SELECTION PARAMETERS IN GROUNDNUT

BY

RADHIKA, C.

THESIS

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT

FOR THE DEGREE OF

MASTER OF SCIENCE IN AGRICULTURE

FACULTY OF AGRICULTURE

KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF PLANT BREEDING

COLLEGE OF AGRICULTURE

VELLAYANI, TRIVANDRUM

1984

DECLARATION

I hereby declare that this thesis entitled "Selection parameters in groundnut" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

Radhika. C

(RADHIKA, C.)

Vellayani,
18-6-1984.

CERTIFICATE

Certified that this thesis, entitled "Selection parameters in groundnut" is a record of research work done independantly by Kum. RADHIKA, C., under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

(V.GOPINATHAN NAIR)
Chairman,
Advisory Committee
(Professor and Head, Department of plant Breeding)

Vellayani,
18-6-1984.

Approved by:

Chairman:

Dr. V. GOPINATHAN NAIR

Members:

1. Dr. P. MANIKANTAN NAIR

2. Dr. P. SARASWATHY

3. Shri K. GOPAKUMAR

External Examiner: 28/8/84

ACKNOWLEDGEMENT

It is a pleasure to express my deep sense of gratitude to Dr. V. Gopinathan Nair, Professor and Head, Department of Plant Breeding and Chairman of my Advisory Committee for his inspiring guidance and constant help throughout the course of the research work and in the preparation of the thesis.

Sincere gratitude is also expressed to Dr.P. Manikantan Nair, Associate Professor, Department of Plant Breeding and Dr. P. Saraswathy, Associate Professor, Department of Statistics, members of my Advisory Committee for their valuable help and guidance in the endeavour.

I also wish to thank Shri.K. Balakrishna Pillai, Associate Professor, Rice Research Station, Kayamkulam and member of my Advisory Committee for permitting me to conduct the experiment at the Research Station and for providing me with the necessary facilities. I am also grateful to the Kerala Agricultural University for the financial assistance given to me by way of fellowship.

My thanks are also due to the Staff and students of the Department of Plant Breeding for the sincere help extended to me throughout the research programme.

Radhika, C.

CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

INTRODUCTION

The groundnut of commerce known by various names in English speaking countries like earthnut, peanut, monkeynut, goobernut etc. has the botanical name Arachis hypogaea Linn., derived from two greek words 'Arachis' meaning 'a legume', and 'hypogaea' meaning 'below ground'. This crop has never been found in the wild state anywhere and therefore its origin has been a matter of considerable speculation and even controversy. There are two main schools of thought on the subject, one supporting the view that it originated in Africa and the other tracing its origin to South America. However, recent botanical surveys and archeological excavations have indicated South America as the most likely centre of origin of this crop (Seshadri, 1962).

Many uses have been attributed to this crop. The pods are mainly used for edible purposes and for oil extraction. Groundnut is well known as the 'King of oil-seeds' in India since it contributes to 60 per cent of the vegetable oil production in the country. The haulms can be used as green fodder. The seeds of groundnut are rich both in oil (43-55%) and protein (25-28%) and make a substantial contribution to human nutrition (Gregory and Gregory, 1976). Virginia types contain 38-47 per cent oil and spanish types, 47-50 per cent. The oil contains mainly unsaturated fatty acids viz., oleic andlinoleic acids and a small fraction of saturated arachidic acid. The principal proteins are arachin and conarachin. The kernals are also rich in Vitamins B and E.

The crop is presumed to have been introduced into India in the sixteenth century. At present, the area under groundnut in the country is 6.9 million hectares which is about 40 per cent of the total oilseed acreage. In Kerala, it is considered to be an important annual oilseed crop, ranking only next to sesame in area. Majority of the area under groundnut cultivation in Kerala is in the Chitoor Taluk of Palghat District.

In Kerala, the crop is cultivated mainly during two seasons, one as kharif crop in traditional uplands during May to August, either as a pure crop or as a constituent in the mixed cropping system and the other as a catch crop in the non-traditional but potential rice fallows during January to April utilizing the residual moisture or marginal irrigation facilities. Though groundnut is the most important annual oilseed crop of Kerala, no attention has been paid in the past for its genetic improvement.

Lack of high yielding and short duration varieties is the major constraint in the popularisation of groundnut cultivation in the rice fallows, the lack of stability of cultivars being another. Hence a major requirement of groundnut improvement in Kerala is the identification of appropriate varieties possessing adaptability to each soil type, season and cropping system. Collection of germplasm and its critical evaluation for desirable attributes can lead to the identification of genotypes specific to each situation.

Genetic variability in a crop forms the primary requisite for achieving genetic improvement. The extent of genetic variability can be estimated by genotypic coefficient of variation. The estimates of heritability are also worked out since the heritable portion of variability alone constitutes to genetic improvement. The extent of relationship between attributes is measured by correlation coefficients at the genotypic and phenotypic levels.

Selection for complex characters like yield can be effectively made by employing biometric techniques which will indicate the importance of different components in contributing to yield. The present work aims at the formulation of a dependable criteria for selection in groundnut in terms of the observational components that bear a significant association with yield and exhibit greater response to selection. A study on the genotype x environment interaction is also aimed at, to help in identifying characters having stable performance. The informations gathered and conclusions drawn are expected to be of practical importance in the future works on genetic improvement of groundnut.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Breeding for high yield is a major objective in any breeding programme. As is now well recognised, yield is a complex character which depends upon the action and interaction of a number of factors. The study of the association of quantitative characters with yield is important to the groundnut breeder in fixing up characters which have a decisive contributory influence on yield. These components may form additional indices for selection from the breeding material. A brief review of the work done on these aspects is presented below:

I. VARIABILITY STUDIES:

1. Number of days to flowering:

The variation for number of days taken for the first flower to open was found to be narrow by Majumdar et al. (1969, 1970). The early varieties took 26 to 27 days, medium - 28 days and late - 28 to 29 days for the first flower to open, indicating that the varieties do not differ much with respect to this character. But a wide range of phenotypic variation was observed in the period of flowering. They observed that the period of flowering in early varieties was 55 to 59 days, medium - 73 days and late - 75 days. Kushwaha and Tawar (1973) had also observed that the range of variability was narrow for the days to 50 per cent flowering. In a study of the variety Gangapuri, Ramachandran and Venkateswaran (1980) reported that 50 per cent of the flowers were produced within 20 days after the first flower opening. Heritability study by Majumdar et al. (1969) revealed that the broad sense heritability was high for the number of days to first flowering.

2. Number of days to maturity:

A wide range of phenotypic variability was observed for this character by Majumdar et al. (1969). Contrary to this finding, only a narrow range of variability was observed by Kushwaha and Tawar (1973) and Patra (1975). An attempt to classify early, medium and late varieties by Majumdar et al. (1970) revealed that length of peg, depth of pod burial, percentage of moisture in the kernal and shell and period of flowering could be used as indices for classification of early and late varieties. The medium and late varieties appeared to form one maturity group. Number of days to maturity was observed to be a highly heritable character by Majumdar et al. (1969) and Kushwaha and Tawar (1973).

3. Number of primary branches per plant:

A wide range of phenotypic variation was observed in the number of branches per plant by Majumdar et al. (1969). Contrary to this, was the finding of Dixit et al. (1970, 1971) that the range of phenotypic variability was low for the 7 quantitative characters studied. They found that the range of variation was lowest for the number of primary branches. Kushwaha and Tawar (1973) in a study with 36 Indian and 4 African varieties also reported that the phenotypic and genotypic variances were lowest for the number of primary branches.

The character was observed to have a comparatively high genotypic coefficient of variation and heritability by Majumdar et al. (1969). The highly heritable nature was also reported by Dixit et al. (1971) and Dolaria and Joshi (1972). Kushwaha and Tawar (1973) found that the expected genetic advance was the lowest in this case among the several characters studied. But Patra (1975) reported a high expected genetic advance for the number of primary branches.

4. Height of plants:

In a study of 7 quantitative characters in 57 varieties of groundnut under 3 environments, Dixit et al. (1971) observed high variability for the height of main axis. The study of phenotypic and genotypic variabilities of 40 varieties under rainfed conditions by Kushwaha and Tawar (1973) yielded similar results. Patra (1975) observed maximum range of variability for the height of main axis among the 7 quantitative characters studied using 35 hybrid derivatives.

Height of main axis was found to have a high heritability estimate along with high genetic advance by Dixit et al. (1971). Kushwaha and Tawar (1973) also reported that the expected genetic advance was high for this character. On assessing the magnitude of heritable variability in bunch groundnut, Sivasubramanian et al. (1977) recorded high values for genotypic coefficient of variation, broad sense heritability and genetic advance in respect of the height of main stem.

5. Number of mature pods per plant:

Majumdar et al, (1969) reported a wide range of variability in the number of mature pods. In an assessment of the genetic divergence of 27 spreading varieties, Sangha (1971) found that number of pods were more important in contributing to genetic divergence. A study of the morphological characters of 691 indigenous and exotic varieties by Muhammad et al. (1973 a) also revealed a wide range of variation in the number of pods. Similar results were reported by Kushwaha and Tawar (1973) in a study of the phenotypic and genotypic variabilities under rainfed conditions. High genetic variability for the number of pods was recorded by Shettar (1974) in 42 varieties and Sandhu and Sangha (1974) utilizing 27 divergent varieties.

Of the 8 characters studied in 27 varieties by Sangha (1973 b), number of pods per plant had high genotypic and phenotypic coefficients of variation next only to 100-kernal weight. High genotypic and phenotypic coefficients of variation were recorded by Khangura and Sandhu (1973) in a study of 30 spreading varieties. In an evaluation of 30 bunch varieties by Natarajan et al. (1978 a) number of pods per plant exhibited maximum genotypic and phenotypic coefficients of variation. Broad sense heritability was low for the number of mature pods by Majumdar et al. (1969). Contrary to this, high heritability estimate was observed for the number of pods with high expected genetic gain in the bunch group by Dholaria and Joshi (1972). Similarly, a high estimate of broad sense heritability and a moderately high estimate of genetic advance were recorded for this character by Khangura and Sandhu (1973). High values recorded for genotypic coefficient of variation, broad sense heritability and genetic advance as a percentage of mean by Sivasubramanian et al. (1977) indicated that certain amount of reliance can be placed on this character for selection and recombination.

6. Number of immature pods per plant:

The character was observed to have a wide range of variation in a study by Harisingh et al. (1982). But in a study by Kushwaha and Tawar (1973), phenotypic and genotypic variabilities were found to be low for this character. Heritability estimate was also the lowest for this character.

High phenotypic and genotypic coefficients of variations were recorded by Patra (1975) along with a high heritability estimate. Harisingh et al. (1982) also observed that the broad sense heritability was high for this character.

7. Number of pegs per plant:

Analysis of 50 newly evolved genotypes of groundnut by Harisingh et al. (1982) revealed high variability for pod: peg ratio. The difference between phenotypic and genotypic variances was also high for this character. A study of the yield characters in 220 bunch varieties by Rao (1980) indicated that number of pegs per plant showed the highest broad sense heritability.

8. Weight of haulms per plant:

A large amount of genetic variability was recorded for fodder weight per plant by Dixit et al. (1970).

9. Fresh weight of mature pods per plant:

A large amount of genetic variability for the green weight of mature pods per plant was reported by Dixit et al. (1970). In a study of 7 quantitative characters under 3 environments by Dixit et al. (1971), the maximum range of variability was recorded for green weight of mature pods. Phenotypic and genotypic coefficients of variation were also found to be high for this character.

10. Dry weight of mature pods per plant:

A wide range of phenotypic variability was observed in the yield of pods by Majumdar et al. (1969). In a study by Dixit et al. (1970), the genetic variability for yield was found to be high. The variety Gangapuri showed high variability for pod yield when grown under favourable and unfavourable soil moisture conditions (Ramachandran and Venkateswaran, 1980). An evaluation of 22 genotypes of groundnut by Kumar and Yadava (1982) also revealed substantial amount of genetic variability for pod yield and yield components. A similar observation was made by Harisingh et al. (1982) in an analysis of 50 newly evolved genotypes of groundnut. They also observed that the difference between phenotypic and genotypic variations was high for pod yield.

A low estimate of heritability was made by Majumdar et al. (1969). Phenotypic and genotypic coefficients of variation were high for dry weight of mature pods (Dixit et al., 1971). The genotypic coefficient of variation was found to be highest for this character by Kushwaha and Tawar (1973) in a study of 36 Indian and 4 African varieties. High phenotypic and genotypic coefficients of variation and high estimate of broad sense heritability were recorded by Khangura and Sandhu (1973). A moderately high estimate of genetic advance was also reported. Patra (1975) in a study with 35 hybrid derivatives concluded that the phenotypic and genotypic coefficients of variability were high with high heritability for pod yield per plant. Yield per plant was also found to have high expected genetic advance.

11. 100-pod weight:

A wide range of phenotypic variability was observed for this character by Majumdar et al. (1969). Genotypic coefficient of variation was the lowest in a study of 36 Indian and 4 African varieties by Kushwaha and Tawar (1973). Majumdar et al. (1969) found a high heritability estimate for the character. The highly heritable nature of 100-pod weight accompanied by high genetic advance was also observed by Dixit et al. (1970). In a study of 30 bunch varieties by Natarajan et al. (1978 a), 100-pod weight had maximum heritability and genetic advance.

12. 100-kernal weight:

In assessing the genetic diversity of 27 spreading varieties of groundnut, Sangha (1971) found that 100-kernal weight was important in contributing to genetic divergence. But Sangha (1973 a) concluded from an evaluation study of 27 spreading varieties that 100-kernal weight contributes to least diversity. Data on 100-kernal weight in 234 bunch, 170 semi-spreading and 268 prostrate varieties by Natarajan et al. (1978 b) reveal that variation in kernal weight was generally higher in semi-prostrate and prostrate varieties and could be exploited to improve the existing varieties.

Harisingh et al. (1982) in an analysis of 50 newly evolved genotypes revealed a high range of variability for the character.

Of the eight characters studied by Sangha (1973 b) in 27 varieties, 100-kernal weight showed the highest estimate of genotypic and phenotypic coefficients of variation. Dixit et al. (1970) observed that 100-kernal weight was a highly heritable character which was accompanied by high genetic advance. A similar observation was made by Dholaria and Joshi (1972). High broad sense heritability was also recorded by Khangura and Sandhu (1973) and Harisingh et al. (1982).

13. Shelling percentage:

A wide range of phenotypic variation was observed in shelling percentage by Majumdar et al. (1969). Muhammad et al. (1973 b) observed that semi-spreading and spreading varieties had a lower shelling outturn than bunch varieties. Data on the shelling percentage from 234 bunch, 170 semi-spreading and 268 prostrate varieties from Tindivanam by Natarajan et al. (1978 b) revealed that variation in shelling percentage was highest in prostrate varieties and can be exploited to improve the existing varieties.

The heritability estimate was found to be high by Majumdar et al. (1969). In a study of the genetic analysis of shelling percentage in groundnut by Sandhu and Khehra (1977 a), the broad sense heritability was found to be high but the narrow sense heritability was low to high. A high estimate of broad sense heritability was also recorded by Harisingh et al. (1982), in an analysis of 50 newly evolved genotypes of groundnut.

14. Disease incidence:

A gradation of groundnut varieties to Cercospora resistance in Madras state by Muhammad and Dorairaj (1968) indicated that bunch varieties were more susceptible to infection. Of the 206 bunch varieties tested, only 2.4% were highly resistant, while of the 44 semi-spreading varieties, 43.2% fell within this category. In a trial of more than 110 varieties, 54 showed resistance to Mycosphaerella arachidicola and M. berkeleyii. Resistant varieties were identified in bunch, semi-spreading and spreading varieties by Aulakh et al. (1972). A study of the variety TMV-10 by Sridharan et al. (1972) revealed that it was less susceptible to tikka than TMV-1. The greater susceptibility of bunch varieties to Tikka when compared to spreading varieties was also observed by Muheet et al. (1975). In an evaluation of several methods for taking disease severity readings for Cercospora leaf spot in groundnut, Pedrosa (1977) found that percentage defoliation by height measurement and number of spots per leaf were the best of the 9 measures of severity of Cercospora spp infection. A trial by Prasad et al. (1979) revealed that at 60 days, plants of the wild species

Arachis monticola, A. prostrata and A. villosa were free of the disease and at 90 days only A. monticola was infected. The bunch types, BH 8-18, C-501, HYG 13-3-18 and T-98 and semi-spreading type EC.21011 showed good resistance in both years but were not as resistant as the wild species. Data from field trials of 3 groundnut forms which differed in yield and maturity by Miller and Norden (1980) confirmed that resistance to Cercospora arachidichola and Cercosporidium personatum is negatively correlated with yield and early maturity.

II. GENOTYPE X ENVIRONMENT INTERACTION:

Studies with six varieties at 5 places for 3 years by Joshi et al. (1970) revealed that the variety x year, variety x place and variety x year x place interactions were not significant. In trials of 5 bunch varieties of groundnut at a wide range of localities, the genotype x environment interaction estimated for yield was found to be the least in Junagadh 11, which had consistent performance in favourable and unfavourable conditions (Joshi et al., 1972). Of the eight characters studied in 15 semi-spreading varieties over 2 years, Merchant and Munshi (1973) found that the various combinations of characters were affected by seasons. Eight promising spreading varieties were evaluated for level and stability of performance for pod yield over 4 locations in the Punjab by Singh et al. (1974). They found that the differences in stability were mainly due to linear regression. Variety M-13 was found to have average stability and high level of performance for pod yield. Analysis of variance for yield from six varieties grown at 6 centres over 3 years by Kushwaha and Tawar (1974) showed that varietal differences in the regression on environmental means were significant, indicating genetic control of response to environment. A highly significant first order variety x environment interaction and a second order variety x environment x year interaction became apparent from the results of field experiments in Punjab using 12 varieties, by Sangha and Jaswal (1975).

Sandhu and Khehra (1977 b) reported that genotype x environment interactions were significant for pod yield, 100-seed weight and length of primary and secondary branches but not for number of mature pods, number of primary branches and oil content. Genotype x environment interaction effects for yield components were worked out by Tai and Hammons (1978) on two different soils with and without irrigation. They found that irrigation treatment caused marked response and interaction effects for some of the factors. Data from 26 trials with 3 to 4 varieties by Williams et al. (1978) indicated that the varieties react differently to environment, some being superior under cool, cloudy conditions, others under warm, sunny conditions. A study on the genotype x environment interaction for pod yield and number of days to maturity in 15 varieties grown in 4 environments by Yadava and Kumar (1978 a) showed that Faizpur 1-5 was early and stable for both the traits in all environments. The variety TG-3 was considered suited to poor environments because of its above average performance coupled with a low response to changing environments. Yadava and Kumar (1978 b) in the study of phenotypic stability of 11 varieties in 3 environments, for pod yield, shelling percentage, 100-kernal weight and oil content found that the magnitude of the linear compenent of G x E interaction was high for pod yield, 100-kernal weight and oil content.

Phenotypic stability for yield components and oil content in bunch group of groundnut studied by Yadava and Kumar (1979 a) indicated significant genotype x environment interaction for all the characters. Yadava and Kumar (1979 b) also observed that the linear portion of the G x E interaction was significant for pod yield and maturity while the non-linear portion was significant for days to maturity only. Eighteen lines were evaluated for 3 characters during 3 winters by Yadava et al. (1980). Pooled analysis of varieties showed variability among lines and environment and that genotype x environment interaction was significant for all traits. Another study by Mercer-Quarshie (1980) using 17 varieties grown at 7 locations in two years indicated that the variety x year x location interactions were significant for all the 5 characters, viz., pod yield, number of pods per plant, seed yield, shelling out turn, and 100-kernal weight. The variety x year interaction was significant only for 100-seed weight and the variety x location interaction was significant for seed yield, and 100-seed weight. It was concluded that testing in several locations is more important than testing in several years.

III. CORRELATION STUDIES:

Mishra as early as in 1958 carried out correlation studies in groundnut. Preliminary studies on correlation of yield with other characters like shoot weight, root weight and shoot length were also conducted by Mahapatra (1966). A negative correlation between pod yield and number of days to flowering was observed by Kushwaha and Tawar (1973), Shettar (1974), Rao (1978, 1980) and Yadava et al. (1981). According to Badwal and Gupta (1968) earliness had some influence on pod yield in the bunch group. Pod yield was negatively correlated with number of days to maturity (Kushwaha and Tawar, 1973; Kumar and Yadava, 1978). Contrary to this observation, pod yield was found to have significant positive association with number of days to maturity by Kumar and Yadava (1982) and path analysis revealed that the positive association was due to direct effect.

Positive correlation was reported between pod yield and number of primary branches per plant, by several workers like Jaswal and Gupta (1967), Khangura and Sandhu (1972), Dholaria et al. (1972), Chandola et al. (1973), Kushwaha and Tawar (1973), Balaiah et al. (1980), Yadava et al. (1981) and Kumar and Yadava (1982). But Sangha and Sandhu (1970) and Sangha (1973 b) has reported negative correlation between pod yield and number of primary branches. Pod yield was also found to be positively correlated with number of branches by Prasad and Srivastava (1968). Dholaria et al. (1973) observed that branch number was more important in selecting for improved yield in spreading varieties. Length of primary branch was also found to have positive correlation with yield in a study of 220 bunch varieties by Rao (1980) and 105 semi-spreading F_2 segregants by Balaiah et al. (1980).

A negative correlation between pod yield and shoot length was reported by Mahapatra (1966). Contrary to this, positive correlation between pod yield and height of main axis was reported by Dorairaj (1962), Moustafa and Sayid (1971), Kushwaha and Tawar (1973), Shettar (1974), Rao (1978, 1980) and Yadava et al. (1981). But a study of 105 semi-spreading F_2 segregants by Balaiah et al. (1980) revealed that height of main axis was not positively correlated with yield.

Number of pods per plant was highly correlated with pod yield (Ling, 1954). In spreading and bunch varieties, pod yield was reported to be positively and significantly correlated with pod number (Dorairaj, 1962). Positive correlation between pod yield and number of mature pods per plant was also reported by several workers like Jaswal and Gupta (1966), Chandra Mohan et al. (1967), Jaswal and Gupta (1967), Badwal and Gupta (1968), Prasad and Srivastava (1968), Sangha and Sandhu (1970), Moustafa and Sayid (1971), Khangura and Sandhu (1972), Dholaria et al. (1972), Phadnis et al. (1973), Kushwaha and Tawar (1973), Dholaria et al. (1973), Shettar (1974), Rao (1980), Balaiah et al. (1980), Patra (1980), Yadava et al. (1981) and Kumar and Yadava (1982). Chandola et al. (1973) found that pod number was the most important character contributing to yield. A negative correlation between pod yield and total number of pods was reported by Shettar (1974). Partial correlation analysis by Chandra Mohan et al. (1967) has shown that number of immature pods had a high positive correlation with yield. Patra (1980) also observed that number of immature pods per plant was very effective in selecting for pod yield. A positive correlation between pod yield and number of pegs per plant was reported by Jaswal and Gupta (1966) and Rao (1980).

