0.414** | —0.758** | 0.320** | 0.334** |
| | 20 krad+40 m*M* | | 0.569** | 0.132 | 0234* | 0.212 |
| No. of branches | Control | | | 0.473** | 0.438** | 0.467** |
| | 20 krad | | | 0.320** | 0.500** | 0.394** |
| | 30 krad | | | 0.393** | 0.418** | 0.334** |
| | 40 krad | | | 0.157 | 0.263* | 0.234* |
| | 40 m*M* | | | 0.383** | 0.553** | 0.517** |
| | 60 m*M* | | | 0.263* | 0.438** | 0.271* |
| | 80 m*M* | | | —0.184 | 0.360** | 0.272* |
| | 20 krad + 40 m*M* | | | 0.422** | 0.305** | 0.286* |
| No. of flowers | Control | | | | 0.551** | 0.526** |
| | 20 krad | | | | 0.523** | 0.334** |
| | 30 krad | | | | 0.170 | 0.845** |
| | 40 krad | | | | 0.309** | 0.209 |
| | 40 m*M* | | | | 0.630** | 0.581** |
| | 60 m*M* | | | | 0.577** | 0.537** |
| | 80 m*M* | | | | 0.119 | 0.205 |
| | 20 krad+40m*M* | | | | 0.437** | 0.357** |
| No. of pods | Control | | | | | 0.908** |
| | 20 krad | | | | | 0.813** |
| | 30 krad | | | | | 0.881** |
| | 40 krad | | | | | 0.904** |
| | 40 mm | | | | | 0.932** |
| | 60 mm | | | | | 0.877** |
| | 80 mm | | | | | 0.824** |
| | 20 krad+40 m*M* | | | | | 0.839** |

+ Observations were recorded on 360 plants in each treatment from three replications.

* Significant at 5% level.

** Significant at 1% level.

Table 2 : Total correlation co-efficient between pod yield and its components in $M_2$ generation of Ah 7911+

| Trait | Treatments | Length of primary branch | Number of branches | Number of flowers | Number of pods | Pod yield |
|---|---|---|---|---|---|---|
| Height of main stem | Control | 0.576** | 0.492** | 0.108 | −0.121 | −0.103 |
| | 20 krad | 0.611** | 0.243* | 0.154 | 0.148 | 0.114 |
| | 30 krad | 0.857** | 0.213 | 0.155 | 0.871** | 0.229 |
| | 40 krad | 0.537** | 0.321** | 0.900** | 0.566** | 0.707** |
| | 40 m*M* | 0.648** | 0.327** | 0.199 | 0.134 | 0.190 |
| | 60 m*M* | 0.861** | 0.164 | 0.945** | 0.114 | 0.983** |
| | 80 m*M* | 0.899** | 0.616** | 0.301* | 0.415** | 0.372** |
| | 20 krad+40m*M* | 0.763** | 0.173 | 0.341 | 0.405** | 0.66[illegible]** |
| Length of primary branch | Control | | 0.489** | 0.140 | 0.513** | 0.574** |
| | 20 krad | | 0.292* | 0.308** | 0.269* | 0.337** |
| | 30 krad | | 0.322** | 0.155 | 0.151 | 0.294** |
| | 40 krad | | 0.271* | 0.309** | 0.328** | 0.[illegible]59** |
| | 40 m*M* | | 0.426** | 0.314** | 0.442** | 0.492** |
| | 60 m*M* | | 0.314** | 0.32 ** | 0.367** | 0.420** |
| | 80 m*M* | | 0.556** | 0.267* | 0.405** | 0.392** |
| | 20 krad+40 m*M* | | 0.272* | 0.185 | 0.513** | 0.344** |
| No. of branches | Control | | | 0.211 | 0.343** | 0.269* |
| | 20 krad | | | 0.285* | 0.163 | 0.183 |
| | 30 krad | | | 0.281** | 0.362** | 0.356** |
| | 40 krad | | | 0.363** | 0.337** | 0.394** |
| | 40 m*M* | | | 0.282* | 0.553** | 0.483** |
| | 60 m*M* | | | 0.348** | 0.317** | 0.346** |
| | 80 m*M* | | | 0.218 | 0.345** | 0.347** |
| | 20 krad+40 m*M* | | | 0.225 | −0.802** | 0.113 |
| No. of flowers | Control | | | | 0.492** | 0.411** |
| | 20 krad | | | | 0.308** | 0.102 |
| | 30 krad | | | | 0.305** | 0.165 |
| | 40 krad | | | | 0.435** | 0.375** |
| | 40 m*M* | | | | 0.404** | 0.380** |
| | 60 m*M* | | | | 0.613** | 0.569** |
| | 80 m*M* | | | | 0.477** | 0.475** |
| | 20 krad+40m*M* | | | | 0.170 | 0.117 |
| No. of pods | Control | | | | | 0.902** |
| | 20 krad | | | | | 0.835** |
| | 30 krad | | | | | 0.834** |
| | 40 krad | | | | | 0.904** |
| | 40 m*M* | | | | | 0.900** |
| | 60 m*M* | | | | | 0.926** |
| | 80 m*M* | | | | | 0.916** |
| | 20 krad+40 m*M* | | | | | 0.902** |

+ Observations were recorded on 360 plants in each treatment from three replications.

* Significant at 5% level.

** Significant at 1% level.