In a correlation study by Prasad and Srivastava (1968)

100-pod weight was found to be positively correlated with pod yield. 100-kernal weight was also found to have a positive influence on pod yield by Badwal and Gupta (1968). The positive correlation between pod yield and 100-kernal weight was also reported by Prasad and Srivastava (1968) Sangha and Sandhu (1970), Dholaria et al., (1972), Phadnis et al. (1973), Sangha (1973 b), Shettar (1974), Natarajan et al. (1978 a), Rao (1978) and Kumar and Yadava (1982). Studies with 30 varieties by Khangura and Sandhu (1972) have revealed that pod yield was positively and significantly correlated with shelling percentage. But a negative correlation between pod yield and shelling percentage was reported by Shettar (1974). Shelling percentage appeared to be a major component of pod yield for 18 strains of bunch type tested by Kumar and Yadava (1978). Patra (1980) reported that indirect selection based on shelling percentage was very effective. Pod yield was observed to be positively correlated with plant weight by Chandra Mohan et al. (1967) and Kushwaha and Tawar (1973).

In a correlation study with 40 varieties of groundnut, Kushwaha and Tawar (1973) observed that number of days to flowering and maturity were negatively associated with all characters except 100-kernal weight. As per the report of Sangha (1973 b), number of primary branches, had a high positive correlation with number of pods and 100-kernal weight. A study of 30 early erect varieties by Lin et al.

(1969) revealed that length of main stem was negatively correlated with number of pods per plant. According to the report of Chandola et al. (1973), pod number was indirectly affected by number of primary branches. Natarajan et al. (1978 a) observed that number of pods had a negative association with 100-pod and 100-kernal weights but shelling percentage was positively and significantly correlated with these two characters. Shelling percentage was positively correlated with number of pods per plant (Lin et al., 1969). Kushwaha and Tawar (1973) reported that weight of haulms per plant was positively correlated with number of primary branches.

IV. SELECTION INDEX IN GROUNDNUT

Preliminary steps in the formulation of selection index for yield in groundnut was suggested by Dorairaj (1962). Studies on the yield components of peanut like length of main stem, number and length of branches, number of pods per plant and average weight per pod were undertaken by Lin and Chen in 1967. In the spreading varieties, weight of pods was positively and significantly correlated with pod number and number of secondary branches. In the bunch types, weight of pods was positively and significantly correlated with pod number, mean number of nodes in the primaries, number of secondaries, mean length of primaries, length of the main axis and number of nodes in the main axis in the order of decreasing correlation coefficients. A selection criterion for improving the bunch types of groundnut was suggested by Jaswal and Gupta (1967). Here pod weight was found to be positively correlated with number of primary and secondary branches, mature pods, needles and branch length. Selection indices estimated over 2 seasons showed that number of mature pods per plant and total branch length are the more important criteria for selection in bunch types. In a study to work out the correlations of quantitative traits and selection indices for improving pod yield, Badwal and Gupta (1968) found that in bunch, semi-spreading and spreading varieties, pod yield was largely influenced by number of mature pods and 100-kernal weight.

Formulation of selection indices under high and low fertility in groundnut, suggested that branch number was more important in selecting for improved yield in spreading varieties while pod number was more important in selecting bunch types (Dholaria et al., 1973). But Venkateswaran (1980) reported that for spreading varieties, weight per seed was the most important character in the selection index. Total number of pods was important in spreading varieties and in bunch varieties, height of main axis, total leaf area and weight per seed were equally important. The formulation of selection index for yield in groundnut on the basis of correlation studies was also made by Shettar (1974).

The utilization of an appropriate multiple selection criteria based on selection indices was found to be more desirable for making improvements in yield since several economically important characters contribute to yield (Singh and Singh, 1974). The use of discriminant function as a tool in groundnut breeding was suggested by Venkateswaran (1980). In a multiple criteria selection in some hybrid populations in groundnut, Patra (1980) found that selection based on 3 components, such as shelling percentage, number of mature pods per plant and number of immature pods per plant proved more effective than direct selection based on yield alone.

MATERIALS AND METHODS

MATERIALS AND METHODS

The materials comprised of forty diverse varieties of groundnut belonging to the bunch and semi-spreading groups. These varieties differed not only in their growth habit but also in other morphological characters such as stature, size of pod, size of kernal and colour of seed coat. The varieties were obtained from the germplasm maintained at the Department of Plant Breeding, Vellayani. Details of varieties are presented in table 1.

The field experiments were conducted under two diverse cropping conditions, in rice fallows during January to May at the Rice Research Station, Kayamkulam and in uplands during May to September at the Instructional Farm, Vellayani. A randomised block design with three replications was adopted at both locations. Each plot consisted of three rows of ten plants each, at a spacing of 30 x 30 cm. The sample for observation consisted of 10 plants per variety per replication selected at random. The data on characters 1 to 10 were recorded on these plants. Observations 11 to 13 were taken from bulk samples of each variety.

1. Number of days to flowering: the number of days from sowing to the opening of the first flower.
2. Number of days to maturity: the number of days from sowing to the date of pod maturity.
3. Number of primary branches per plant: the main stem and the branches arising rrom its base.

4. Height of plants: length of the plant from the base to the tip of the longest branch.

5. Number of mature pods per plant: the number of pods with fully developed kernals.

6. Number of immature pods per plant: all undeveloped pods were counted.

7. Number of pegs per plant: the undeveloped ovary stalks which did not develop into pods were counted.

8. Weight of haulm per plant: the fresh weight of green matter after removing the pods.

9. Fresh weight of mature pods per plant: the weight of mature pods collected immediately after harvest.

10. Dry weight of mature pods per plant: the mature pods were sundried for 5 to 7 days and their weights recorded.

11. 100-pod weight: random samples of 100 mature dry pods were taken from the bulk sample in each variety and replication and their weights recorded.

12. 100-kernal weight: the weights of random samples of 100 kernals obtained by shelling mature dry pods in each variety and replication.

13. Shelling percentage: the weight of a definite number of mature dry pods was recorded. These pods were shelled, and the weight of kernals, thus obtained was also recorded. The percentage of the weight of

kernals to the weight of pods gave the shelling percentage in each variety and replication.

Observations were also made on the incidence of major diseases like tikka and root rot and pests like pod borer. Susceptibility of varieties was ascertained.

The data for both the locations were subjected to the following statistical analyses:

I. Estimation of Mean and Variance

i) Means were estimated for each character for all the 40 varieties.

ii) The significance of the variation between varieties with respect to each character was tested by applying the analysis of variance:

Source of variation	Degrees of freedom	Sum of squares	Mean square	'F' ratio
Blocks	(b-1)	$\frac{\sum_i B_i^2}{v} - C = SS_B$	$SS_B/(b-1) = MS_B$	MS_B/MS_E
Varieties	(v-1)	$\frac{\sum_i V_i^2}{b} - C = SS_V$	$SS_V/(v-1) = MS_V$	MS_V/MS_E
Error	(b-1)(v-1)	$SS_T-(SS_B+SS_V) = SS_E$	$SS_E/(b-1)(v-1) = MS_E$	
Total	(bv-1)	$\sum_{ij} Y_{ij}^2 - C = SS_T$		

Where Bjs' are the block totals, $j = 1, 2, --- b$.

Vis' are the treatment totals, $i = 1, 2, --- v$.

Y_{ij}s' are the individual observations.

The ratio $\frac{MS_B}{MS_E}$ follows an 'F' distribution with (b-1) and (b-1)(v-1) degrees of freedom and provides a test of significance for blocks. Similarly the ratio $\frac{MS_V}{MS_E}$ follows an 'F' distribution with (v-1) and (b-1)(v-1) degrees of freedom and provides a test of significance of varieties. MS_E is the estimate of error variance and $\sqrt{\frac{MS_E}{r}}$ is the estimate of standard error of the mean. The varieties were compared by using the value of the critical difference given by,

$$CD = t_{(b-1)(v-1)} \sqrt{\frac{2\ MS_E}{r}}$$

The analysis of variance was done separately for both the locations.

iii) Pooled analysis of variance was done to investigate the variety x location interaction for the various characters (Nigam and Gupta, 1979). Prior to pooling, the estimates of error variances for the two locations were tested by applying the 'F' test. Wherever the error variances were homogenous, the following analysis was done:

Source of variation	Degrees of freedom	Sum of squares	Mean squares	'F' ratio
Locations	(l-1)	$\frac{\sum_{j} L_j^2}{v} - C = SS_L$	$SS_L/(l-1) = MS_L$	
Varieties	(v-1)	$\frac{\sum_{i} V_i^2}{l} - C = SS_V$	$SS_V/(v-1) = MS_V$	MS_V/MS_{VL}
Variety x Location	(v-1)(l-1)	$SS_T - (SS_L + SS_V) = SS_{VL}$	$SS_{VL}/(v-1)(l-1) = MS_{VL}$	MS_{VL}/MS_E
Pooled error	$n_1 + n_2 = n$	$SSE_1 + SSE_2 = SS_E$	$SS_E/n = MS_E$	

Where L_j's are the location totals, j = 1,2, ----l

V_i's are the treatment totals, i = 1,2, ----v

n_1 = error degrees of freedom for the first location

n_2 = error degrees of freedom for the second location

SS_T = Total sum of squares

SSE_1 = Error sum of squares for the first location

SSE_2 = error sum of squares for the second location.

The ratio MS_{VL}/MS_E follows an 'F' distribution with (v-1)(l-1) and n degrees of freedom and provides a test of significance for variety x location interaction. Similarly the ratio MS_V/MS_{VL} follows an 'F' distribution with (v-1) and (v-1)(l-1) degrees of freedom and provides a test of significance varieties.

Wherever the error variances were found to be heterogenous, the procedure of weighted analysis of variance was done as follows:-

$$\text{Weight for each location} = W_i = \frac{r}{S_i^2}$$

Where r = number of replications,

S_i^2 = error mean square of the corresponding character. W_iP_i for each location, where P_i's are the location totals for the corresponding character.

$\Sigma W_i t_i$ for each variety, where t_i's are the means for each variety at each location.

S_i = The column wise sum of squares.

The various items in the analysis of variance were calculated as follows.

$$\text{Total sum of squares} = \Sigma W_i S_i - C = SS_T$$

$$\text{Where, } C = \frac{G^2}{t \Sigma W_i}, \quad G = \Sigma(\Sigma W_i t_i) = \Sigma W_i P_i$$

t = number of varieties

$$\text{Location sum of squares} = \frac{1}{t}\Sigma(W_i P_i^2) - C = SS_L$$

$$\text{Variety sum of squares} = \frac{\Sigma(\Sigma W_i t_i)^2 - C}{\Sigma W_i} = SS_V$$

Variety x Location sum of squares = Total sum of squares-

Location sum of squares-Variety sum of squares = SS_{VL}

Source of variation	Sum of squares
Locations	SS_L
Varieties	SS_V
Variety x Location	SS_{VL}
Total	SS_T

For testing the significance of variety x location interaction, $\chi^2 = \frac{(n-4)(n-2)}{n(n+t-3)} \times I$ was compared with the table value of χ^2 having $\frac{(p-1)(t-1)(n-4)}{(n+t-3)}$ degrees of freedom where,

$I = SS_{VL}$

n = degrees of freedom for error

p = number of locations

t = number of varieties

The significant χ^2 values indicated that the varieties differed from location to location with respect to the particular character. Hence the relevant varietal differences were tested by comparing the variety and interaction mean squares obtained from an unweighted analysis.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	'F' ratio
Locations	(l-1)	$\frac{\sum_j L_j^2}{v} - C = SS_L$	$SS_L/(l-1) = MS_L$	
Varieties	(v-1)	$\frac{\sum_i V_i^2}{l} - C = SS_V$	$SS_V/(v-1) = MS_V$	MS_V/MS_{VL}
Variety x location	(v-1)(l-1)	$SS_T - (SS_L + SS_V) = SS_{VL}$	$SS_{VL}/(v-1)(l-1) = MS_{VL}$	
Total	(vl-1)	$\sum_{ij} Y_{ij}^2 - C = SS_T$		

Where, L_j's are the location totals, $j = 1,2,---l$

V_i's are the treatment totals, $i = 1,2,---v$

Y_{ij}'s are the individual observations

The ratio MS_V/MS_{VL} follows an 'F' distribution with (v-1) and (v-1)(l-1) degrees of freedom and provides a test of significance of varieties.

Non-significant χ^2 values indicated the absence of interaction. Under such a condition, no general test for overall treatment difference was available. Hence the treatment means were tested individually.

(iv) Genotypic, phenotypic and environmental variances were estimated for each character as follows:

Genotypic variance (V_g) = $\frac{MS_V - MS_E}{r}$

Where, MS_V = Mean square of varieties

MS_E = Error mean square

r = Number of replications

Environmental variance (Ve) = MS_E

Phenotypic variance (Vp) = Genotypic variance + Environmental variance

v) Coefficients of variation for the various characters were calculated as:

Genotypic coefficient of variation (Vg) = $\frac{\sqrt{V(g)}}{Mean} \times 100$

Phenotypic coefficient of variation (Vp) = $\frac{\sqrt{V(p)}}{Mean} \times 100$

Mean here refers to the general mean of all the 40 varieties for the particular character.

(vi) Heritability in the broad sense was calculated for the various characters as follows:

Heritability = $\frac{\text{Genotypic variance}}{\text{Phenotypic variance}} \times 100$

II. <u>Correlation studies</u>

(i) Genotypic, phenotypic and environmental covariances between pairs of characters were calculated as:

Genotypic covariance between x_1 and x_2 (Cov. $g_1 \cdot g_2$)

$$= \frac{MSP_V - MSP_E}{r}$$

Where MSP_V = Mean sum of products of varieties

MSP_E = Mean sum of products of error

Environmental covariance ($Cov.e_1.e_2$) = MSP_E

Phenotypic covariance ($Cov.p_1.p_2$) = Genotypic covariance + Environmental covariance

(ii) Correlations between pairs of characters in all possible combinations were calculated as a measure of the degree of association between them.

$$\text{Genotypic correlation between } x_1 \text{ and } x_2 \;(r_g) = \frac{\text{Genotypic co-variance of } (x_1, x_2)}{\sqrt{\text{Genotypic variance of } (x_1 \times \text{Genotypic variance of } x_2)}}$$

$$\text{Phenotypic correlation between } x_1 \text{ and } x_2 \;(r_p) = \frac{\text{Phenotypic co-variance of } (x_1, x_2)}{\sqrt{\text{Phenotypic variance of } (x_1 \times \text{Phenotypic variance of } x_2)}}$$

The genotypic correlation coefficient (r_g) was tested by calculating the standard error of the genotypic correlation coefficient as suggested by Narain et al. (1979).

V(rg) = Variance of genotypic correlation coefficient $r_{(g)}$

$$= \frac{1}{(f+1)}\left[\tfrac{1}{2}(1-\hat{r}g^2)^2 - \tfrac{1}{2}(1-\hat{r}g^2)\left(\frac{1}{D} - \frac{\hat{r}p\,\hat{r}g}{C} + 4\left(\frac{\hat{r}g}{D} - \frac{\hat{r}p}{C}\right)^2 + \frac{2(1-\hat{r}g^2)^2\,(1-\hat{r}p^2)}{C^2}\right]$$

Where, f = error degrees of freedom

$$\frac{1}{D} = \frac{1}{2}\left(\frac{1}{h_x^2} + \frac{1}{h_y^2}\right) \quad \text{and } C = \sqrt{h_x^2\, h_y^2}$$

$\hat{rg}$ and $\hat{rp}$ are the genotypic and phenotypic correlations between the two characters respectively

h_x^2 = heritability estimate of character x

h_y^2 = heritability estimate of character y.

$SE(\hat{rg}) = \sqrt{V(\hat{rg})}$, where $SE(\hat{rg})$ is the standard error of the genotypic correlation coefficient. The significance of genotypic correlation $(\hat{rg})$ values were tested by applying the students' 't' test given by $\frac{|\hat{rg}|}{SE(\hat{rg})}$ with error degrees of freedom.

The phenotypic correlation coefficient (rp) was tested for significance with reference to the critical values of 'r' at n-2 degrees of freedom from table VI of Fisher and Yates where 'n' is the total number of observations. The significance of environmental correlation coefficient (re) was also tested with reference to the critical values of 'r' from the same table at error degrees of freedom.

III. <u>Selection index</u>

On the basis of characters having significant contribution to yield a selection index was formulated. A discriminant function was applied as a basis for making simultaneous selection for these characters and to discriminate the desirable genotypes from the undesirable ones on the basis of their phenotypic performance as suggested by Singh and Choudhary (1977).

The genetic worth of an individual (H) is defined as:

$$H = a_1G_1+a_2G_2 + ------ + a_nG_n$$

where G_1, G_2, - - -, G_n are the genotypic values of individual characters and a_1, a_2, - - -, a_n signify their relative economic importance. Another function (I) based on phenotypic performance of various characters was defined as:

$$I = b_1p_1+b_2p_2 + ------ +b_np_n$$

Where b_1, b_2, - - - -, b_n are to be estimated such that the correlation between H and I, i.e. r(H,I) became maximum. Once such a function was obtained, the discrimination of desirable genotypes from the undesirable ones would be possible on the basis of their phenotypic performance, i.e. p_1, p_2, p_2- - - , p_n directly.

As the first step, the genotypic and phenotypic variances and covariances of the selected characters were written down in a matrix form. Yield and the component characters were assumed to have equal economic importance. In this particular case, where yield and 3 characters contributing to yield were selected,

$$a_1 = a_2 = a_3 = a_4 = 1$$

Then the simultaneous equation was written in a maxtix form as follows:

$$\begin{bmatrix} P_{11} & P_{12} & P_{13} & P_{14} \\ P_{21} & P_{22} & P_{23} & P_{24} \\ P_{31} & P_{32} & P_{33} & P_{34} \\ P_{41} & P_{42} & P_{43} & P_{44} \end{bmatrix} \begin{bmatrix} b_1 \\ b_2 \\ b_3 \\ b_4 \end{bmatrix} = \begin{bmatrix} G_{11} & G_{12} & G_{13} & G_{14} \\ G_{21} & G_{22} & G_{23} & G_{24} \\ G_{31} & G_{32} & G_{33} & G_{34} \\ G_{41} & G_{42} & G_{43} & G_{44} \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

Where, P_{11}, P_{12}, - - - etc. are the phenotypic variance-covariance matrix and G_{11}, G_{12}, - - - etc. the genotypic variance-covariance matrix.

The regression coefficient b_i was calculated as $b_i = p^{-1}G_a$.

The inverse of phenotypic variance matrix, p^{-1}, was prepared by the Doolittle method. This was then multiplied by the genotypic variance-Covariance matrix. The resultant $p^{-1}G$ was then multiplied by a_i vector to get b_i values.

The mathematical description of the function (I) is known as the selection index - $I = b_1p_1 + b_2p_2 + - - - - + b_np_n$. Using this function, the selection criterion or the index value for each individual was determined and the varieties ranked accordingly.

The selection index was prepared separately for both the locations and 30% selection exercised. Top ranking 12 varieties suited for the two locations were thus identified.

The gain in efficiency through this indirect selection was calculated as follows:

(a) Genetic advance due to discriminant function =

$$\frac{\sum_i \sum_j a_i b_j \times g_{ij}}{\sqrt{\sum_i \sum_j b_i b_j \times t_{ij}}} \times \frac{Z}{q} \text{ at q\% intensity of selection}$$

(b) Genetic advance due to straight selection for the same intensity

$$= \frac{\sum_i \sum_j a_i a_j \times g_{ij}}{\sqrt{\sum_i \sum_j a_i a_j \times t_{ij}}} \times \frac{Z}{q}$$

Where 'Z' is the value of Normal Probability Integral at 'q' % intensity of selection

g_{ij} = genotypic variance-Covariance matrix

t_{ij} = phenotypic variance-Covariance matrix

a_i and a_j are the economic weightages

b_i and b_j are the regression coefficients.

The percentage gain in efficiency was calculated as:

$$\left[\left(\frac{\text{Genetic advance due to discriminant function}}{\text{Genetic advance due to straight selection}}\right) -1\right] \times 100$$

RESULTS

RESULTS

The data on trials at the two locations (summer rice fallows and kharif uplands) with 40 varieties were subjected to analyses of variance. The various genetic parameters such as variances (genotypic, phenotypic and environmental), coefficients of variation (genotypic and phenotypic), heritability and correlations (genotypic and phenotypic) were computed for the different characters for the two locations. The important yield contributing characters were identified and a selection model was fitted for both the locations separately. The results on the various aspects are presented below.

i) Analysis of variance

The analysis of variance was done separately for each character at the two locations. Pooled analysis was also done to test the influence of environment on these characters.

1. Number of days to flowering:

The analysis of variance presented in Appendix-I revealed that the varieties were on par in rice fallows. However, significant differences in mean values among the different varieties were recorded under upland conditions. Since the error variances were heterogenous, a weighted analysis was done to investigate the genotype x environment interaction. A χ^2 value of 65.9 revealed the existence of genotype x environment interaction. Hence the relevant treatment differences were tested against this interaction using an unweighted analysis but were found to be non-significant.

The mean values for the different varieties presented in table 2 indicated that the variability was rather restricted. The mean number of days to flowering in rice fallows ranged from 26 days for KG-61-240 to 30 days for EC.21118. In uplands, the mean ranged from 23 days for G.270 to 30 days for S-7-5-13. Varieties ICG.3859, Ah.6915 and Big Japan were on par with S-7-5-13, the variety having the longest flowering duration and TG.17 was on par with G.270, having the shortest flowering duration. The standard varieties TMV-2 and TMV-7 had medium flowering duration and did not fall into either of the above groups.

2. Number of days to maturity:

The analysis of variance presented in Appendix-2 revealed significant differences among the 40 varieties under rice fallow and upland conditions. The error variances were homogenous, and hence an unweighted pooled analysis was done to investigate the genotype x environment interaction. The interaction was found to be significant and the treatment differences were tested against this interaction using unweighted analysis and found to be significant.

Table 2. Number of days to flowering

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	29	27	28
2.	EC.21118	30	27	29
3.	EC.116596	27	25	26
4.	ICG.3859	29	29	29
5.	EC.24412	30	26	28
6.	EC.21095	30	27	28
7.	S-7-5-13	28	30	29
8.	EC.2100	30	26	28
9.	EC.112027	29	26	28
10.	B.353	28	26	27
11.	EC.21079	27	28	28
12.	EC.35999	29	26	28
13.	EC.119704	28	27	28
14.	Ah.6915	27	29	28
15.	GAUG-I	28	26	27
16.	J.11	28	26	27
17.	Spanish Improved	28	26	27
18.	Dh-3-13	28	26	27
19.	Jyothi	29	26	28
20.	Exotic-6	27	26	27

Table 2 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	29	26	28
22.	TMV.10	30	26	28
23.	Ak.811	28	26	27
24.	EC.21078	30	25	28
25.	G.270	28	23	26
26.	TMV.2	28	26	27
27.	KG-61-240	26	26	26
28.	TMV.11	27	26	27
29.	Pollachi II	28	27	28
30.	TG.3	28	26	27
31.	TG.14	27	26	27
32.	TG.17	27	24	26
33.	TG.19	29	26	28
34.	Spanish peanut	28	27	28
35.	Pollachi I	28	28	28
36.	TMV.7	28	27	28
37.	Gangapuri	29	26	28
38.	Big Japan	27	29	28
39.	Co.1	29	26	28
40.	EC.21075	28	26	27
	C.D.	2.5	1.1	NS

The means of varieties presented in table 3, ranged from 97 days for B.353 and TMV-2 to 108 days for TG-14, TG-17, TG-19, TMV-7 and Gangapuri, in rice fallows. In uplands, the range was from 106 days for EC.21127, EC.21118, EC.2100, EC.21078, KG-61-240, TG-19 and CO.1 to 125 days for EC.116596, EC.119704, Ah.6915 and Big Japan. TMV-2 had a duration of 108 days and TMV-7 matured in 107 days. A comparison of the pooled means, indicated that EC.21118 with 102 days matured earliest and EC.116596, EC.119704, Ah.6915 and Big Japan took the maximum of 116 days to mature. TMV-2 and TMV-7 took 103 days and 108 days respectively and were statistically on par with the shortest duration variety, EC.21118.

3. Number of primary branches per plant:

The results presented in Appendix-3 showed significant variability for the character at both the locations. Pooled analysis was done and the genotype x environment interaction was found to be significant. So the treatments were tested against this interaction and were significant.

The means are presented in table 4. A comparison of the means at the two locations for the different varieties is presented in Figure-1. The value ranged from 4.4 for EC.116596 and EC.24412 to 11.4 for EC.119704 in rice fallows. Varieties EC.2100, EC.112027, Jyothi, AK.811, EC.21078, G.270, KG 61-240, TMV-11, Pollachi-II, TG-14, TG-17, Pollachi-I, TMV-7, Gangapuri, CO-1 and EC.21075 were on par

Table 3. Number of days to maturity

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	99	106	103
2.	EC.21118	98	106	102
3.	EC.116596	107	125	116
4.	ICG.3859	106	111	106
5.	EC.24412	102	109	106
6.	EC.21095	107	107	107
7.	S-7-5-13	105	111	108
8.	EC.2100	100	106	103
9.	EC.112027	101	107	104
10.	B.353	97	108	103
11.	EC.21079	99	108	104
12.	EC.35999	107	109	108
13.	EC.119704	106	125	116
14.	Ah.6915	106	125	116
15.	GAUG-I	105	107	106
16.	J.11	107	108	108
17.	Spanish Improved	100	107	104
18.	Dh-3-13	107	107	107
19.	Jyothi	102	105	104
20.	Exotic-6	99	107	103

Table 3 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	101	110	106
22.	TMV.10	105	108	107
23.	Ak.811	107	107	107
24.	EC.21078	106	106	106
25.	G.270	106	107	107
26.	TMV.2	97	108	103
27.	KG-61-240	100	106	103
28.	TMV.11	102	107	105
29.	Pollachi II	98	109	104
30.	TG.3	101	110	106
31.	TG.14	108	110	109
32.	TG.17	108	110	109
33.	TG.19	108	106	107
34.	Spanish peanut	98	107	103
35.	Pollachi I	105	108	107
36.	TMV.7	108	107	108
37.	Gangapuri	108	110	109
38.	Big Japan	106	125	116
39.	CO.1	102	106	104
40.	EC.21075	100	109	105
	C.D.	0	0	6.2

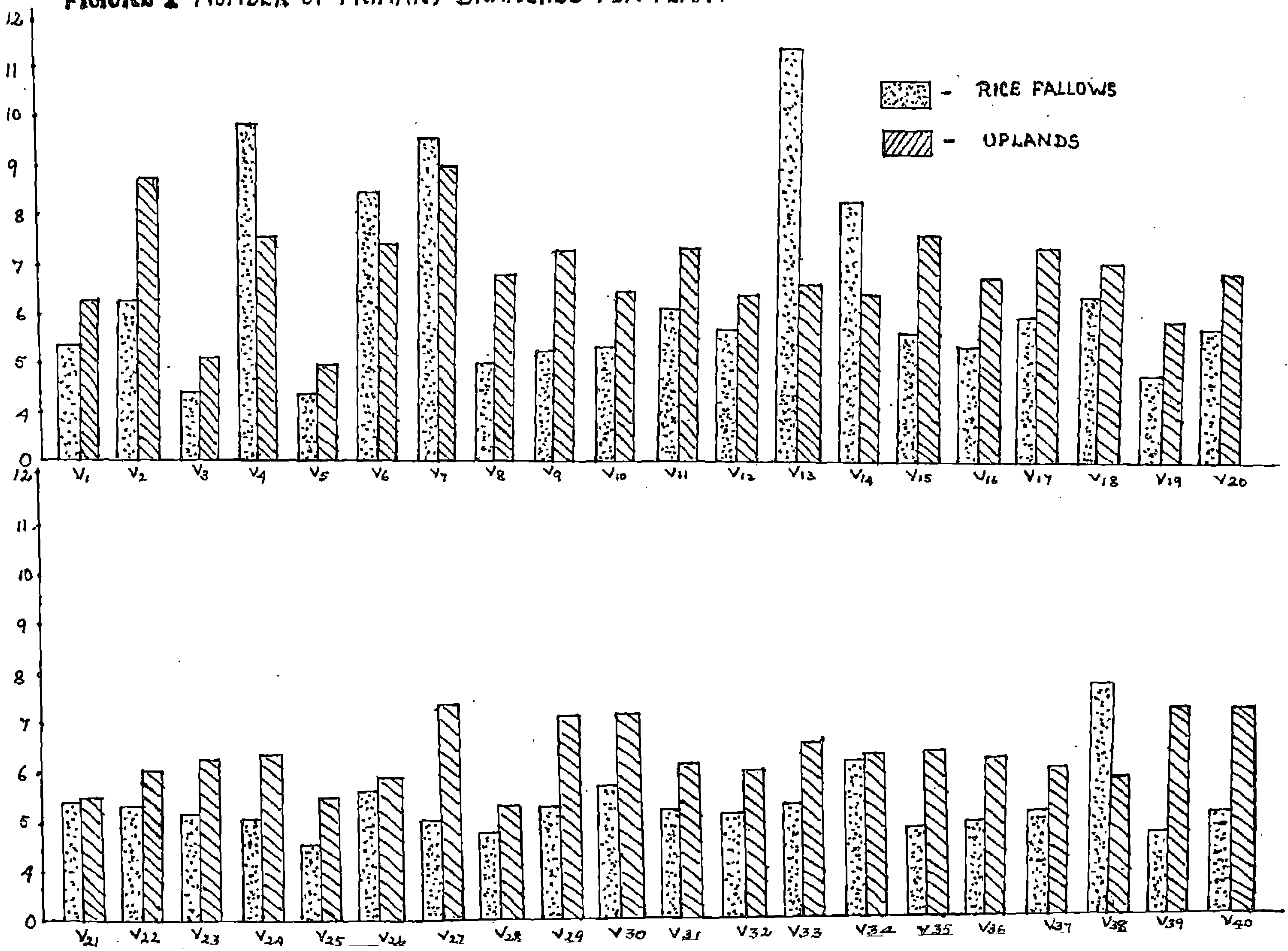
Table 4. Number of primary branches per plant

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	5.3	6.3	5.8
2.	EC.21118	6.2	8.7	7.5
3.	EC.116596	4.4	5.2	4.8
4.	ICG.3859	9.9	7.6	8.8
5.	EC.24412	4.4	5.0	4.7
6.	EC.21095	8.5	7.4	8.0
7.	S-7-5-13	9.6	9.0	9.3
8.	EC.2100	5.0	6.8	5.9
9.	EC.112027	5.2	7.3	6.3
10.	B.353	5.4	6.5	6.0
11.	EC.21079	6.1	7.3	6.7
12.	EC.35999	5.7	6.4	6.1
13.	EC.119704	11.4	6.6	9.0
14.	Ah.6915	8.3	6.4	7.4
15.	GAUG-I	5.6	7.6	6.6
16.	J.11	5.3	6.7	6.0
17.	Spanish Improved	5.9	7.3	6.6
18.	Dh-3-13	6.3	7.0	6.7
19.	Jyothi	4.7	5.8	5.3
20.	Exotic-6.	5.6	6.7	6.2

Table 4 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	5.4	5.5	5.5
22.	TMV.10	5.3	6.1	5.7
23.	Ak.811	5.2	6.3	5.8
24.	EC.21078	5.0	6.4	5.7
25.	G.270	4.5	5.5	5.0
26.	TMV.2	5.6	5.9	5.8
27.	KG-61-240	5.0	7.4	6.2
28.	TMV.11	4.7	5.3	5.0
29.	Pollachi II	5.2	7.1	6.2
30.	TG.3	5.7	7.2	6.5
31.	TG.14	5.2	6.1	5.7
32.	TG.17	5.1	6.0	5.6
33.	TG.19	5.3	6.6	6.0
34.	Spanish peanut	6.2	6.3	6.3
35.	Pollachi I	4.8	6.4	5.6
36.	TMV.7	5.0	6.3	5.7
37.	Gangapuri	5.1	6.0	5.6
38.	Big Japan	7.7	5.8	6.8
39.	CO.1	4.7	7.2	6.0
40.	EC.21075	5.1	7.2	6.2
	C.D.	0.84	1.28	2.78

FIGURE-1 NUMBER OF PRIMARY BRANCHES PER PLANT



with EC.116596, having the lowest mean. In uplands, the mean values ranged from 5.1 for EC.116596 to 9.0 for S-7-5-13. Several varieties such as TMV-2, TMV-7, TMV-9, Jyothi, TMV-11, TG-14 and TG-17 were on par with EC.116596. EC.21118 was the only variety on par with S-7-5-13, which had the highest mean.

The pooled means indicated EC.24412 as the variety having the lowest mean of 4.7. S-7-5-13 had the highest value of 9.3. TMV-2 and TMV-7 were on par with EC.24412. Varieties, EC.119704 and ICG.3859 were on par with S-7-5-13.

4. Height of plants:

The analysis of variance is presented in Appendix-4. Significant variability existed among the different varieties in rice fallows and uplands. Pooled analysis was done to estimate the genotype x environment interaction. Since the error variances were homogenous, an unweighted analysis was done, which revealed the absence of interaction. Significant differences were not observed in pooled means.

Table 5 gives the means of varieties at the two locations. In rice fallows, the value ranged from 49 cm for S-7-5-13 to 91 cm for EC.116596. Varieties, EC.21127, EC.21118, ICG.3859, TMV-10, TMV-2, TMV-11, Spanish Improved and Pollachi-I were on par with S-7-5-13 whereas Jyothi, TMV-9, G.270, TMV-7 and Big Japan were on par with EC.116596, the tallest variety. In uplands, the means ranged from

Table 5. Height of plants (cm)

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	57	83	70
2.	EC.21118	60	80	70
3.	EC.116596	91	92	92
4.	ICG.3859	57	75	66
5.	EC.24412	62	77	70
6.	EC.21095	67	76	72
7.	S-7-5-13	49	66	58
8.	EC.2100	72	62	67
9.	EC.112027	75	83	79
10.	B.353	70	77	74
11.	EC.21079	73	74	74
12.	EC.35999	65	77	71
13.	EC.119704	68	69	69
14.	Ah.6915	70	70	70
15.	GAUG-I	66	82	74
16.	J.11	71	72	72
17.	Spanish Improved	55	79	67
18.	Dh-3-13	69	75	72
19.	Jyothi	77	82	80
20.	Exotic-6	65	86	76

Table 5. (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	79	88	84
22.	TMV.10	58	73	66
23.	Ak.811	66	77	72
24.	EC.21078	67	76	72
25.	G.270	90	95	93
26.	TMV.2	57	72	65
27.	KG-61-240	68	84	76
28.	TMV.11	57	84	71
29.	Pollachi II	70	85	78
30.	TG.3	62	74	68
31.	TG.14	53	76	65
32.	TG.17	60	65	63
33.	TG.19	71	68	70
34.	Spanish peanut	69	78	74
35.	Pollachi I	63	65	64
36.	TMV.7	80	89	85
37.	Gangapuri	74	90	82
38.	Big Japan	77	79	78
39.	CO.1	73	80	77
40.	EC.21075	61	74	68
	C.D.	14.1	13.3	17.3

62 cm for EC.2100 to 95 cm for G.270. Varieties ICG.3859, S-7-5-13, EC.119704, J-11, TMV-2 and Pollachi-I were on par with EC.2100 with the minimum height. Likewise, varieties EC.21127, Jyothi, TMV-9, TMV-11, TMV-7, Pollachi-II and Gangapuri were on par with G.270 having maximum height. A graphic representation of the height of plants of the 40 varieties at the two locations is given in Figure-2. A comparison of the pooled means showed S-7-5-13 as the shortest variety with a height of 58 cm. ICG-3859, EC.2100, Spanish Improved, TMV-10 and TMV-2, were on par with this. G.270 had the maximum height of 93 cm. EC.112027, Dh-3-13, TMV-9, EC.116596, TMV-7 and Gangapuri performed similarly.

5. Number of mature pods per plant:

The analysis of variance presented in Appendix-5 revealed significant difference in the means of different varieties in rice fallows as well as uplands. The error variances were heterogenous, and the weighted pooled analysis was done. A χ^2 value of 38.2 revealed significant genotype x environment interaction, The varieties differed significantly on testing against this interaction.

The means for summer rice fallows ranged from 22 for Gangapuri to 37 for TG-14 (Table 6). The number of mature pods per plant for the 40 varieties at the two locations are graphically represented in Figure-3. Varieties EC.21127, S-7-5-13, EC.24412, Ah-6915, Spanish Improved, Exotic-6,

FIGURE-2 HEIGHT OF PLANTS

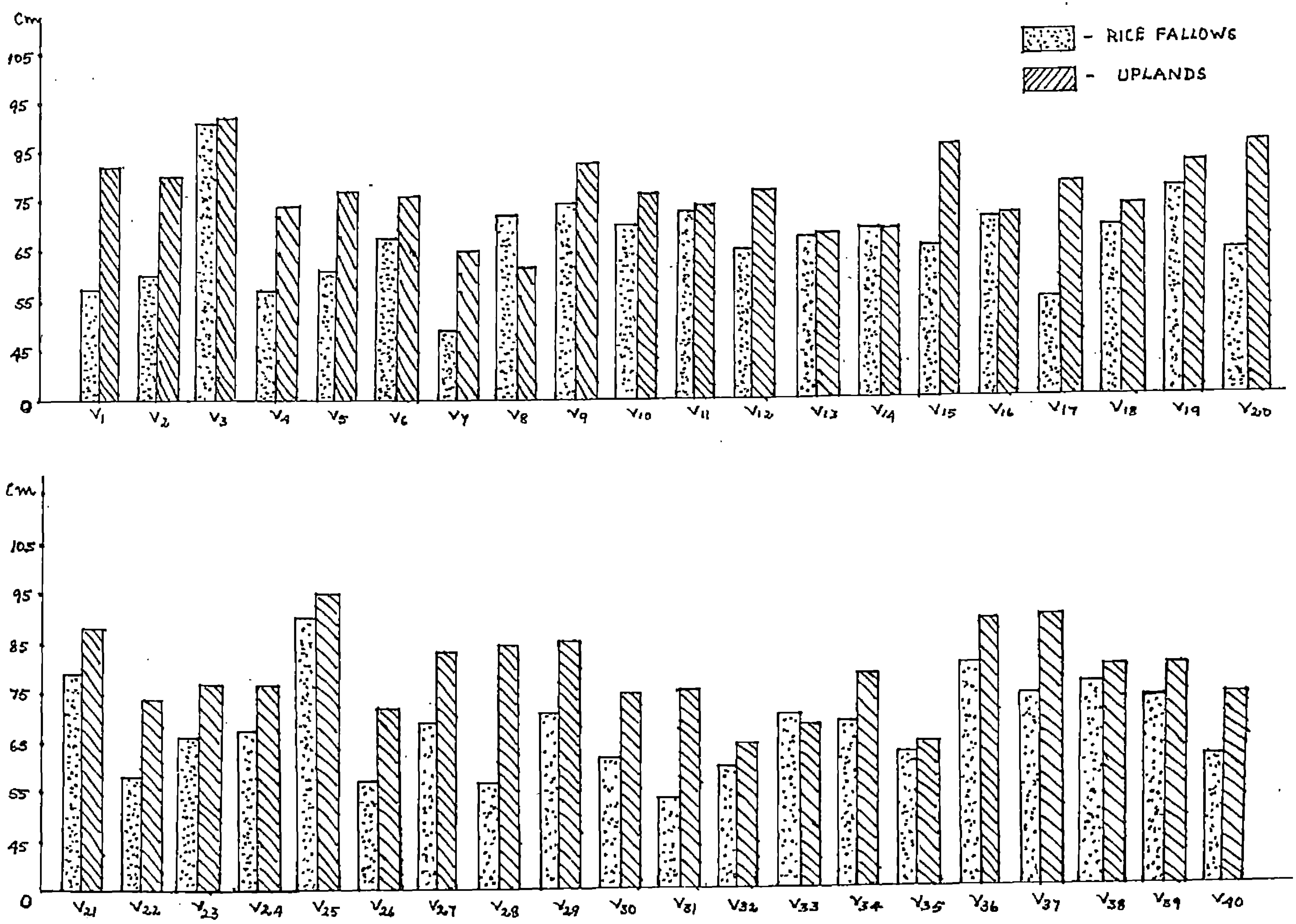


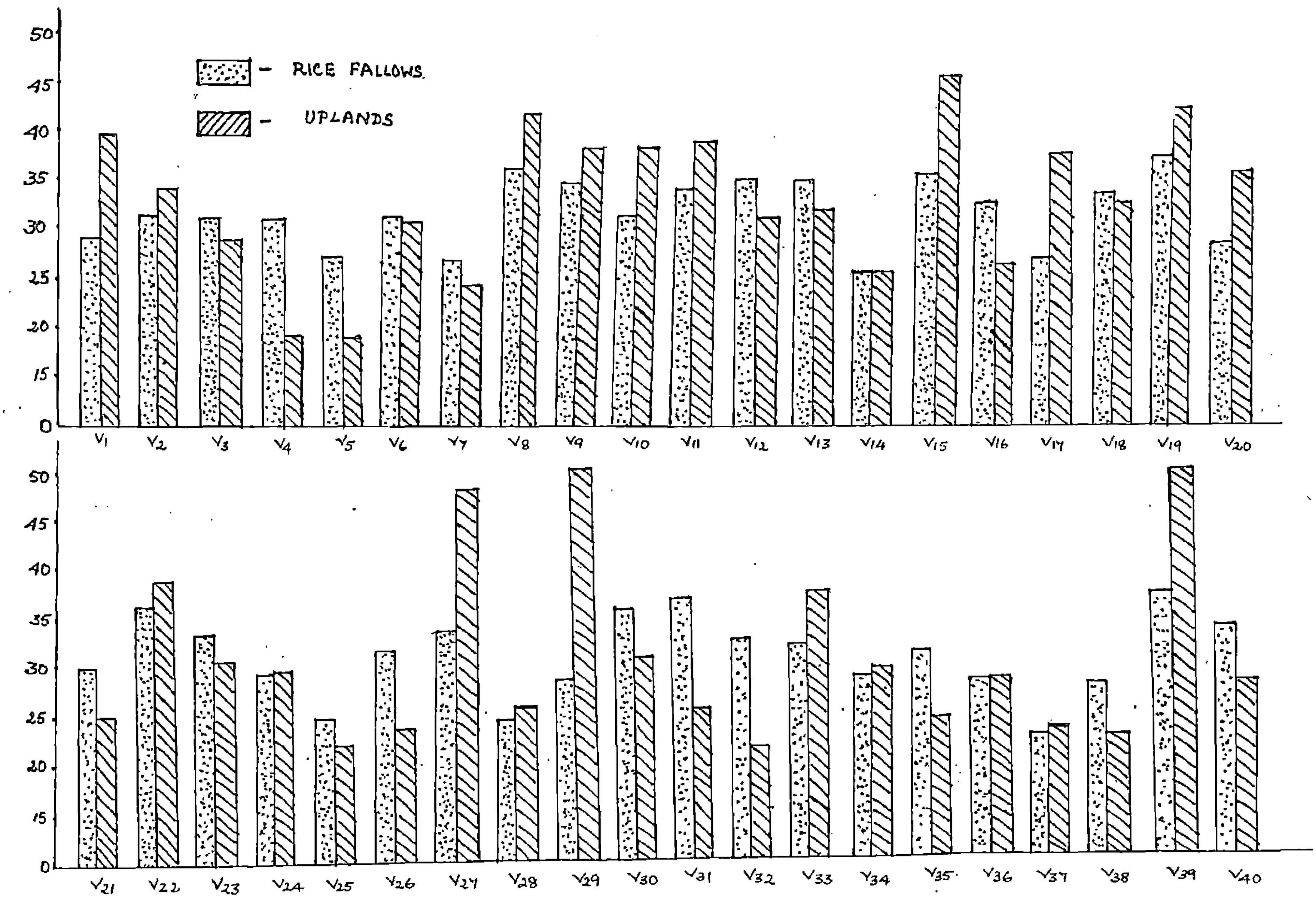
Table 6. Number of mature pods per plant

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	29	40	35
2.	EC.21118	31	34	33
3.	EC.116596	32	29	31
4.	ICG.3859	31	19	25
5.	EC.24412	28	19	24
6.	EC.21095	32	31	32
7.	S-7-5-13	27	25	26
8.	EC.2100	36	42	39
9.	EC.112027	35	38	37
10.	B.353	32	39	36
11.	EC.21079	34	39	37
12.	EC.35999	35	31	33
13.	EC.119704	35	32	34
14.	Ah.6915	26	26	26
15.	GAUG-I	36	46	41
16.	J.11	33	26	30
17.	Spanish Improved	27	38	33
18.	Dh-3-13	33	33	33
19.	Jyothi	37	42	40
20.	Exotic-6	28	36	32

Table 6 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	30	25	28
22.	TMV.10	36	39	38
23.	Ak.811	33	31	32
24.	EC.21078	29	29	29
25.	G.270	25	22	24
26.	TMV.2	32	24	28
27.	KG-61-240	33	48	41
28.	TMV.11	25	26	26
29.	Pollachi II	29	41	35
30.	TG.3	35	31	33
31.	TG.14	37	25	31
32.	TG.17	33	21	27
33.	TG.19	32	37	35
34.	Spanish peanut	29	29	29
35.	Pollachi I	31	24	28
36.	TMV.7	28	28	28
37.	Gangapuri	22	23	23
38.	Big Japan	28	22	26
39.	CO.1	36	49	43
40.	EC.21075	33	27	30
	C.D.	7.9	12.6	13.2

FIGURE-3 NUMBER OF MATURE PODS PER PLANT



TMV-9, TMV-7, TMV-11, Pollachi-II, and Big Japan were on par with Gangapuri, possessing the minimum number. Varieties EC.116596, ICG.3859, EC.2100, B.353, GAUG-I, J-11, Jyothi, TMV-2, TMV-10, TG-3 and CO-1 were on par with TG-14, with maximum number. In uplands, EC.24412 and ICG.3859 with 19 pods per plant were the varieties with minimum number. Several varieties like EC.21095, S-7-5-13, Ah.6915, J-11, TMV-9, G.270, TMV-2, TMV-11, TG-14, TG-17, TMV-7, Gangapuri and Big Japan were similar to EC.24412 and ICG.3859. CO-1 yielded the maximum of 49 pods per plant and EC.21127, EC.2100, B.353, GAUG-I, Jyothi, KG-61-240, Pollachi-II were on par with CO-1.

Comparing the pooled means, EC.24412 and G.270 with 24 pods had the lowest number of pods per plant. Varieties, ICG.3859, S-7-5-13, Ah.6915, TMV-2, TMV-11, TMV-7 and Gangapuri had similar values. CO-1 was ranked at the top with 43 mature pods per plant. Varieties such as GAUG-I, Jyothi, TMV-10, KG-61-240 and EC.2100, were on par with this top ranking variety.

6. Number of immature pods per plant:

Appendix-6 giving the analysis of variance revealed significant difference among the 40 varieties in rice fallows. But no significant difference was noted among these varieties in uplands. Since the error variances were heterogenous, a weighted analysis was done to test the variety x environment interaction. A χ^2 value of 54.5 revealed the significant influence of environment. Pooled means were not significantly different when tested against this interaction.

The means for the two locations are given in table 7. The values ranged from 4 for EC.21078 to 25 for ICG.3859, in rice fallows. Varieties EC.21127, EC.21095, EC.35999, GAUG-I, Jyothi, TMV-9, G.270, TMV-2, TG-3, TMV-7 and CO-1 were on par with EC.21078. S-7-5-13 was the only variety on par with EC.21078, which had the maximum number of immature pods per plant. The range of variability for this character was very limited in uplands. The mean number of immature pods per plant ranged from 5 for TMV-10 to 18 for EC.116596.

7. Number of pegs per plant:

The analysis of variance presented in Appendix-7 indicated significant difference in the means of varieties in rice fallows and uplands. Since the error variances were heterogenous, a weighted analysis was done to investigate the variety x environment interaction. The interaction being significant, the pooled means were compared against this interaction and found to be non-significant.

Table-8 gives the means in rice fallows and uplands. In rice fallows, the range was from 23 for TMV-2 and 108 for EC.116596. Varieties which were on par with TMV-2,

Table 7. Number of immature pods per plant

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	4.7	9.7	7.2
2.	EC.21118	6.4	16.5	11.5
3.	EC.116596	7.1	17.7	12.4
4.	ICG.3859	25.1	12.3	18.7
5.	EC.24412	5.4	11.9	8.7
6.	EC.21095	4.6	7.7	6.2
7.	S-7-5-13	22.7	10.5	16.6
8.	EC.2100	5.5	8.0	6.8
9.	EC.112027	3.9	6.5	5.2
10.	B.353	6.4	9.7	8.1
11.	EC.21079	8.4	8.6	8.5
12.	EC.35999	4.7	6.6	5.7
13.	EC.119704	11.1	12.6	11.9
14.	Ah.6915	9.0	13.1	11.1
15.	GAUG-I	4.7	9.4	7.1
16.	J.11	5.4	4.9	5.2
17.	Spanish Improved	5.9	12.2	9.1
18.	Dh-3-13	6.5	8.4	7.5
19.	Jyothi	4.5	7.3	5.9
20.	Exotic-6	7.2	8.0	7.6

Table 7 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	4.5	7.7	6.1
22.	TMV.10	5.3	5.3	5.3
23.	Ak.811	5.0	6.3	5.7
24.	EC.21078	3.9	12.0	8.0
25.	G.270	4.1	9.2	6.7
26.	TMV.2	5.1	8.9	7.0
27.	KG-61-240	4.8	13.1	9.0
28.	TMV.11	5.6	12.4	9.0
29.	Pollachi II	6.3	7.2	6.8
30.	TG.3	4.6	11.6	8.1
31.	TG.14	7.3	16.1	11.7
32.	TG.17	10.2	14.9	12.6
33.	TG.19	5.5	8.7	7.1
34.	Spanish peanut	5.5	9.9	7.7
35.	Pollachi I	6.4	9.8	8.1
36.	TMV.7	4.2	14.6	9.4
37.	Gangapuri	5.1	7.2	6.2
38.	Big Japan	13.2	9.7	11.5
39.	CO.1	4.7	6.3	5.5
40.	EC.21075	14.1	13.1	13.6
	C.D.	4.83	7.85	NS

Table 8. Number of pegs per plant

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	45	57	51
2.	EC.21118	32	20	26
3.	EC.116596	108	33	71
4.	ICG.3859	86	59	73
5.	EC.24412	61	71	66
6.	EC.21095	51	58	55
7.	S-7-5-13	70	42	56
8.	EC.2100	54	64	59
9.	EC.112027	66	60	63
10.	B.353	40	52	46
11.	EC.21079	48	42	45
12.	EC.35999	49	39	44
13.	EC.119704	75	30	53
14.	Ah.6915	70	36	53
15.	GAUG.I	43	20	32
16.	J.11	53	48	51
17.	Spanish Improved	27	47	37
18.	Dh-3-13	49	38	44
19.	Jyothi	49	17	33
20.	Exotic-6	49	52	50

Table 8 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	50	38	44
22.	TMV.10	49	32	41
23.	Ak.811	45	50	48
24.	EC.21078	52	58	55
25.	G.270	79	60	70
26.	TMV.2	23	29	26
27.	KG-61-240	48	27	38
28.	TMV.11	58	57	58
29.	Pollachi II	51	56	54
30.	TG.3	53	41	47
31.	TG.14	50	39	45
32.	TG.17	103	72	88
33.	TG.19	68	51	60
34.	Spanish peanut	24	61	43
35.	Pollachi I	40	38	39
36.	TMV.7	73	68	71
37.	Gangapuri	69	41	55
38.	Big Japan	72	30	51
39.	CO.1	65	56	61
40.	EC.21075	38	35	37
	C.D.	26.6	15.6	NS

included EC.21127, B-353, EC.35999, GAUG-I, Spanish Improved and TMV-10. Varieties on par with EC.116596 included ICG.3859 and TG-17. TMV-7 was intermediate with respect to this character. Under upland conditions, the range was from 17 for Jyothi to 72 for TG-17. Varieties EC.21118, EC.119704, GAUG-I, TMV-10, TMV-2, KG-61-240 and Big Japan were on par with Jyothi. Varieties ICG.3859, EC.24412, G.270, TMV-11 and TMV-7 were on par with TG-17 with maximum number of pegs per plant.

8. Weight of haulms per plant:

Appendix-8 presents the analyses of variance at the two locations and reveals significant differences among varieties in rice fallows and uplands. Since the error variances were heterogenous, a weighted analysis was performed to investigate the variety x environment interaction. A χ^2 value of 59.7 revealed the influence of environment. So the varieties were tested against this interaction and the differences in mean were significant.

The mean weight of haulms for rice fallows and uplands are given in table-9. The means ranged in rice fallows from 109 g for TMV-2 to 315 g for Ah.6915. Varieties EC.21118, EC.24412, GAUG-I, TMV-11, TG-14 and TG-3 were on par with TMV-2. Varieties ICG.3859, S-7-5-13, EC.119704, G.270 and Big Japan were similar to Ah.6915. The mean weight of haulms for TMV-7 was intermediate.

Table 9. Weight of haulms per plant (g)

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	186	91	139
2.	EC.21118	164	74	119
3.	EC.116596	188	100	144
4.	ICG.3859	291	150	221
5.	EC.24412	170	113	142
6.	EC.21095	198	96	147
7.	S-7-5-13	255	118	187
8.	EC.2100	216	84	150
9.	EC.112027	184	88	136
10.	B.353	151	80	116
11.	EC.21079	236	87	162
12.	EC.35999	183	84	134
13.	EC.119704	287	115	201
14.	Ah.6915	315	139	227
15.	GAUG.I	173	73	123
16.	J.11	183	71	127
17.	Spanish Improved	139	86	113
18.	Dh-3-13	200	85	143
19.	Jyothi	183	64	124
20.	Exotic-6	191	86	139

Table 9 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	247	98	173
22.	TMV.10	165	79	122
23.	Ak.811	174	57	116
24.	EC.21078	189	101	145
25.	G.270	270	98	184
26.	TMV.2	109	89	99
27.	KG-61-240	180	88	134
28.	TMV.11	162	102	132
29.	Pollachi II	220	108	164
30.	TG.3	155	103	129
31.	TG.14	141	92	117
32.	TG.17	165	87	126
33.	TG.19	206	77	142
34.	Spanish peanut	145	86	116
35.	Pollachi I	154	92	123
36.	TMV.7	229	119	174
37.	Gangapuri	215	96	156
38.	Big Japan	286	101	194
39.	CO.1	183	88	136
40.	EC.21075	147	87	117
	C.D.	67.3	32.0	80.7

In uplands, the range for mean values was from 57 g for AK.811 to 139 g for Ah.6915. Varieties which were on par with AK.811 included EC.21118, EC.112027, GAUG-I, TG-17, TMV-2 and Spanish peanut. Varieties ICG.3859, EC.24412, S-7-5-13, EC.119704, Pollachi-II and TMV-7 were on par, with Ah.6915.

Figure-4 gives a comparison in rice fallows and uplands. TMV-2 with 99 g, had the lowest pooled mean. The maximum weight of 227 g was recorded by the variety Ah.6915. Varieties EC.21118, B.353, Spanish Improved, AK.811, and TG-14, were on par with TMV-2. Varieties ICG.3859, EC.119704, G.270, Gangapuri and S-7-5-13 were on par with Ah.6915.

9. Fresh weight of mature pods per plant:

The analysis of variance for the two locations are presented in Appendix-9. Significant difference existed among varieties in rice fallows. In uplands, no significant difference was observed. To test the variety x environment interaction, a weighted analysis was done since the error variances were heterogenous at the two locations. A χ^2 value of 42.2 indicated the presence of variety x environment interaction. The varieties on testing against this interaction differed significantly.

The mean values at the two locations are given in table-10. In rice fallows, a range of 28 g for Pollachi-II

FIGURE-4 WEIGHT OF HAULMS PER PLANT

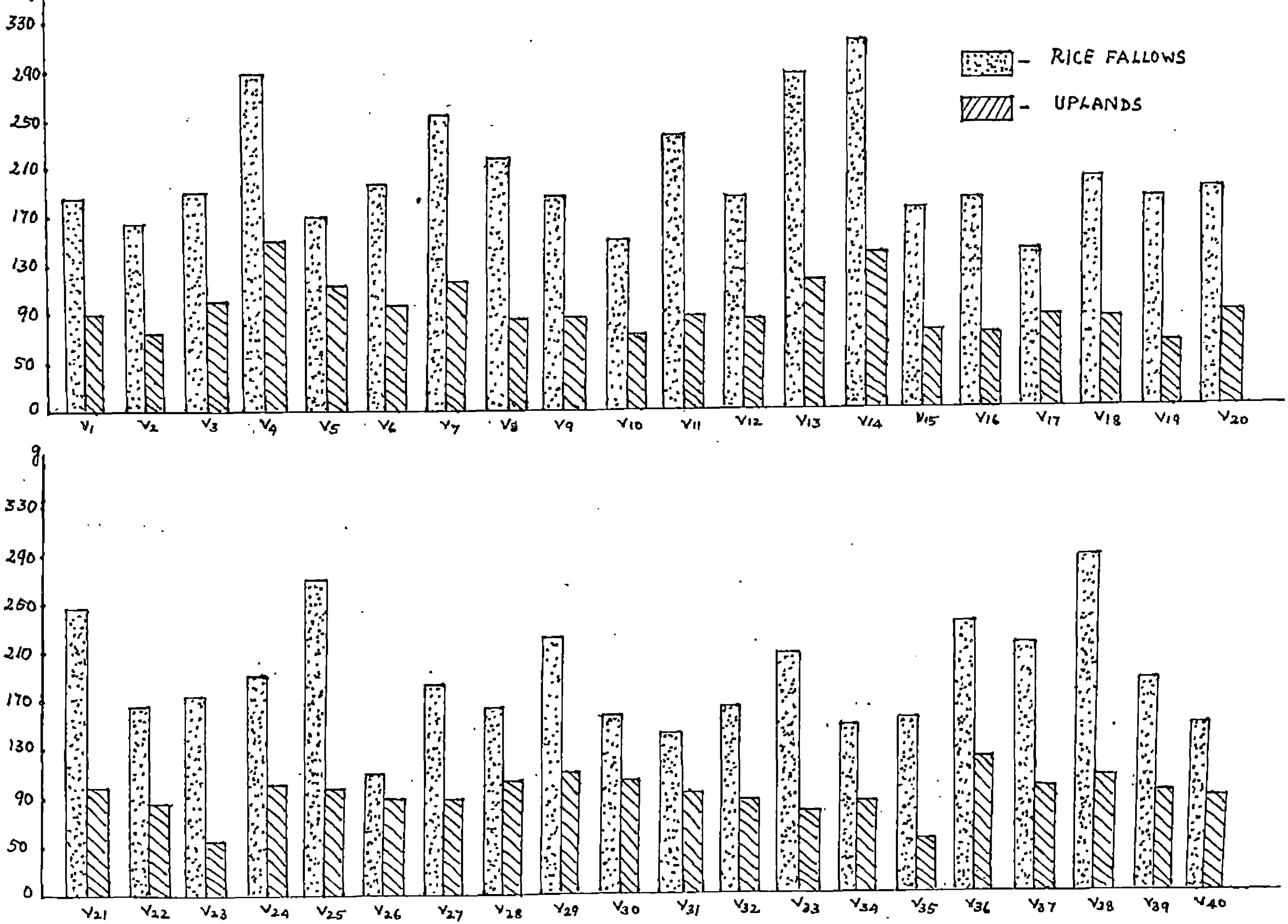


Table 10. Fresh weight of mature pods per plant (g)

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	28	43	36
2.	EC.21118	31	35	33
3.	EC.116596	49	57	53
4.	ICG.3859	52	33	43
5.	EC.24412	56	35	46
6.	EC.21095	35	32	34
7.	S-7-5-13	40	38	39
8.	EC.2100	33	40	37
9.	EC.112027	31	36	34
10.	B.353	32	39	36
11.	EC.21079	38	47	43
12.	EC.35999	47	50	49
13.	EC.119704	67	64	66
14.	Ah.6915	50	55	53
15.	GAUG.I	42	51	47
16.	J.11	42	33	38
17.	Spanish Improved	40	53	47
18.	Dh-3-13	41	48	45
19.	Jyothi	42	46	44
20.	Exotic-6	29	36	33

Table 10 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	33	33	33
22.	TMV.10	44	49	47
23.	Ak.811	38	42	40
24.	EC.21078	39	39	39
25.	G.270	45	36	41
26.	TMV.2	40	42	41
27.	KG-61-240	30	52	41
28.	TMV.11	43	47	45
29.	Pollachi II	28	47	38
30.	TG.3	47	40	44
31.	TG.14	64	47	56
32.	TG.17	63	42	53
33.	TG.19	42	48	45
34.	Spanish peanut	31	37	34
35.	Pollachi I	49	39	44
36.	TMV.7	40	38	39
37.	Gangapuri	40	42	41
38.	Big Japan	45	33	39
39.	CO.1	41	54	48
40.	EC.21075	38	43	41
	C.D.	12.1	18.0	20.2

to 67 g for EC.119704 was observed. Many varieties like EC.21127, EC.21118, S-7-5-13, Jyothi, TMV-9, Pollachi-II, TMV-2, TMV-7 and EC.21075 were on par with TMV-11. Varieties EC.24412, TG-14 and TG-17 were on par with EC.119704. The mean values ranged from 32 g for EC.21095 to 64 g for EC. 119704, in uplands. Varieties EC.21118, ICG.3859, EC.24412, GAUG-I, TMV-9, TMV-2, TG-3, TMV-7 and Big Japan were on par with EC.21095. Varieties EC.116596, Ah.6915, GAUG-I, Spanish Improved, KG-61-240 and CO-I were on par with EC.119704. On comparison of pooled means it was found that EC.21118, Exotic-6, and TMV-9 with a fresh weight of 33 g gave the lowest weight. Most of the varieties including TMV-2 and TMV-7 were statistically on par with the varieties having the lowest fresh weight. EC.119704 with a fresh weight of 66 g per plant was top ranking. TG-14 was on par with this variety.

10. Dry weight of mature pods per plant:

The analysis of variance for the two locations are presented in Appendix-10. Significant differences were seen in rice fallows but not in uplands. Since the error variances were heterogenous at the two locations, a weighted analysis was performed to test the variety x environment interaction. A χ^2 value of 31.9 was low indicating the absence of interaction. Hence, the varietal means were tested individually and were found to be significant.

The means in rice fallows and uplands are given in table 11. A comparison of the dry weight of mature pods per plant in rice fallows and uplands for the different varieties is provided in Figure-5. The range in rice fallows was from 15 g for S-7-5-13 to 33 g for EC.119704. Varieties EC.21127, ICG-3859, B.353, TMV-9, TMV-11, TMV-7 and Gangapuri were on par with S-7-5-13 whereas EC.35999, TG-3, TG-14, TG-17 and Dh-3-13, were similar to EC.119704. In uplands, the means ranged from 21 for ICG.3859 to 44 for EC.119704. Varieties EC.116596, Ah.6915, GAUG-I, Spanish Improved, KG-61-240, Pollachi-II, TG-19 and CO-I were on par with EC.119704, having the maximum dry weight of mature pods per plant. Most of the other varieties including TMV-2 and TMV-7 were similar to ICG.3859.

11. 100-pod weight:

The analysis of variance presented in Appendix-11 revealed significant differences among the 40 varieties at both the locations. Since the error variances at the two locations were heterogenous, a weighted analysis was done to test the variety x environment interaction. A computed χ^2 value of 76.2 revealed significant interaction between varieties and environment. So the varieties were tested against this interaction and found to be significant.

Table 12 gives the mean values for the 40 varieties at the two locations. In rice fallows, the means ranged

Table 11. Dry weight of mature pods per plant (g)

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	17	31	24
2.	EC.21118	18	25	22
3.	EC.116596	23	36	30
4.	ICG.3859	18	21	20
5.	EC.24412	25	22	24
6.	EC.21095	21	25	23
7.	S-7-5-13	15	25	20
8.	EC.2100	23	30	27
9.	EC.112027	23	27	25
10.	B.353	19	31	25
11.	EC.21079	25	33	29
12.	EC.35999	28	34	31
13.	EC.119704	33	44	39
14.	Ah.6915	19	36	28
15.	GAUG.I	24	36	30
16.	J.11	25	24	25
17.	Spanish Improved	20	37	29
18.	Dh-3-13	29	34	32
19.	Jyothi	23	32	28
20.	Exotic-6.	19	27	23

Table 11 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	20	22	21
22.	TMV.10	26	34	30
23.	Ak.811	23	30	27
24.	EC.21078	22	28	25
25.	G.270	21	25	23
26.	TMV.2	23	24	24
27.	KG-61-240	20	36	28
28.	TMV.11	22	31	27
29.	Pollachi II	17	35	26
30.	TG.3	29	27	28
31.	TG.14	32	31	32
32.	TG.17	28	30	29
33.	TG.19	23	34	29
34.	Spanish peanut	22	26	24
35.	Pollachi I	25	26	26
36.	TMV.7	22	27	25
37.	Gangapuri	19	27	23
38.	Big Japan	18	21	20
39.	CO.1	23	41	32
40.	EC.21075	25	28	27
	C.D.	7.3	12.7	NS

FIGURE-5 DRY WEIGHT OF MATURE PODS PER PLANT

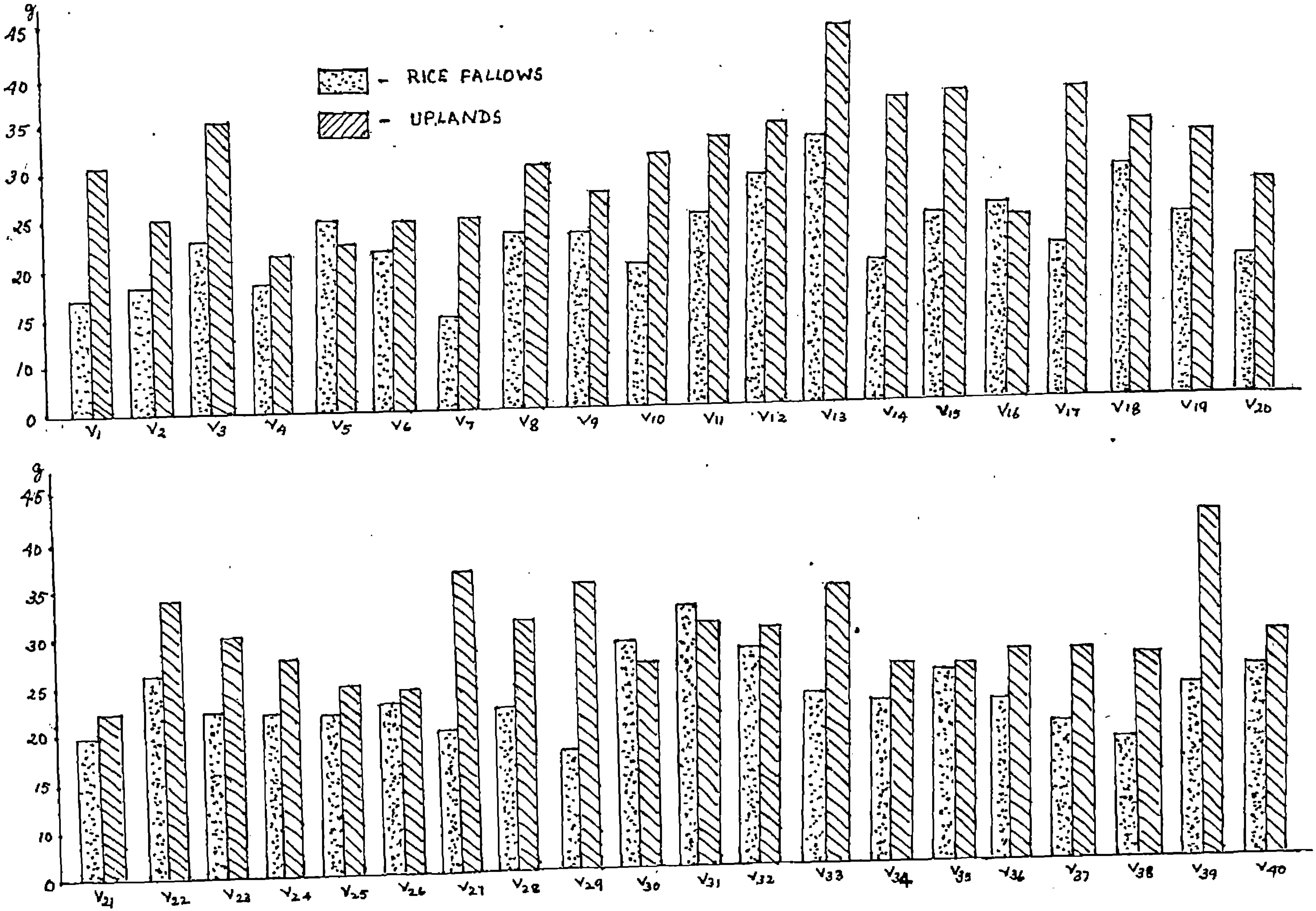


Table 12. 100-pod weight (g)

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	80	107	94
2.	EC.21118	83	104	94
3.	EC.116596	109	157	133
4.	ICG.3859	105	125	115
5.	EC.24412	133	163	148
6.	EC.21095	92	101	97
7.	S-7-5-13	91	120	106
8.	EC.2100	88	99	94
9.	EC.112027	86	101	94
10.	B.353	85	94	90
11.	EC.21079	94	96	95
12.	EC.35999	113	139	126
13.	EC.119704	139	162	151
14.	Ah.6915	136	180	158
15.	GAUG.I	92	108	100
16.	J.11	100	108	104
17.	Spanish Improved	103	126	115
18.	Dh-3-13	108	127	118
19.	Jyothi	87	94	91
20.	Exotic-6	90	102	96

Table 12 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	96	110	103
22.	TMV.10	94	96	95
23.	Ak.811	96	110	103
24.	EC.21078	107	129	118
25.	G.270	127	167	147
26.	TMV.2	111	133	122
27.	KG-61-240	82	96	89
28.	TMV.11	124	152	138
29.	Pollachi II	87	98	93
30.	TG.3	105	117	111
31.	TG.14	127	142	137
32.	TG.17	134	187	161
33.	TG.19	110	110	111
34.	Spanish peanut	104	116	110
35.	Pollachi I	110	142	126
36.	TMV.7	111	114	113
37.	Gangapuri	121	114	118
38.	Big Japan	108	119	114
39.	CO.1	84	92	88
40.	EC.21075	102	121	112
	C.D.	12.0	15.8	13.7

from 80 g for EC.21127 to 139 g for EC.119704. Varieties EC.21118, EC.21095, S-7-5-13, EC.2100, Pollachi-II and CO-I were on par with EC.21127. Varieties EC.24412, Ah.6915, G.270, TG-14 and TG-17 were similar to EC.119704 having the maximum mean weight. The range in uplands was from 92 g for CO-I to 187 g for TG-17. Many varieties like EC.21127, EC.21118, J-11, Jyothi, TMV-10 and Pollachi-II were on par with CO.I. Ah.6915 was the only variety on par with TG-17. Varieties TMV-2 and TMV-7 had intermediate values at both locations. Figure-6 graphically represents the 100-pod weight for 40 varieties at the two locations. CO-I had the lowest pooled mean of 88 g. Variety TG-17 with a mean of 161 g topped the list. Varieties EC.119704, G.270, EC.24412 and Ah.6915 were on par with TG-17.

12. 100-kernal weight:

The analysis of variance for 100-kernal weight for both the locations are presented in Appendix-12. Significant differences among varieties were recorded at both the locations. Since the error variances were homogenous, an unweighted analysis was done to test the variety x environment interaction. Absence of interaction indicated that the varieties did not differ from location to location. But the pooled varietal means differed significantly.

The mean values for rice fallows and uplands are given in table 13. The variety EC.116596 with a mean of

FIGURE-6 100-POD WEIGHT

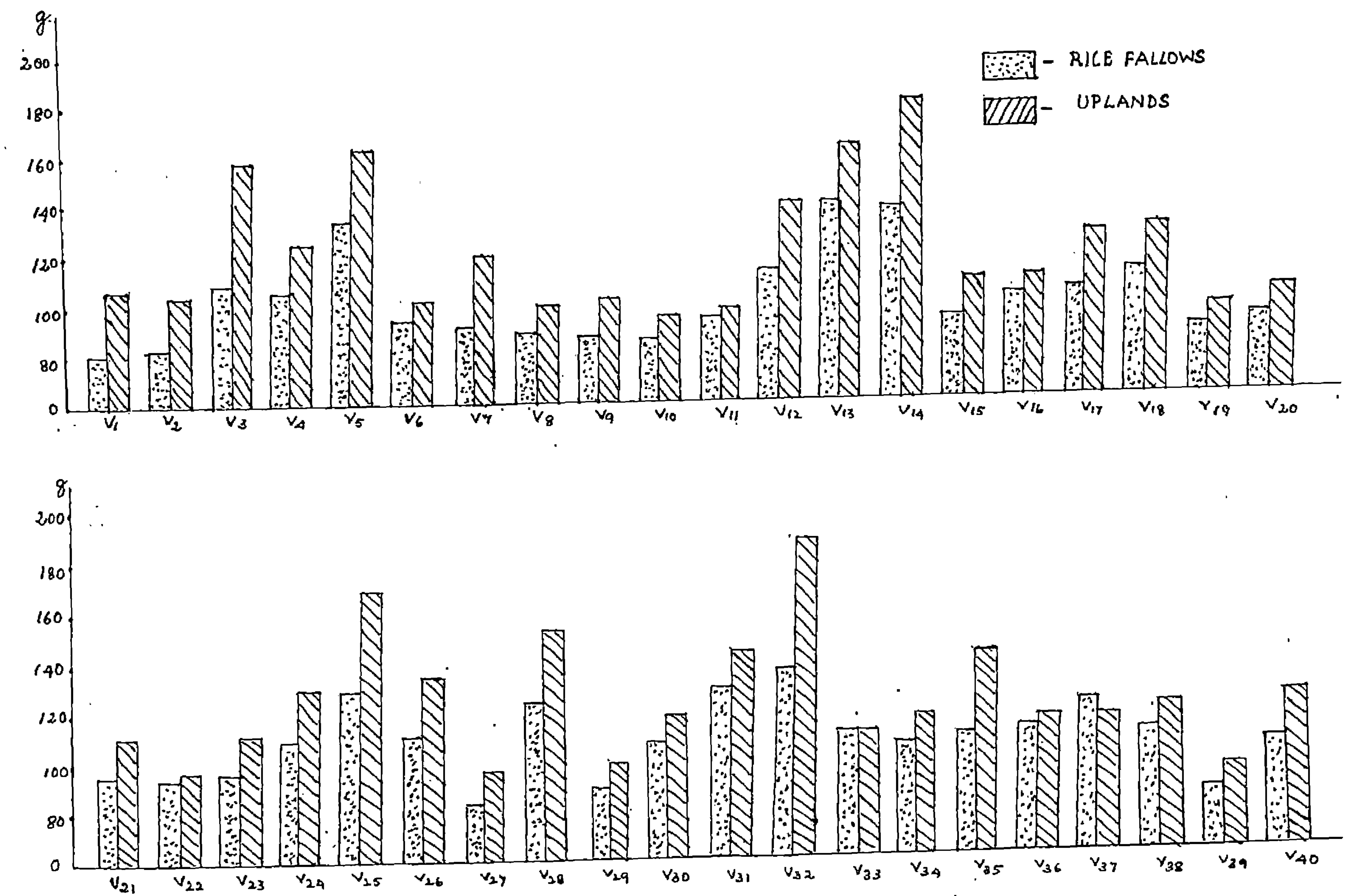


Table 13. 100-kernal weight (g)

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	28	45	37
2.	EC.21118	30	46	38
3.	EC.116596	27	43	35
4.	ICG.3859	37	50	44
5.	EC.24412	38	51	45
6.	EC.21095	37	45	41
7.	S-7-5-13	36	54	45
8.	EC.2100	35	43	39
9.	EC.112027	33	41	37
10.	B.353	32	39	36
11.	EC.21079	38	27	33
12.	EC.35999	44	46	45
13.	EC.119704	51	55	53
14.	Ah.6915	47	57	52
15.	GAUG.I	36	44	40
16.	J.11	37	42	40
17.	Spanish Improved	35	54	45
18.	Dh-3-13	40	54	47
19.	Jyothi	31	38	35
20.	Exotic-6	34	43	39

Table 13. (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	34	44	39
22.	TMV.10	30	37	34
23.	Ak.811	29	44	37
24.	EC.21078	33	50	42
25.	G.270	32	40	36
26.	TMV.2	39	55	47
27.	KG-61-240	30	40	35
28.	TMV.11	35	54	45
29.	Pollachi II	31	44	38
30.	TG.3	37	50	44
31.	TG.14	45	57	51
32.	TG.17	44	63	54
33.	TG.19	38	42	40
34.	Spanish peanut	37	43	40
35.	Pollachi I	30	49	40
36.	TMV.7	36	43	40
37.	Gangapuri	33	52	43
38.	Big Japan	39	48	44
39.	CO.1	29	36	33
40.	EC.21075	36	49	42
	C.D.	4.5	4.7	6.4

27 g had the lowest value in rice fallows. EC.119704 with 51 g topped the list. Varieties EC.21118, Jyothi, TMV-10, Pollachi-I and CO.I were statistically on par with EC.116596. None of the varieties was on par with EC.119704. In uplands, the mean ranged from 27 g for EC.21079 to 63 g for TG-19. EC.21079 and CO-I had the lowest 100-kernal weight of 33, when the pooled means were compared. Varieties EC.116596, EC.21127, Jyothi, TMV-10 and KG-61-240 were on par with EC.21079 and CO-I. TG-17 with 54 g had the maximum 100-kernal weight. EC.119704, Ah.6915 and TG-14 were on par with TG-17.

13. Shelling percentage:

From the analysis of variance presented in Appendix-13 it could be inferred that significant differences existed among varieties in rice fallows as well as uplands. On testing, the error variances were found to be heterogenous. Hence a weighted analysis was done to test the variety x environment interaction. A χ^2 value of 84.8 indicated the presence of interaction but the varietal means, when compared against this interaction, were not significant.

Table 14 gives the means of the different varieties at both locations. The mean shelling percentage ranged from 52 per cent for TMV-11 and 73 per cent for J-11 in rice fallows. Spanish Improved, AK-811, TG-17, Pollachi-I

Table 14. Shelling percentage

Sl. No.	Varieties	Summer rice fallows	Kharif uplands	Pooled
(1)	(2)	(3)	(4)	(5)
1.	EC.21127	61	75	68
2.	EC.21118	65	74	70
3.	EC.116596	67	75	71
4.	ICG.3859	62	72	67
5.	EC.24412	65	72	69
6.	EC.21095	70	75	73
7.	S-7-5-13	68	76	72
8.	EC.2100	70	77	74
9.	EC.112027	72	75	74
10.	B.353	70	77	74
11.	EC.21079	71	76	74
12.	EC.35999	68	75	72
13.	EC.119704	67	67	67
14.	Ah.6915	71	65	68
15.	GAUG.I	73	76	75
16.	J.11	72	76	74
17.	Spanish Improved	59	75	67
18.	Dh-3-13	67	76	72
19.	Jyothi	69	77	73
20.	Exotic-6.	69	77	73

Table 14 (Contd.)

(1)	(2)	(3)	(4)	(5)
21.	TMV.9	69	77	73
22.	TMV.10	61	74	68
23.	Ak.811	59	78	69
24.	EC.21078	60	76	68
25.	G.270	70	72	71
26.	TMV.2	62	73	68
27.	KG-61-240	64	74	69
28.	TMV.11	52	71	62
29.	Pollachi II	60	77	69
30.	TG.3	61	74	68
31.	TG.14	66	74	70
32.	TG.17	56	71	64
33.	TG.19	65	74	70
34.	Spanish peanut	68	74	71
35.	Pollachi I	57	66	62
36.	TMV.7	63	75	69
37.	Gangapuri	55	73	64
38.	Big Japan	65	74	70
39.	CO.1	68	75	72
40.	EC.21075	66	74	70
	C.D.	7.8	3.3	NS

and Gangapuri were on par with TMV-11. Varieties EC.116596, S-7-5-13, B.353, EC.119704 and Big Japan were similar to J-11, with highest shelling percentage. TMV-2 and TMV-7 were intermediate with respect to this character. In uplands, the mean value ranged from 65 per cent for Ah.6915 to 77 per cent for B.353. EC.119704 and Pollachi-I were on par with Ah.6915. Varieties like EC.21127, S-7-5-13, EC.21079, Spanish Improved, and TMV-7 were on par with B-353. TMV-2 was intermediate.

ii) <u>Genotypic, phenotypic and environmental variances</u>

The genotypic, phenotypic and environmental variances in rice fallows and uplands for the various characters were calculated separately and presented in table 15.

Number of days to flowering, in rice fallows had a phenotypic variance of 2.52. The genotypic variance was only 0.23 since the environmental variance had a high value of 2.29. In uplands, the phenotypic variance was 1.86 and the genotypic variance 1.43, indicating a lesser influence of environment on the character.

In rice fallows, number of days to maturity had a phenotypic variance of 13.67 and the same value for genotypic variance indicating the absence of influence of environment. A similar trend was noted in uplands for the character. The genotypic variance had the same value as phenotypic variance (29.64) since the environmental variance was zero.

Table 15. Genotypic, phenotypic and environmental variances

No.	Characters	Summer rice fallows				Kharif uplands			
		General mean	Variances			General mean	Variances		
			Genotypic	Phenotypic	Environmental		Genotypic	Phenotypic	Environmental
1.	Number of days to flowering	28.3	0.23	2.52	2.29	26.3	1.43	1.86	0.44
2.	Number of days to maturity	103.4	13.67	13.67	0	109.5	29.64	29.64	0
3.	Number of primary branches per plant	5.8	2.24	2.52	0.27	6.6	0.55	1.17	0.61
4.	Height of plants (cm)	67.4	58.64	132.89	74.26	77.7	37.62	103.71	66.09
5.	Number of mature pods per plant	31.4	6.64	29.43	22.78	31.7	44.77	104.28	59.51
6.	Number of immature pods per plant	7.2	17.78	26.53	8.74	10.1	2.45	25.55	23.10
7.	Number of pegs per plant	55.9	256.49	524.87	268.38	45.6	175.39	267.13	91.74
8.	Weight of haulms per plant (g)	194.3	1917.76	3617.33	1699.57	93.3	199.21	583.48	384.27
9.	Fresh weight of mature pods per plant (g)	41.4	72.52	128.23	55.71	43.0	17.81	139.38	121.58
10.	Dry weight of mature pods per plant	22.7	9.60	29.70	20.09	29.8	9.17	69.26	60.09
11.	100-pod weight (g)	103.8	248.89	302.79	53.90	122.8	609.81	704.35	94.54
12.	100-kernal weight (g)	35.5	25.69	33.15	7.46	46.3	46.51	54.76	8.26
13.	Shelling percentage	65.1	18.62	41.46	22.84	74.1	6.92	10.97	4.05

The phenotypic variance for the number of primary branches per plant in rice fallows was 2.52. The environmental variance was 0.27 and hence the genotypic variance was calculated as 2.24. But in uplands, the phenotypic variance was 1.17 and the environmental variance being proportionately larger, the genotypic variance was found to have a lower value of 0.55.

For height of plants, the phenotypic variance in rice fallows was 132.89. The environmental variance was larger than the genotypic variance, the value of genotypic variance being 58.64. In uplands also the environmental variance was larger than the genotypic variance. The value for phenotypic variance was 103.71 and that for genotypic variance was 37.62.

The phenotypic variance for the number of mature pods per plant in rice fallows was 24.43. The majority of this variance was attributed to the environmental variance (22.78). The genotypic variance was only 6.64. In uplands, the phenotypic variance was 104.28. The genotypic variance was 44.77, which was slightly lesser than the environmental variance (59.51).

The genotypic variance for the number of immature pods per plant in rice fallows was 17.78, the phenotypic variance being 26.53. But in uplands, the genotypic variance was only 2.45 out of the phenotypic variance of 25.55. The environmental variance was therefore very high (23.10).

In rice fallows, the number of pegs per plant had a phenotypic variance of 524.87 and a genotypic variance of 256.49. The environmental variance amounted to 268.38. In uplands, the genotypic variance was 175.39, the phenotypic variance being 267.13. The environmental variance had a lower value than genotypic variance. In rice fallows, weight of haulms per plant had a genotypic variance of 1917.76, the phenotypic variance being 3617.33. Compared to genotypic variance, the environmental variance was also large. Weight of haulms per plant in uplands had a phenotypic variance of 583.48. The environmental variance was 384.27, giving a lower genotypic variance of 199.21.

The genotypic variance for fresh weight of mature pods per plant was larger in rice fallows when compared to the environmental variance. The phenotypic variance was 128.23 and the genotypic variance was 72.52. But in uplands, the genotypic variance was only 17.81 out of a total phenotypic variance of 139.38, a large portion being attributed to environmental variance.

Dry weight of mature pods per plant had a phenotypic variance of 29.70 in rice fallows. The genotypic variance was 9.60. This was very low when compared to the environmental variance of 20.09. In uplands also the genotypic variance was only 9.17 out of a phenotypic variance of 69.26. The environmental variance amounted to

60.09.

For 100-pod weight, in rice fallows, the phenotypic variance was 302.79 which was mainly due to a large genotypic variance of 248.89. The environmental variance was only 53.90. The character behaved in the same manner in uplands also. Here the phenotypic variance was 704.35 out of which the genotypic variance was 609.81. The environmental variance was 94.54.

100-kernal weight had a phenotypic variance of 33.15 in rice fallows. The genotypic variance was much larger compared to the environmental variance, the value being 25.69. In uplands also the environmental variance was only 8.26 for the character having a phenotypic variance of 54.76. The genotypic variance was 46.51.

Shelling percentage in rice fallows had a phenotypic variance of 41.46. The character had a slightly less genotypic variance of 18.62 compared to the environmental variance. The phenotypic variance in uplands was 10.97. The genotypic variance was 6.92, which was slightly higher than the environmental variance.

iii) Genotypic and phenotypic coefficients of variation

The coefficients of variation, both genotypic and phenotypic, for the two locations are presented in table 16.

Table 16. Genotypic and phenotypic coefficients of variation

Characters	Summer rice fallows		Kharif uplands	
	Genotypic	Phenotypic	Genotypic	Phenotypic
1. Number of days to flowering	1.69	3.62	4.54	5.18
2. Number of days to maturity	6.20	6.20	8.61	8.61
3. Number of primary branches per plant	25.86	27.33	11.26	16.35
4. Height of plants	11.36	17.10	7.90	13.10
5. Number of mature pods per plant	7.91	17.41	21.14	32.26
6. Number of immature pods per plant	58.90	71.92	15.36	49.86
7. Number of pegs per plant	28.78	40.96	29.06	35.86
8. Weight of haulms per plant	22.55	30.96	15.10	25.89
9. Fresh weight of mature pods per plant	20.72	27.42	9.81	27.46
10. Dry weight of mature pods per plant	13.64	23.98	10.12	27.89
11. 100-pod weight	15.20	16.77	20.07	21.57
12. 100-kernal weight	14.28	16.22	14.73	15.99
13. Shelling percentage	6.63	9.88	3.55	4.47

In rice fallows, number of immature pods per plant had the maximum genotypic coefficient of variation of 58.9 followed by number of pegs per plant, number of primary branches per plant, weight of haulms per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight, dry weight of mature pods per plant, height of plants, number of mature pods per plant, shelling percentage and number of days to maturity, with the lowest value of 1.7 for the number of days to flowering.

The highest phenotypic coefficient of variation was for the number of immature pods per plant (71.9). This was followed by number of pegs per plant, weight of haulms per plant, fresh weight of mature pods per plant, number of primary branches per plant, dry weight of mature pods per plant, number of mature pods per plant, height of plants, 100-pod weight, 100-kernal weight, shelling percentage and number of days to maturity. Number of days to flowering had the lowest phenotypic coefficient of variation of 5.6.

The highest genotypic coefficient of variation, in uplands, was 29.1 for the number of pegs per plant. This was followed by number of mature pods per plant, 100-pod weight, number of immature pods per plant, weight of haulms per plant, 100-kernal weight, number of primary branches per plant, dry weight of mature pods per plant, fresh weight of mature pods per plant, number of days to maturity, height of plants and number of days to flowering. Shelling percentage had the least genotypic coefficient of variation of 3.5.

Number of immature pods per plant had the highest phenotypic coefficient of variation of 49.9, followed by number of pegs per plant, number of mature pods per plant, dry weight of mature pods per plant, fresh weight of mature pods per plant, weight of haulms per plant, 100-pod weight, number of primary branches per plant, 100-kernal weight, height of plants, number of days to maturity and number of days to flowering, with the lowest value for shelling perċentage (4.5).

iv) <u>Heritability</u>

Heritability in the broad sense was estimated for the various characters in rice fallows and uplands and presented in table 17. Number of days to flowering had a heritability of only 9.1 per cent in rice fallows, whereas in uplands it was found to be 76.6 per cent. Number of days to maturity was completely heritable at both the locations. Number of primary branches per plant had a heritability of 89.1 per cent in rice fallows but the value was only 47.3 per cent in uplands. Height of plants was only 44.1 per cent heritable in rice fallows. Almost similar result was observed in uplands, where the heritability was 36.3 per cent. Number of mature pods per plant

Table 17. Heritability

Characters	Heritability (%)	
	Summer rice fallows	Kharif uplands
1. Number of days to flowering	9.11	76.55
2. Number of days to maturity	100	100
3. Number of primary branches per plant	89.11	47.37
4. Height of plants	44.12	36.27
5. Number of mature pods per plant	22.57	42.93
6. Number of immature pods per plant	67.04	9.58
7. Number of pegs per plant	48.87	65.66
8. Weight of haulms per plant	53.02	34.14
9. Fresh weight of mature pods per plant	56.55	12.78
10. Dry weight of mature pods per plant	32.34	13.24
11. 100-pod weight	82.19	86.58
12. 100-kernal weight	77.49	84.92
13. Shelling percentage	44.91	63.08

had a heritability of 22.6 per cent in rice fallows and 42.9 per cent in uplands. In rice fallows, number of immature pods per plant had a relatively high heritability value of 67.0 per cent, whereas the value was only 9.6 per cent in uplands. The heritability estimated for the number of pegs per plant was 48.9 per cent in rice fallows. In uplands, a slightly higher value of 65.7 per cent was observed. For weight of haulms per plant, the value was more in rice fallows compared to uplands, the values being 53.0 and 34.1 per cent respectively.

Fresh weight of mature pods per plant was found to be 56.6 per cent heritable in rice fallows, but gave a low heritability of 12.8 per cent in uplands. The heritability of dry weight of mature pods per plant in rice fallows was 32.3 per cent. In uplands, it was only 13.2 per cent. 100-pod weight was a highly heritable character, the value being 82.2 per cent in rice fallows and 86.6 per cent in uplands. For 100-kernal weight, the heritability was 77.5 per cent in rice fallows. In uplands also the character had a high heritability of 84.9 per cent. The heritability of shelling percentage in rice fallows and uplands were 44.9 per cent and 63.1 per cent respectively.

On comparing the heritability among characters at each location, number of days to maturity which was 100 per cent heritable topped the list at both the locations. This was followed, in rice fallows, by the number of primary branches per plant, 100-pod weight, 100-kernal weight, number of immature pods per plant, fresh weight of mature pods per plant, weight of haulms per plant, number of pegs per plant, shelling percentage, height of plants, dry weight of mature pods per plant and number of mature pods per plant, with number of days to flowering having the lowest heritability of 9.1 per cent.

In uplands, number of days to maturity was followed by 100-pod weight, 100-kernal weight, number of days to flowering, number of pegs per plant, shelling percentage, number of primary branches per plant, number of mature pods per plant, height of plants, weight of haulms per plant, dry weight of mature pods per plant and fresh weight of mature pods per plant. Number of immature pods per plant was the least heritable character, with a value of 9.6 per cent.

v) Correlations

The genotypic and phenotypic correlation coefficients of yield and various biometric characters were calculated for the two locations and the results are presented in tables 18 and 19.

1. Yield (Dry weight of mature pods per plant):

In rice fallows, the genotypic correlations of yield were positive and significant with fresh weight of mature pods per plant, 100-pod weight and 100-kernal weight. With number of mature pods per plant and number of days to maturity they were positive but non-significant. The correlations were however negative and non-significant with all other characters, namely number of days to flowering, number of primary branches per plant, height of plants, number of immature pods per plant, number of pegs per plant, shelling percentage and weight of haulms per plant. The phenotypic correlations of yield with number of mature pods per plant, fresh weight of mature pods per plant, 100-pod weight, and 100-kernal weight were positive and significant. Non-significant, positive correlations were recorded between yield and number of days to maturity, height of plants, number of pegs per plant and shelling percentage. With number of immature pods per plant, it was negative and significant. Non-significant, negative correlations were observed for yield with number of days to flowering, number of primary branches per plant and weight of haulms per plant.

In uplands, the genotypic correlation coefficient was positive and significant with fresh weight of mature pods per plant. Positive, non-significant correlations were observed between yield and number of days to maturity, number of mature pods per plant, 100-pod weight and shelling percentage. Yield was negatively but non-significantly correlated with number of days to flowering, number of primary branches per plant, height of plants, number of immature pods per plant, number of pegs per plant, 100-kernal weight and weight of haulms per plant. Phenotypic correlations between yield and number of mature pods per plant, number of immature pods per plant and fresh weight of mature pods per plant were positive and significant. Non-significant positive correlations were observed between yield and number of days to maturity, number of primary branches per plant, plant height, 100-pod weight and weight of haulms per plant. However, yield was negatively and non-significantly correlated with number of days to flowering, number of pegs per plant, 100-kernal weight and shelling percentage, phenotypically.

2. Number of days to flowering:

In rice fallows, the number of days to flowering has non-significant genotypic correlation with all the other characters. Number of days to flowering has non-significant phenotypic correlation also with all the other characters.

In uplands, number of days to flowering had significant, positive genotypic correlations with the number of days to maturity and weight of haulms per plant, but significant, negative correlation with number of pegs per plant. But the days to flowering was positively but non-significantly correlated with number of primary branches per plant and 100-kernal weight. Negative, non-significant correlations were observed for days to flowering with height of plants, number of mature pods per plant, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, shelling percentage and yield of mature pods per plant.

3. Number of days to maturity:

Significant, positive genotypic correlations were recorded for days to maturity with number of pegs per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant, in rice fallows. With number of primary branches per plant, height of plants, number of mature pods per plant, and dry weight of mature pods per plant, the correlations were positive but non-significant. Negative, non-significant correlations were recorded between the number of days to maturity and number of days to flowering, number of mature pods per plant and shelling percentage. Days to maturity had positive significant phenotypic correlation with number of pegs per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant. It was non-significantly correlated with all the other characters.

In uplands, the genotypic correlations of days to maturity were positive and significant with number of days to flowering, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant. Negative, significant correlations were observed between days to maturity and number of mature pods per plant and shelling percentage.

Number of days to maturity was observed to be non-significantly correlated with dry weight of mature pods per plant, number of primary branches per plant, height of plants and number of pegs per plant.

Number of days to maturity had positive and significant phenotypic correlation with number of days to flowering, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant. Significant, negative correlations were recorded with number of primary branches per plant, number of mature pods per plant, number of pegs per plant and shelling percentage. It was non-significantly correlated with plant height and dry weight of mature pods per plant.

4. Number of primary branches per plant:

The genotypic correlations for the number of primary branches per plant in rice fallows were positive and significant with number of immature pods per plant, 100-kernal weight and weight of haulms per plant. The correlations however, were positive but non-significant with number of days to maturity, number of pegs per plant, fresh weight of mature pods per plant, 100-pod weight and shelling percentage. With number of days to flowering, height of plants, number of mature pods per plant and yield of mature pods per plant, the correlations were negative, but non-significant.

The character, in rice fallows had positive, significant phenotypic correlation with number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant. Positive but non-significant correlations were observed for number of primary branches per plant with number of days to maturity, number of pegs per plant and shelling percentage. Only height of plants had negative significant correlation with number of primary branches per plant. Number of days to flowering, number of mature pods per plant and dry weight of mature pods per plant had negative, non-significant correlations with the character.

The genotypic correlation in uplands for the number of primary branches per plant was negative and significant with 100-pod weight. Positive, non-significant correlations were observed between number of primary branches per plant and days to flowering, number of mature pods per plant and shelling percentage. Number of primary branches per plant had negative, non-significant correlation with number of days to maturity, height of plants, number of immature pods per plant, number of pegs per plant, fresh weight of mature pods per plant, 100-kernal weight, weight of haulms per plant and yield of mature pods per plant. The phenotypic correlations were positive and significant for number of primary branches per plant with number of days to flowering and number of mature pods per plant. Significant, negative correlations were observed for the character with number of days to maturity and 100-pod weight. It was found to have non-significant, positive correlation with number of immature pods per plant, fresh weight of mature pods per plant, shelling percentage, weight of haulms per plant and yield of mature pods per plant. Non-significant, but negative correlations were observed for the number of primary branches per plant with height of plants, number of pegs per plant and 100-kernal weight.

5. Height of plants:

Height of plants in rice fallows has positive and significant genotypic correlation with only shelling percentage. Number of days to maturity, number of pegs per plant and weight of haulms per plant had positive, non-significant correlations with height. Negative, but non-significant correlations were recorded for height of plants with number of days to flowering, number of primary branches per plant, number of mature pods per plant, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and yield of mature pods per plant. But, height of plants had positive significant phenotypic correlation with number of pegs per plant, shelling percentage and weight of haulms per plant. The character recorded significant, negative correlation with number of primary branches per plant and number of immature pods per plant. Non-significant, positive correlations were observed between height of plants and number of mature pods per plant, fresh weight of mature pods per plant, 100-pod weight and dry weight of mature pods per plant. Height of plants had negative, non-significant correlation with number of days to flowering and 100-kernal weight.

In uplands, height of plants had non-significant genotypic correlations with all the characters, a few being positive; the others being negative. The phenotypic correlation for height was positive and significant with shelling percentage. Negative, significant correlation was recorded with 100-kernal weight. Height of plants had non-significant positive correlation with number of mature pods per plant, number of immature pods per plant, number of pegs per plant, fresh weight of mature pods per plant, weight of haulms per plant and yield of mature pods per plant. With number of days to maturity, number of days to flowering, number of primary branches per plant and 100-pod weight, it had negative, non-significant correlation.

6. Number of mature pods per plant:

In rice fallows, the genotypic correlations were positive and significant for the number of mature pods per plant with number of days to flowering, 100-kernal weight, shelling percentage and yield of mature pods per plant. Negative, but non-significant correlations were recorded with all other characters, namely number of days to maturity, number of primary branches per plant, height of plants, number of immature pods per plant, number of pegs per plant, fresh weight of mature pods per plant, 100-pod weight and weight of haulms per plant.

The phenotypic correlations in rice fallows, for the number of mature pods per plant were positive and significant with fresh weight of mature pods per plant, shelling percentage and yield of mature pods per plant. Positive, non-significant correlations were observed with number of days to flowering, height of plants, number of pegs per plant, 100-kernal weight and weight of haulms per plant. Number of days to maturity, number of primary branches per plant, number of immature pods per plant and 100-pod weight had negative, non-significant correlations with number of mature pods per plant.

Significant, positive genotypic correlation was observed for number of pods per plant with shelling percentage in uplands. Significant, negative correlations were recorded with number of days to maturity, 100- pod weight, 100-kernal weight and weight of haulms per plant. Number of primary branches per plant, height of plants, fresh weight of mature pods per plant and dry weight of mature pods per plant had non-significant, positive correlation with number of mature pods per plant. Non-significant, negative correlations were recorded for number of mature pods per plant with number of days to flowering, number of immature pods per plant and number of pegs per plant. The phenotypic correlations, for the number of mature pods per plant, were positive and significant with number of primary branches per plant, fresh weight of mature pods per plant, shelling percentage and yield of mature pods per plant. 100-pod weight, 100-kernal weight, number of days to maturity and weight of haulms per plant had significant, negative correlation with number of mature pods per plant. With height of plants, the character had positive, non-significant correlation. With number of days to flowering, number of immature pods per plant and number of pegs per plant, it had negative, non-significant correlation.

7. Number of immature pods per plant:

The genotypic correlations in rice fallows were positive and significant for the number of immature pods per plant with number of primary branches per plant, as well as weight of haulms per plant. Positive but non-significant correlations were recorded with number of days to maturity, number of pegs per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and shelling percentage. With number of days to flowering, height of plants, number of mature pods per plant and dry weight of mature pods per plant also, the character was non-significantly correlated. Positive, significant phenotypic correlations were recorded in rice fallows, for the number of immature pods per plant with number of primary branches per plant, number of pegs per plant, fresh weight of mature pods per plant, 100-kernal weight and weight of haulms per plant. The phenotypic correlations were positive but non-significant with number of days to maturity and 100-pod weight. Number of immature pods per plant had significant, negative correlations with height of plants, shelling percentage and dry weight of mature pods per plant. Non-significant, negative correlations were recorded with days to flowering and number of mature pods per plant.

In uplands, the number of immature pods per plant had non-significant genotypic correlation with all the characters under study, except the number of days to maturity with which the character has significant positive correlation. Number of immature pods per plant had significant positive phenotypic correlations with number of days to maturity, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight, weight of haulms per plant and yield of mature pods per plant. With shelling percentage, negative significant correlation was observed. Number of primary branches per plant, height of plants and number of pegs per plant had positive, non-significant correlation with the number of immature pods per plant. With days to flowering and number of mature pods per plant, the character had negative non-significant correlation.

8. Number of pegs per plant:

In rice fallows, the genotypic correlations were positive and significant for the number of pegs per plant with number of days to maturity, fresh weight of mature pods per plant, 100-pod weight, and weight of haulms per plant. The character was non-significantly correlated with number of primary branches per plant, height of plants, number of immature pods per plant, 100-kernal weight, number of days to flowering, number of mature pods per plant and dry weight of mature pods per plant. Number of pegs per plant had positive significant phenotypic correlation with number of days to maturity, height of plants, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight and weight of haulms per plant. Positive, but non-significant correlations were exhibited by the number of pegs per plant with number of primary branches per plant, number of mature pods per plant, 100-kernal weight and dry weight of mature pods per plant. Number of pegs per plant had negative, non-significant correlations with number of days to flowering and shelling percentage.

The genotypic correlation in uplands was negative and significant for the number of pegs per plant with number of days to flowering. Number of pegs per plant was non-significantly correlated with number of days to maturity, number of primary branches per plant, height of plants, number of mature pods per plant, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight, shelling percentage, weight of haulms per plant and dry weight of mature pods per plant.

Number of pegs per plant had significant, positive phenotypic correlation with weight of haulms per plant and significant, negative correlation with number of days to maturity in uplands. With height of plants, number of immature pods per plant, 100-pod weight, 100-kernal weight and shelling percentage, it had positive, non-significant correlation. Negative, non-significant correlations were recorded with number of days to flowering, number of primary branches per plant, number of mature pods per plant and dry weight of mature pods per plant.

9. Weight of haulms per plant:

The genotypic correlations in rice fallows were positive and significant for the weight of haulms per plant with number of days to maturity, number of primary branches per plant, number of immature pods per plant and number of pegs per plant. The character was non-significantly correlated with number of days to flowering, height of plants, number of mature pods per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight, shelling percentage and dry weight of mature pods per plant. The phenotypic correlations were positive and significant with the number of days to maturity, number of primary branches per plant, height of plants, number of immature pods per plant, number of pegs per plant, fresh weight of mature pods per plant, 100-pod weight and 100-kernal weight. It had non-significant phenotypic correlation with number of days to flowering, number of mature pods per plant, shelling percentage, and dry weight of mature pods per plant.

The genotypic correlations in uplands were positive and significant with number of days to flowering, number of days to maturity, 100-pod weight and 100-kernal weight. Significant, negative correlations were recorded with number of mature pods per plant and shelling percentage. The character was non-significantly correlated with number of primary branches per plant, height of plants, number of immature pods per plant, number of pegs per plant, fresh weight of mature pods per plant and dry weight of mature pods per plant. The phenotypic correlations for the weight of haulms per plant were positive and significant with number of days to maturity, number of immature pods per plant, number of days to flowering, number of pegs per plant, 100-pod weight and 100-kernal weight. Negative, significant correlations were recorded with number of mature pods per plant and shelling percentage. The character was non-significantly correlated with number of primary branches per plant, height of plants, fresh weight of mature pods per plant and dry weight of mature pods per plant.

10. Fresh weight of mature pods per plant:

In rice fallows, the genotypic correlations for this character were positive and significant for the number of days to maturity, number of pegs per plant, 100-pod weight, 100-kernal weight and dry weight of mature pods per plant. Positive, non-significant correlations were recorded with number of primary branches per plant, number of immature pods per plant and weight of haulms per plant. Number of days to flowering, height of plants, number of mature pods per plant and shelling percentage had negative, non-significant correlation with fresh weight of mature pods per plant. The character had positive significant phenotypic correlation with number of days to maturity, number of primary branches per plant, number of mature pods per plant, number of immature pods per plant, number of pegs per plant, 100-pod weight, 100-kernal weight, weight of haulms per plant and dry weight of mature pods per plant. With height of plants, number of days to flowering and shelling percentage, the character was non-significantly correlated.

The genotypic correlations in uplands for the fresh weight of mature pods per plant were positive and significant with number of days to maturity and yield of mature pods per plant. With number of mature pods per plant, 100-pod weight and 100-kernal weight, the character had positive but non-significant correlation. Fresh weight of mature pods per plant had negative, non-significant correlations with number of days to flowering, number of primary branches per plant, height of plants, number of immature pods per plant, number of pegs per plant, shelling percentage and weight of haulms per plant. The phenotypic correlations in uplands for the fresh weight of mature pods per plant were positive and significant with number of days to maturity, number of mature pods per plant, number of immature pods per plant and dry weight of mature pods per plant, while it was negative and significant with shelling percentage. The character recorded positive, but non-significant correlations with number of primary branches per plant, height of plants, 100-pod weight, 100-kernal weight and weight of haulms per plant. With number of days to flowering and number of pegs per plant, the correlations were negative and non-significant.

11. 100-pod weight:

100-pod weight in rice fallows had significant positive genotypic correlations with number of days to maturity, number of pegs per plant, fresh weight of mature pods per plant, 100-kernal weight and dry weight of mature pods per plant. Number of primary branches per plant, number of immature pods per plant and weight of haulms per plant had positive, non-significant correlations with 100-pod weight. Negative, non-significant correlations were recorded by 100-pod weight with number of days to flowering, height of plants, number of mature pods per plant and shelling percentage. The phenotypic correlations in rice fallows were positive and significant with number of days to maturity, number of primary branches per plant, number of pegs per plant, fresh weight of mature pods per plant, 100-kernal weight, weight of haulms per plant and dry weight of mature pods per plant. Negative, significant correlation was recorded with shelling percentage. With height of plants, number of days to flowering, number of mature pods per plant and number of immature pods per plant, the character was non-significantly correlated.

In uplands, the genotypic correlations for 100-pod weight were significant and positive with number of days to maturity, 100-kernal weight and weight of haulms per plant. Significant, negative correlations were recorded with number of primary branches per plant, number of mature pods per plant and shelling percentage. 100-pod weight has non-significant genotypic correlation with number of immature pods per plant, number of pegs per plant, fresh weight of mature pods per plant, dry weight of mature pods per plant, number of days to flowering and height of plants. In uplands, the phenotypic correlations for 100-pod weight were positive and significant with number of days to maturity, number of immature pods per plant, 100-kernal weight and weight of haulms per plant. 100-pod weight had negative significant correlation with number of primary branches per plant, number of mature pods per plant and shelling percentage. Non-significant, positive correlations were recorded with number of pegs per plant, fresh weight of mature pods per plant and dry weight of mature pods per plant, while number of days to flowering and height of plants were correlated negatively and non-significantly with 100-pod weight.

12. 100-kernal weight:

In rice fallows, 100-kernal weight had significant, positive genotypic correlation with number of days to maturity, number of primary branches per plant, fresh weight of mature pods per plant, 100-pod weight and dry weight of mature pods per plant. Positive, non-significant correlations were recorded for 100-kernal weight with number of mature pods per plant, number of immature pods per plant, number of pegs per plant, shelling percentage and weight of haulms per plant. Days to flowering and height of plants were negatively but non-significantly correlated with 100-kernal weight. 100-kernal weight had significant positive phenotypic correlations with number of days to maturity, number of primary branches per plant, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, weight of haulms per plant, and dry weight of mature pods per plant. Shelling percentage recorded negative, significant correlation with 100-kernal weight. 100-kernal weight had positive, non-significant correlation with number of pegs per plant and number of mature pods per plant. Number of days to flowering and height of plants had negative, non-significant correlations with 100-kernal weight.

In uplands, the genotypic correlations for 100-kernal weight were significant and positive with number of days to maturity, 100-pod weight and weight of haulms per plant. Significant, negative correlations were recorded with number of mature pods per plant and shelling percentage. 100-kernal was non-significantly correlated with number of days to flowering, number of primary branches per plant, height of plants, number of immature pods per plant, number of pegs per plant, fresh weight of mature pods per plant and dry weight of mature pods per plant. The phenotypic correlations in uplands were positive and significant for 100-kernal weight with number of days to maturity, number of immature pods per plant, 100-pod weight, and weight of haulms per plant. Negative, significant correlations were recorded with height of plants, number of mature pods per plant and shelling percentage. The character was not significantly correlated with number of days to flowering, number of pegs per plant, number of primary branches per plant, fresh weight of mature pods per plant and dry weight of mature pods per plant.

13. Shelling percentage:

Height of plants was the only character in rice fallows which recorded a significant positive genotypic correlation with shelling percentage. The other characters had non-significant correlation with shelling percentage. The phenotypic correlations in rice fallows were positive and significant for shelling percentage with height of plants, number of mature pods per plant and 100-kernal weight, but with number of immature pods per plant and 100-pod weight, it had significant negative correlations. Number of days to flowering, number of primary branches per plant, weight of haulms per plant and dry weight of mature pods per plant recorded positive non-significant correlations with shelling percentage. Shelling percentage had negative, non-significant correlation with number of days to maturity, number of pegs per plant and fresh weight of mature pods per plant.

The genotypic correlation of shelling percentage in uplands was positive and significant with number of mature pods per plant but negative and significant with number of days to maturity, 100-pod weight, 100-kernal weight and weight of haulms per plant. Shelling percentage was non-significantly correlated with number of days to flowering, number of primary branches per plant, height of plants, number of immature pods per plant, number of pegs per plant, fresh weight of mature pods per plant and dry weight of mature pods per plant. In uplands, the phenotypic correlations of shelling percentage were positive and significant with height of plants and number of mature pods per plant. It had significant, negative correlation with number of days to flowering, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant. Shelling percentage was non-significantly correlated with number of primary branches per plant, number of days to flowering, number of pegs per plant and dry weight of mature pods per plant.

vi) Selection model

Number of primary branches per plant, number of mature pods per plant and 100-pod weight were concluded to be the more important characters contributing to yield. So they were selected for the formulation of selection indices at both the locations. The selection index prepared separately for both the locations by exercising 30 per cent selection are presented in table 20.

In rice fallows, the b_i values were calculated and found to have the following values:

Table 20. Selection index values

No.	Summer rice fallows		Kharif uplands	
	Varieties	Index values	Varieties	Index values
(1)	(2)	(3)	(4)	(5)
1.	EC.119704	116.7	TG.17	103.9
2.	Ah.6915	101.7	Ah.6915	101.6
3.	TG.17	101.5	EC.119704	94.1
4.	EC.24412	100.4	G.270	89.9
5.	TG.14	98.7	EC.116596	89.8
6.	G.270	94.4	EC.24412	87.7
7.	TMV.11	93.2	TMV.11	84.5
8.	Gangapuri	90.6	TG.14	77.9
9.	EC.35999	87.0	Gangapuri	77.8
10.	Dh-3-13	86.6	EC.35999	75.2
11.	Pollachi I	82.6	Pollachi I	74.1
12.	TMV.7	82.5	TMV.2	69.3
13.	TG.3	82.3	Dh-3-13	67.2
14.	TMV.2	81.3	EC.21078	66.5
15.	TG.19	79.8	Spanish Improved	66.1
16.	Spanish peanut	79.2	EC.21075	62.3
17.	EC.21078	78.7	ICG.3859	61.9
18.	EC.116596	78.6	Big Japan	61.0
19.	Big Japan	78.0	Spanish peanut	58.6
20.	ICG.3859	77.3	TMV.7	58.2
21.	Spanish Improved	77.2	TG.3	57.2
22.	EC.21075	75.8	S-7-5-13	57.2
23.	J.11	75.4	Ak.811	56.8
24.	EC.21079	70.5	TG.19	56.7
25.	EC.21095	70.5	TMV.9	55.8
26.	TMV.10	69.3	J.11	52.8
27.	Ak.811	68.7	EC.21127	52.2
28.	TMV.9	68.6	GAUG.I	52.0

Table 20 (Contd.)

(1)	(2)	(3)	(4)	(5)
29.	GAUG.I	66.4	TMV.10	48.6
30.	S-7-5-13	66.1	Pollachi II	48.2
31.	Exotic.6	64.8	Exotic 6	48.1
32.	EC.112027	61.6	EC.21118	48.0
33.	EC.2100	60.6	EC.21095	46.7
34.	Pollachi II	60.5	Jyothi	46.0
35.	Jyothi	60.2	EC.21079	45.9
36.	B.353	59.3	EC.2100	45.7
37.	CO.1	58.1	B.353	45.6
38.	EC.21118	57.4	EC.112027	45.4
39.	KG-61-240	55.7	CO.1	45.3
40.	EC.21127	55.4	KG-61-240	44.8

Note: b_i values for the two locations are given below:

			Summer rice fallows	Kharif uplands
Yield (dry weight of mature pods per plant)	-	b_1	1.3728	0.6769
Number of primary branches per plant	-	b_2	1.3311	-1.7019
Number of mature pods per plant	-	b_3	-0.9346	-0.4203
100-pod weight	-	b_4	0.6464	0.5499

b_1	(yield)	= 1.3729
b_2	(number of primary branches per plant)	= 1.3311
b_3	(number of mature pods per plant)	= -0.9346
b_4	(100-pod weight)	= 0.6464

Using the function $I = b_1p_1 + b_2p_2 + \dots + b_np_n$ the index value for each variety was determined and the varieties were ranked accordingly. The 12 top ranking varieties in rice fallows were thus identified as EC.119704, Ah.6915, TG-17, EC.24412, TG-14, G-270, TMV-11, Gangapuri, EC.35999, Dh-3-13, Pollachi I and TMV-7 in decreasing order of index values.

The gain in efficiency of the above model was then calculated. The genetic advance due to discriminant function was 15.73 and that due to straight selection was 14.25. The percentage gain in efficiency was then calculated and found to be 10.37 per cent.

In uplands, the following were the b_i values.

b_1	(yield)	= 0.6769
b_2	(number of primary branches per plant)	= -1.7019
b_3	(number of mature pods per plant)	= -0.4203
b_4	(100-pod weight)	= 0.5499

Using the function $I = b_1p_1 + b_2p_2 + \dots + b_np_n$ the index value for each variety was determined and the

12 top ranking varieties were thus identified as TG-17, Ah.6915, EC.119704, G-270, EC.116596, EC.24412, TMV-11, TG-14, Gangapuri, EC.35999, Pollachi I and TMV-2 in the decreasing order of their index values.

The percentage gain in efficiency of the model was then calculated. The genetic advance due to discriminant function was calculated as 17.78 and that due to straight selection was found to be 14.55. Hence the percentage gain in efficiency of the model in uplands was calculated to be 22.19 per cent.

Varieties EC.24412, EC.35999, EC.119704, Ah.6915, G-270, TMV-11, TG-14, TG-17, Pollachi I and Gangapuri were common for both the locations among the 12 top ranking varieties. Hence these varieties were inferred to have stable performance.

DISCUSSION

DISCUSSION

The determination of selection parameters in groundnut was carried out at two diverse cropping conditions viz., the summer rice fallows and kharif uplands. The observations recorded on the important characters were statistically analysed. The analyses of variance were done for individual characters separately for each location to estimate the extent of variability among the varieties for each character. The pooled analyses were also done for all the characters to determine the influence of environment on them. Other parameters like variances, coefficients of variation and heritability were also estimated. Correlations among the various characters were calculated to reveal the association among them, if any. Selection models were fitted separately for the two locations using the characters contributing to yield and stable varieties were identified. The present chapter aims to discuss the results obtained and conclusions drawn.

1) Analysis of variance:

The number of days to flowering was significantly different among varieties in uplands but the varieties did not differ significantly in rice fallows. The mean number of days to flowering in uplands ranged from 23 days for G-270 to 30 days for S-7-5-13. In rice fallows the range was from 26 days for KG-61-240 to 30 days for EC.21118. Majumdar et al. (1970) reported that the number of days to flowering was 26 to 27 days in early varieties, 28 days in medium varieties and 28 to 29 days in late varieties. Narrow range of variability had also been reported by Kushwaha and Tawar (1973) for the number of days to 50 per cent flowering. Highly significant differences in the number of days to maturity were observed in both erice fallows and uplands. The mean number of days to maturity in rice fallows ranged from 97 days for B.353 and TMV-2 to 108 days for TG-14, TG-17, TG-19, TMV-7 and Gangapuri. In uplands, the range was from 106 days for EC.21127, EC.21118, EC.2100, EC.21078, KG-61-240, TG-19 and CO.1 to 125 days for EC.116596, EC.119704, Ah.6915 and Big Japan. Majumdar et al. (1969) observed a wide range of variability for this character. However, the reports of Kushwaha and Tawar (1973) and Patra (1975) were contrary to this.

For the number of primary branches per plant, significant variability was found to exist at both the locations. The mean ranged from 4.4 for EC.116596 and EC.24412 to 11.4 for EC.119704 in rice fallows. In uplands, the range was from 5.1 for EC.116596 to 9.0 for S-7-5-13. EC.116596 was found to have the lowest number of primary branches at both the locations. A wide range of phenotypic variation was observed in the number of branches per plant by Dixit et al. (1970). However, Dixit et al. (1971)

observed that the number of primary branches per plant exhibited the least variation. Muhammed et al. (1973 a) also observed a wide range of variation for the branching habit. Significant variability was found to exist among varieties for the height of plants in rice fallows and uplands. Dixit et al. (1971) and Patra (1975) have also observed significant variability for this character. The mean height of plants among varieties in rice fallows ranged from 49 cm for S-7-5-13 to 91 cm for EC.116596. In uplands, the range was from 62 cm for EC.2100 to 95 cm for G.270.

The varieties were observed to differ significantly for the mean number of mature pods per plant at both the locations. In rice fallows, the range was between 22 pods for Gangapuri to 37 for TG-17. In uplands, EC.24412 possessed the minimum of 19 pods and CO.1 had the maximum of 49 mature pods per plant. Majumdar et al. (1969), Kushwaha and Tawar (1973) and Shettar (1974) have observed wide range of variation for the character. Sandhu and Sangha (1974) had suggested that pod number was an important potential factor for divergence at inter and intra-cluster levels. Significant difference among varieties for the number of immature pods per plant was noted in rice fallows but the varieties did not differ significantly in uplands. The mean number of immature pods per plant in rice fallows ranged between 3.9 for EC.21078 and 25.1 for ICG.3859.

In uplands, the range was narrow i.e. from 5 for TMV-10 to 18 for EC.116596. A wide range of variation was reported for the character by Harisingh et al. (1982). The mean number of pegs per plant differed significantly among varieties at both the locations. A wide range of variability for pod-peg ratio was observed by Harisingh et al. (1982). The range in rice fallows was from 23 for TMV-2 to 108 for EC.116596. In uplands, the range was from 17 for Jyothi to 72 for TG-17.

For the weight of haulms per plant, significant variability existed among varieties in rice fallows and uplands. A large amount of genetic variability was recorded for the character by Dixit et al. (1970). The mean value for the character in rice fallows ranged from 109 g for TMV-2 to 315 g for Ah.6915. In uplands, the range was from 57 g for AK.811 to 139 g for Ah.6915.

For the fresh weight of mature pods per plant, significant differences existed among varieties in rice fallows but the varieties were found to be statistically on par in uplands indicating no variability. Dixit et al. (1971) observed that the maximum range of variability was for the fresh weight of mature pods. The mean weight in rice fallows varied from 28 g for Pollachi- II to 67 g for EC.119704. In uplands, the range was from 32 g for EC.21095 to 64 g for EC.119704. EC.119704 topped the list at both the locations. Significant difference among varieties was revealed for the dry weight of mature pods per plant in rice fallows but not in uplands. In rice fallows, the range was between 15 g for S-7-5-13 to 33 g for EC.119704. In uplands the pod yield ranged from 21 g for ICG.3859 to 44 g for EC.119704. Thus EC.119704 had the highest pod yield at both the locations. A wide range of variation was observed for this character by Majumdar et al. (1969). Dixit et al. (1970) also observed a large amount of genetic variability for this character. Ramachandran and Venkateswaran (1980) observed that the variety Gangapuri gave high pod yield under favourable soil moisture conditions but gave poor performance under unfavourable conditions thus showing high variability for pod yield. Harisingh et al. (1982) observed high variability for pod yield among 50 newly evolved genotypes of groundnut. Kumar and Yadava (1982) also observed a substantial amount of genetic variability for the character.

In respect of 100-pod weight, the varieties differed significantly in rice fallows and uplands. In rice fallows, the mean value ranged from 80 g for EC.21127 to 139 g for EC.119704. In uplands, the range was from 92 g for CO.1 to 187 g for TG-17. Weight of 100 kernals also differed significantly at both the locations. The 100-kernal weight was found to be 27 g for EC.116596 and 51 g for EC.119704 in rice fallows whereas in uplands, the range was from 27 g for EC.21079 to 63 g for TG-19. A wide range of phenotypic variability was observed for the character by Majumdar et al. (1969). Sangha (1971) had observed that 100-kernal weight was an important character contributing to genetic divergence. But Sangha (1973 a) based on an evaluation study concluded that 100-kernal weight contributed to least diversity. Harisingh et al. (1982) reported a high range of variation for this character. Shelling percentage was found to differ significantly among varieties at both the locations. It ranged from 52% for TMV-11 to 73% for J.11 in rice fallows and in uplands, the range was from 65% for Ah.6915 to 77% for B.353. Muhammed et al. (1973 b) observed that semi-spreading and spreading varieties had a lower shelling out turn than bunch varieties but Natarajan et al. (1978 b) reported that variation in shelling percentage was highest in prostrate varieties.

2) Genotypic and phenotypic variances:

The genotypic variance was much less than the environmental variance for the days to flowering in rice fallows indicating that environment influenced the character to a large extent. This gave a low heritability estimate for the character. But in uplands, the environmental variance was comparatively smaller than the genotypic variance revealing a lesser influence of environment. The estimate of heritability was thus moderately high. According to Majumdar et al. (1969), broad sense heritability was high for the number of days to first flowering. The genotypic and phenotypic variances were found to be same at both the locations for the number of days to maturity. This showed the lack of environmental influence and hence the character was found to be completely heritable at both the locations. The highly heritable nature of the character had also been reported by earlier workers like Majumdar et al. (1969) and Kushwaha and Tawar (1973).

A high genotypic variance compared to the environmental variance was observed for the number of primary branches per plant in rice fallows indicating high heritability for the character. But in uplands the environmental variance was slightly higher than the genotypic variance showing that the character was only partially heritable. A high heritability estimate was observed for the number of branches by Majumdar et al. (1969). Number of primary branches per plant was also reported to be a highly heritable character by Dixit et al. (1971) and Dholaria and Joshi (1972). Genotypic and phenotypic variances were low as reported by Kushwaha and Tawar (1973). Height of plants had high values for both genotypic and environmental variances in rice fallows, the latter being slightly higher. Hence the character was found to be only partially heritable. But in uplands, the value for environmental variance was almost double that of genotypic variance, indicating a low heritability for the character. Dixit et al. (1971) had reported high heritability for height of plants. Sivasubramanian et al. (1977) had also made a similar observation. High genotypic and phenotypic variances for stem height were reported by Kushwaha and Tawar (1973).

High value for environmental variance as compared to the genotypic variance was recorded in rice fallows for number of mature pods per plant. So the character recorded a low value for broad sense heritability. In uplands the environmental variance was only slightly higher than the genotypic variance and hence the character was moderately heritable. Kushwaha and Tawar (1973) observed high genotypic and phenotypic variabilities for the character under rainfed conditions. A low broad sense heritability was reported by Majumdar et al. (1969). However, Dholaria and Joshi (1972) recorded a high heritability estimate for the number of pods in the bunch group. High estimate of broad sense heritability was also recorded for the number of mature pods per plant by Khangura and Sandhu (1973) and Sivasubramanian et al. (1977). A high genotypic variance compared to the environmental variance in rice fallows for the number of immature pods per plant indicated that the character was highly heritable. But in uplands, the environmental variance being very high as compared to the genotypic variance, the heritability value was low. Low phenotypic and genotypic variances and a low estimate of heritability was reported by Kushwaha and Tawar (1973). But contrary to this, high value for broad sense heritability was observed by Patra (1975) and Harisingh et al. (1982). In rice fallows the number of pegs per plant had high values for genotypic and environmental variances, the environmental variance being slightly higher. The character was only partially heritable. In uplands, the genotypic variance was higher than the environmental variance and hence the heritability was high. A study conducted by Rao (1980) indicated that number of pegs per plant showed the highest broad sense heritability. Harisingh et al. (1982) observed that the difference between phenotypic and genotypic variance was high for pod:peg ratio.

In rice fallows, very high values were recorded for the genotypic and environmental variances for the weight of haulms per plant and hence the character had high heritability. But in uplands, though the genotypic variance was high, it was lesser than the environmental variance and hence heritability was calculated to have a low value.

For the fresh weight of mature pods per plant, genotypic variance was more than the environmental variance in rice fallows and hence heritability was moderately high. But in uplands, the genotypic variance was very low compared to the environmental variance and hence the character exhibited a low value for heritability estimate.

In the case of dry weight of mature pods per plant the genotypic variance was much less compared to the environmental variance in rice fallows and uplands and hence a low heritability was recorded for the character. Similar results were reported for the yield of pods by Majumdar et al. (1969). However, Khangura and Sandhu (1973) reported a high estimate of broad sense heritability for the character. A similar observation was made by Patra (1975). Harisingh et al. (1982) reported that the difference between phenotypic and genotypic variances was high for pod yield, indicative of a low heritability.

The genotypic variance was much higher than the environmental variance for the 100-pod weight, in rice fallows as well as uplands and hence the heritability estimate was very high for the character. The highly heritable nature of 100-pod weight was reported by Majumdar et al. (1969), Dixit et al. (1970) and Natarajan et al. (1978 a). The genotypic variance was higher than the environmental variance in both rice fallows and uplands for 100-kernal weight also, with the result that the heritability was high at both the locations. Dixit et al. (1970) had observed that 100-kernal weight was a highly heritable character. Similar observation was made by other workers like Dholaria and Joshi (1972), Khangura and Sandhu (1973) and Harisingh et al. (1982). Shelling percentage had a slightly lower genotypic variance in comparison to the environmental variance in rice fallows and hence the heritability was moderate for the character. But in uplands, the genotypic variance was slightly higher than the environmental variance and hence heritability was moderately high. High heritability has been reported for the character by Majumdar et al. (1969). Sandhu and Khehra (1977 a) reported that broad sense heritability was high for the character. A high estimate of broad sense heritability was also reported by Harisingh et al. (1982).

3) Coefficient of variation:

Days to flowering was found to have the lowest genotypic and phenotypic coefficients of variation in rice fallows among the 13 characters under study. In uplands also days to flowering had very low genotypic and phenotypic coefficients of variation next to shelling percentage. Days to maturity also had low genotypic and phenotypic coefficients of variation in both the situations.

Number of primary branches per plant had moderately high genotypic and phenotypic coefficients of variation in rice fallows as well as uplands. Majumdar et al. (1969) had observed that the number of branches per plant had a comparatively high genotypic coefficient of variation than other characters. Height of plants had moderate values for genotypic and phenotypic coefficients of variation in rice fallows and in uplands. But a high value for genotypic coefficient of variation for the height of main stem was recorded by Sivasubramanian et al. (1977).

Number of mature pods per plant had low genotypic and phenotypic coefficients of variation in rice fallows, but in uplands it had very high genotypic and phenotypic coefficients. High genotypic and phenotypic coefficients of variation were recorded for the number of pods per plant by Sangha (1973 b), Sivasubramanian et al. (1977), Natarajan et al. (1978 a) and Khangura and Sandhu (1973). Number of immature pods per plant was observed to have the highest genotypic and phenotypic coefficients of variation in rice fallows. In uplands, the phenotypic coefficient of variation was highest for the character but genotypic coefficient of variation was only moderately high. Patra (1975) had reported high phenotypic and genotypic coefficients of variation for the character. High genotypic and phenotypic coefficients of variation for the number of pegs per plant were recorded in rice fallows. In uplands, the genotypic coefficient of variation was highest for the character, but phenotypic coefficient of variation was only next to that for the number of immature pods per plant.

Weight of haulms per plant had comparatively high values for genotypic and phenotypic coefficients of variation in rice fallows and uplands.

Fresh weight of mature pods per plant had high genotypic and phenotypic coefficients of variation in rice fallows. In uplands, the genotypic coefficient of variation was low but the phenotypic coefficient of variation was moderately high. Dixit et al. (1971) reported that phenotypic and genotypic coefficients of variation were high for the character. For the dry weight of mature pods per plant, both genotypic and phenotypic coefficients of variation were comparatively low in rice fallows. Same was the case with genotypic coefficient of variation in uplands. But phenotypic coefficient of variation was moderately high. High genotypic and phenotypic coefficients of variation had been reported for the character by Dixit et al. (1971), Khangura and Sandhu (1973) and Patra (1975). A high genotypic coefficient of variation was observed by Kushwaha and Tawar (1973) also.

100-pod weight had low genotypic and phenotypic coefficients of variation in rice fallows. But in uplands, the values were comparatively high. Kushwaha and Tawar (1973) had reported a low genotypic coefficient of variation for the character. 100-kernal weight also did not record high values for genotypic and phenotypic coefficients of variation in rice fallows. In uplands, it had moderately high values compared to the other characters. Sangha (1973 b) had recorded high values for genotypic and phenotypic coefficients of variation for 100-kernal weight. Shelling percentage had very low genotypic and phenotypic coefficients of variation in rice fallows. In uplands, it had the lowest values for genotypic and phenotypic coefficients of variation.

4) Genotype x environment interaction:

From the pooled analysis it was inferred that for the number of days to flowering, the varieties differed significantly at the two locations indicating the influence of environment on this character. Similar results were obtained for the number of days to maturity, number of primary branches per plant, number of mature pods per plant, number of immature pods per plant, number of pegs per plant, fresh weight of mature pods per plant, 100-pod weight, shelling percentage and weight of haulms per plant. For height of plants, the interaction was absent and hence the character was found to be stable in performance. Dry weight of mature pods per plant and 100-kernal weight were also found to be stable.

Non-significant variety x place interaction for yield and its components was reported by Joshi et al. (1970). Merchant and Munshi (1973) however reported that the various combination of characters were affected by seasons. In a study by Singh et al. (1974), it was observed that the difference in stability of varieties for pod yield was mainly due to linear regression. A highly significant first order variety x environment interaction was reported by

Sangha and Jashwal (1975). Sandhu and Khehra (1977 b) reported that genotype x environment interaction was significant for pod yield, 100-seed weight and length of primary and secondary branches but not for number of mature pods, number of primary branches and oil content. In a study of the genotype x environment interaction, Wynne and Isleib (1978) reported substantial genotype x location x year second order interaction for yield. The phenotypic stability of yield and its components, namely shelling percentage, 100-kernal weight and oil content were assessed in three environments by Yadava and Kumar (1978 b) using 11 semi-spreading varieties. It was observed that the magnitude of the linear component of the genotype x environment interaction was high for pod yield, 100-kernal weight and oil content. Yadava and Kumar (1979 a) indicated the presence of genotype x environment interaction for yield components in bunch group also. In a study of the interactions for pod yield and maturity, Yadava and Kumar (1979 b) observed that the linear portion of the interaction was significant for both the characters, while the non-linear portion was significant for days to maturity only.

Significant genotype x environment interactions for all important traits were reported by Yadava et al. (1980). Mercer-Quarshie (1980) however observed that the variety x year interaction was significant only for 100-seed weight. Variety x location interaction was significant for 100-seed weight and seed yield whereas variety x year x location interaction was significant for pod yield, number of pods per plant, seed yield, shelling percentage and 100-kernal weight, thus emphasising the importance of testing in several locations rather than in several years.

5) Correlations:

Genotypic correlations of dry pod yield were positive and significant with fresh weight of mature pods per plant, 100-pod weight and 100-kernal weight in rice fallows. The phenotypic correlations of dry pod yield were also positive and significant with number of mature pods per plant, fresh weight of mature pods per plant, 100-pod weight and 100-kernal weight. In uplands, the genotypic correlation for dry pod yield was positive and significant with only fresh weight of mature pods per plant. However, the phenotypic correlations were positive and significant with number of mature pods per plant, number of immature pods per plant and fresh weight of mature pods per plant.

Pod yield per plant was reported to be highly correlated with number of pods per plant by Ling (1954), Dorairaj (1962), Lin et al. (1969) and Sangha and Sandhu (1970). Significant positive correlation between pod yield and number of mature pods per plant was reported by Jaswal and Gupta (1966), Chandra Mohan et al. (1967), Jaswal and

Gupta (1967) and Balaiah et al. (1980). Badwal and Gupta (1968) reported positive correlations of pod yield with number of mature pods and 100-kernal weight. Positive correlation between pod yield and 100-kernal weight was also reported by Prasad and Srivastava (1968), Sangha (1973 b), Shettar (1974) and Natarajan et al. (1978 a). Kushwaha and Tawar (1973) observed a strong positive correlation of pod yield with number of mature pods per plant and weight of haulms per plant but negative correlation with days to maturity. Patra (1980) found that the number of mature and immature pods per plant were significantly associated with yield. Yield was found to have significant positive correlation with number of pods per plant and 100-kernal weight due to direct effect (Kumar and Yadava, 1982).

Number of days to flowering was not correlated with any character in rice fallows. In uplands, the character had positive and significant genotypic correlation with weight of haulms per plant and negative significant correlation with number of pegs per plant. Phenotypic correlation was positive and significant with number of primary branches and weight of haulms per plant. Kushwaha and Tawar (1973) found that number of days to flowering had negative correlation with all characters except 100-kernal weight.

Positive, significant genotypic correlations were recorded for the number of days to maturity with number of pegs per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant in rice fallows. The phenotypic correlations were also positive and significant for the number of days to maturity with the above characters. In uplands, the genotypic correlations were positive and significant for the days to maturity with the days to flowering, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant. With number of mature pods per plant and shelling percentage, the correlations were negative and significant. The phenotypic correlations for the number of days to maturity were positive and significant with number of days to flowering, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant and significant but negative with number of mature pods per plant, number of pegs per plant and shelling percentage.

In rice fallows, genotypic correlation was positive and significant for the number of primary branches per plant with number of immature pods per plant, 100-kernal weight and weight of haulms per plant. Number of primary branches per plant had positive and significant phenotypic correlation with number of immature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant in rice fallows. Negative significant correlation was observed with height of plants. In uplands, number of primary branches per plant had negative significant genotypic correlation with only 100-pod weight. The character has significant and positive phenotypic correlation with number of days to flowering and number of mature pods per plant but negative correlation with 100-pod weight.

Sangha (1973 b) observed a high positive correlation of number of primary branches with number of mature pods and 100-kernal weight. Though the present investigation did not reveal any significant correlation between number of primary branches and yield, reports of several earlier workers like Jaswal and Gupta (1967), Dholaria et al. (1972), Balaiah et al. (1980), Yadava et al. (1981) and Kumar and Yadava (1982) revealed that the number of primary branches per plant was positively correlated with yield.

In rice fallows, height of plants had positive, significant genotypic correlation with only shelling percentage whereas it had positive, significant phenotypic correlation with number of pegs per plant, shelling percentage and weight of haulms per plant and negative, significant correlation with number of primary branches and number of immature pods per plant. In uplands, height had no significant genotypic correlation with any character. It had significant, positive phenotypic correlation with shelling percentage but negative correlation with 100-kernal weight.

Number of mature pods per plant had no genotypic correlation with any character in rice fallows, but had significant, positive phenotypic correlation with fresh weight of mature pods per plant, shelling percentage and yield per plant. In uplands, significant positive genotypic correlation was recorded with shelling percentage and significant negative correlations recorded with 100-pod weight, 100-kernal weight and weight of haulms per plant. The phenotypic correlations were positive and significant with number of primary branches per plant, fresh weight of mature pods per plant, shelling percentage and yield per plant. Significant negative correlations were recorded with 100-pod weight, 100-kernal weight and weight of haulms per plant. Natarajan et al. (1978 a) had reported negative correlation for the number of pods with 100-pod and kernal weights.

Significant positive genotypic correlation was recorded for the number of immature pods per plant with number of primary branches per plant and weight of haulms per plant in rice fallows. Significant positive phenotypic correlation was recorded with number of primary branches per plant, number of pegs per plant, fresh weight of mature pods per plant, 100-kernal weight and weight of haulms per plant. The character was significantly but negatively correlated with height, shelling percentage and dry weight of mature pods per plant. In uplands, number of immature pods per plant has no significant genotypic correlation with any character. But it had significant positive phenotypic correlation with fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight, weight of haulms per plant and yield per plant. With shelling percentage, the correlation was significant but negative. High positive correlation for the number of immature pods with yield was reported by Chandra Mohan et al. (1967). Patra (1980) reported that number of immature pods per plant was very effective in selecting for yield in groundnut.

Number of pegs per plant, in rice fallows had positive and significant genotypic correlation with fresh weight of mature pods per plant, 100-pod weight and 100-kernal weight. It had significant positive phenotypic correlation with height, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight and weight of haulms per plant. In uplands, the character had significant negative genotypic correlation with days to flowering and significant positive phenotypic correlation with weight of haulms per plant.

Weight of haulms per plant had positive and significant genotypic correlations with number of primary branches per plant, number of immature pods per plant and number of pegs per plant in rice fallows. It had significant positive phenotypic correlation with number of primary branches per plant, height of plants, number of immature pods per plant, number of pegs per plant, fresh weight of mature pods per plant, 100-pod weight and 100-kernal weight. In uplands, weight of haulms per plant had significant, positive genotypic correlation with number of days to flowering and 100-pod and kernal weights but negative correlation with number of mature pods per plant and shelling percentage. It had positive and significant phenotypic correlation with number of days to flowering, number of immature pods per plant, number of pegs per plant, and 100-pod and kernal weights but negative correlation with number of mature pods per plant and shelling percentage. A positive correlation between fresh weight of haulms per plant and number of primary branches per plant was reported by Kushwaha and Tawar (1973).

In rice fallows, fresh weight of mature pods per plant had significant positive genotypic correlation with number of pegs per plant, 100-pod weight, 100-kernal weight and yield per plant. The character had significant positive phenotypic correlation with number of primary branches per plant, number of mature pods per plant, number of immature pods per plant, number of pegs per plant, 100-pod weight, 100 kernal weight, weight of haulms per plant and yield per plant. In uplands, the character had significant positive genotypic correlation with only yield per plant. It recorded a significant, positive phenotypic correlation with number of mature pods per plant, number of immature pods per plant and yield per plant and had significant but negative correlation with shelling percentage.

100-pod weight had significant, positive genotypic correlation with number of pegs per plant, fresh weight of mature pods per plant, 100-kernal weight and yield per plant in rice fallows. The phenotypic correlations were positive and significant with number of primary branches per plant, number of pegs per plant, fresh weight of mature pods per plant, 100-kernal weight, weight of haulms per plant and yield per plant but negative correlation with shelling percentage. In uplands, the genotypic correlations were positive and significant with 100-kernal weight and weight of haulms per plant but negative with number of primary branches per plant, number of mature pods per plant and shelling percentage. It had significant positive phenotypic correlation with number of immature pods per plant, 100-kernal weight and weight of haulms per plant. With number of primary branches per plant, number of mature pods per plant and shelling percentage, it recorded significant, negative correlations. Positive correlation between 100-pod weight and yield was reported by Prasad and Srivastava (1968). 100-pod weight was reported to have a negative correlation with number of pods per plant and a significant positive correlation with shelling percentage by Natarajan et al. (1978 a).

In rice fallows, 100-kernal weight had positive and significant genotypic correlation with number of primary branches per plant, fresh weight of mature pods per plant, 100-pod weight and dry weight of mature pods per plant. It had positive significant phenotypic correlation with number of primary branches per plant, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, weight of haulms per plant and dry weight of mature pods per plant and significant but negative with shelling percentage. In uplands, 100-kernal weight had significant and positive genotypic correlation with 100-pod weight and weight of haulms per plant. With number of mature pods per plant and shelling percentage, it was significantly but negatively correlated. 100-kernal weight had significant, positive phenotypic correlation with number of immature pods per plant, 100-pod weight and weight of haulms per plant but negative correlation with height of plants, number of mature pods per plant and shelling percentage. Positive correlation between 100-kernal weight and pod yield was observed by Badwal and Gupta (1968), Sangha and Sandhu (1970), Phadnis et al. (1973), Shettar (1974), Rao (1978) and Kumar and Yadava (1982). Significant positive correlation between 100-kernal weight and shelling percentage was reported by Natarajan et al. (1978 a).

In rice fallows, shelling percentage had significant positive correlation with height. Phenotypic correlations were positive and significant with height, number of mature pods per plant and 100-kernal weight but negative and significant with number of immature pods per plant and 100-pod weight. In uplands, it had positive and significant genotypic correlation with number of mature pods per plant but negative with 100-pod weight, 100-kernal weight and weight of haulms per plant. Shelling percentage had positive and significant phenotypic correlations with height and number of mature pods per plant but significant negative correlations with number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight, 100-kernal weight and weight of haulms per plant. Natarajan et al. (1978 a) had recorded positive correlation for shelling out turn with 100-pod and kernal weights.

6) Selection model:

A selection index was formulated to increase the efficiency of selection, taking into account the important characters contributing to yield. From the present as well as earlier studies, it was concluded that number of primary branches per plant, number of mature pods per plant and 100-pod weight highly influenced pod yield in groundnut. Hence an index was formulated separately for the two locations using these characters. Metroglyphs for yield and its components for the two locations are presented in Figures 7 and 8.

Based on the selection index prepared for yield on the basis of its components, the 12 top ranking varieties in rice fallows were identified as EC.119704, Ah.6915, TG-17, EC.24412, TG-14, G.270, TMV-11, Gangapuri, EC.35999, Dh-3-13, Pollachi-I and TMV-7, in the descending order of their index values. In uplands, the varieties TG-17, Ah. 6915, EC.119704, G.270, EC.116596, EC.24412, TMV-11, TG-14, Gangapuri, EC.35999, Pollachi-I and TMV-2 were found to top the list in the descending order of their index values. EC.24412, EC.35999, EC.119704, Ah.6915, G.270, TMV-11, TG-14, TG-17, Pollachi-I and Gangapuri were found to be common for the two locations, indicating their stability in performance over the locations. The percentage gain in efficiency of the selection model was calculated for both the locations and was found to be 10.4% and 22.2% respectively in rice fallows and uplands.

The preliminary step in the formulation of selection index in groundnut was made by Dorairaj (1962). He observed that pod number was a very important character contributing to yield in spreading and bunch varieties. A selection criterion for improving the bunch types of groundnut by Jaswal and Gupta (1967) revealed the importance of number of primary branches and mature pods in contributing to higher yield. Badwal and Gupta (1968) on working out a selection

Figure 7.

Characters	Range, symbol and score								
1. Number of primary branches per plant	< 4.37	ȯ	- 1	4.37 - 6.8	ọ (short line up)	- 2	> 6.8	ọ (long line up)	- 3
2. Height of plants (cm)	< 63.1	ọ (short line down)	- 1	63.1 - 76.9	ọ (medium line down)	- 2	>76.9	ọ (long line down)	- 3
3. Number of mature pods per plant	< 27.1	-0	- 1	27.1 - 31.9	—0	- 2	>31.9	——0	- 3
4. Weight of haulms per plant (g)	<177.8	0-	- 1	177.8 - 246.5	0—	- 2	> 246.5	0——	- 3

List of varieties

1. EC.21127
2. EC.21118
3. EC.116596
4. ICG.3059
5. EC.24412
6. EC.21095
7. S-7-5-13
8. EC.2100
9. EC.112027
10. B.353
11. EC.21079
12. EC.35999
13. EC.119704
14. Ah.6915
15. GAUG-I
16. J.11
17. Spanish Improved
18. Dh-3-13
19. Jyothi
20. Exotic-6
21. TMV.9
22. TMV.10
23. AK.811
24. EC.21078
25. G.270
26. TMV.2
27. KG-61-240
28. TMV.11
29. Pollachi-II
30. TG.3
31. TG.14
32. TG.17
33. TG.19
34. Spanish peanut
35. Pollachi-I
36. TMV.7
37. Gangapuri
38. Big Japan
39. CO-I
40. EC.21075

FIGURE-7 METROGLYPH FOR YIELD AND ITS COMPONENTS - RICE FALLOWS

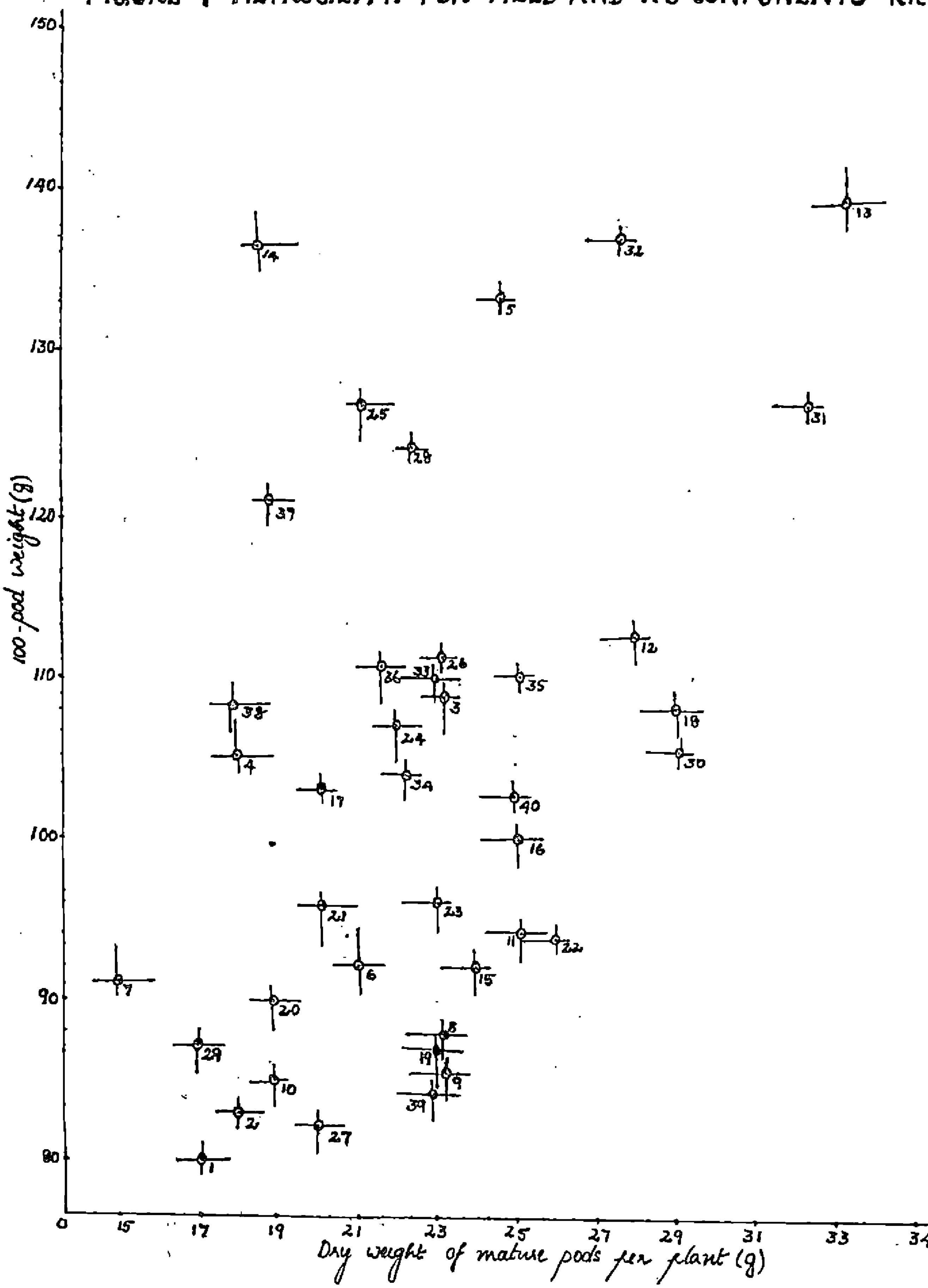
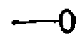


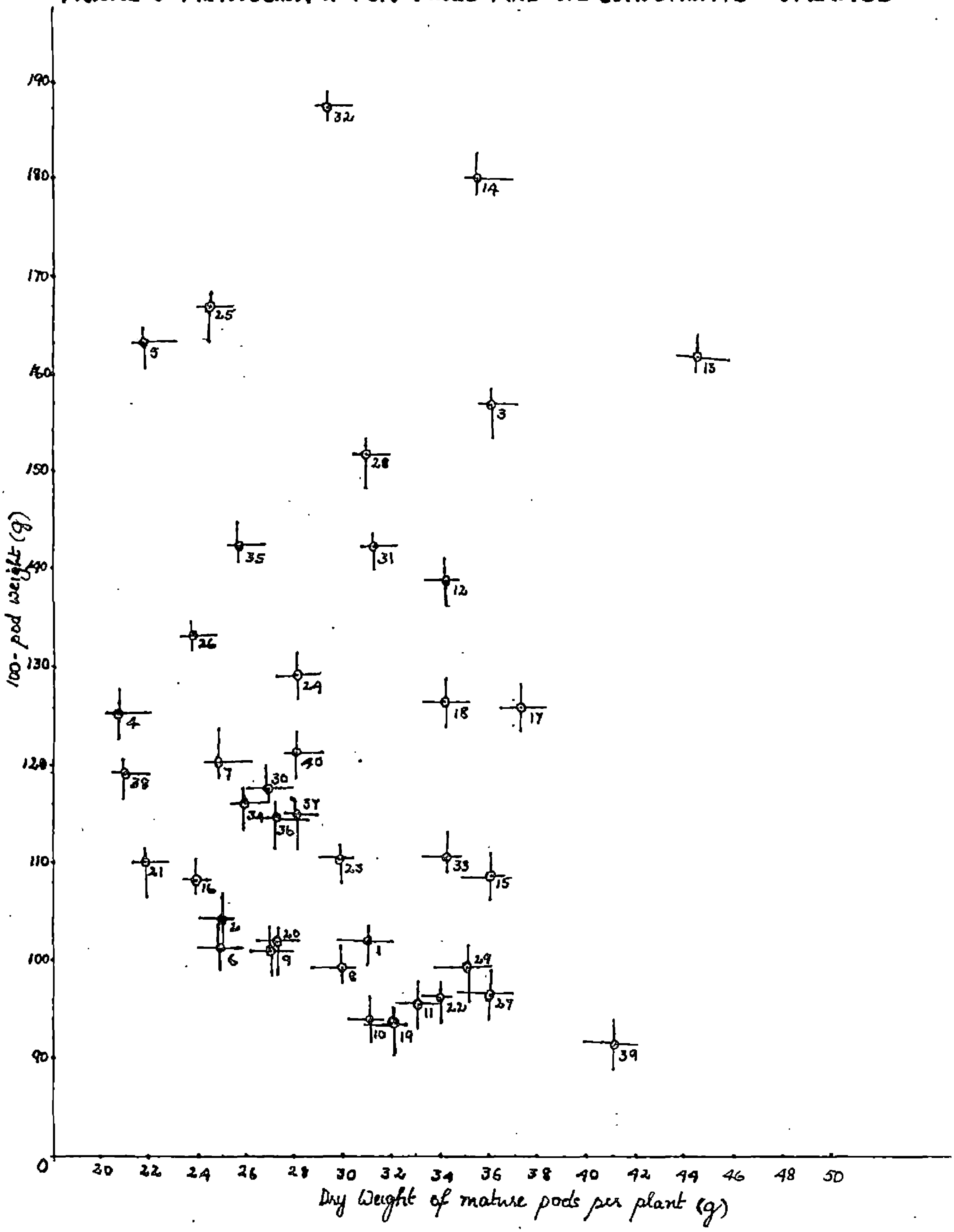
Figure-8

Characters	Range, Symbol and Score								
1. Number of primary branches per plant	< 6.4		- 1	6.4-7.7		- 2	> 7.7		- 3
2. Height of plants (cm)	< 72.9		- 1	72.9-84.1		- 2	> 84.1		- 3
3. Number of mature pods/plant	< 29.1		- 1	29.1-39.2		- 2	> 39.2		- 3
4. Weight of haulms per plant (g)	< 84.1		- 1	84.1-111.3		- 2	> 111.3		- 3

List of varieties

1. EC.21127
2. EC.21118
3. EC.116596
4. ICG.3859
5. EC.24412
6. EC.21095
7. S-7-5-13
8. EC.2100
9. EC.112027
10. B.353
11. EC.21079
12. EC.35999
13. EC.119704
14. Ah.6915
15. GAUG-I
16. J.11
17. Spanish Improved
18. Dh-3-13
19. Jyothi
20. Exotic-6
21. TMV.9
22. TMV.10
23. AK.811
24. EC.21078
25. G.270
26. TMV.2
27. KG-61-240
28. TMV.11
29. Pollachi-II
30. TG.3
31. TG.14
32. TG.17
33. TG.19
34. Spanish peanut
35. Pollachi-I
36. TMV.7
37. Gangapuri
38. Big Japan
39. CO.I
40. EC.21075

FIGURE-8 METROGLYPH FOR YIELD AND ITS COMPONENTS - UPLANDS



index for yield in groundnut observed that pod yield was largely influenced by number of mature pods and 100-kernal weight. The formulation of a selection index for yield based on correlation studies was suggested by Shettar (1974).

Dholaria et al. (1973) in formulating selection indices suggested that branch number was an important yield contributing character in spreading varieties whereas pod number was the important character in bunch types. But Venkateswaran (1980) suggested that total number of pods was an important character in the selection index for spreading varieties whereas for bunch varieties, height of main axis, total leaf area and weight per seed were equally important. Patra (1980) reported that selection based on shelling percentage and number of mature and immature pods per plant was more effective than direct selection.

SUMMARY

SUMMARY

For maximising the production of vegetable oils in the country, the improvement of the productivity of groundnut - the major oil seed crop deserves best attention. As a crop, groundnut has wide adaptability with a number of other favourable attributes. Identification of appropriate varieties suited to the two major areas of groundnut cultivation in Kerala viz., the traditional uplands during kharif and the non-traditional but potential rice fallows during summer is an immediate necessity for popularising the crop in this State.

Field trials were conducted under two diverse cropping conditions - from January to May in the summer rice fallows at Kayamkulam and from May to September in Kharif uplands at Vellayani, using 40 diverse bunch and semi-spreading varieties of groundnut. A randomised block design with 3 replications was employed. Ten plants per variety per replication were randomly selected for recording observations on characters like dry yield of pods, days to flowering and maturity, number of primary branches, height of plants, number of mature pods, immature pods and pegs, fresh weight of mature pods and weight of haulms. Bulk samples were used for recording 100-pod weight, 100-kernal weight and shelling percentage.

Statistical procedures for analysis of data included estimation of variability, variances, coefficients of variation and heritability. Genotype x environment interaction was also estimated to determine the stability of various characters. Correlations between the different characters were also estimated. A simultaneous selection model was fitted to identify varieties suited to the two locations.

In rice fallows, significant differences were noted among varieties for the number of days to maturity, number of primary branches per plant, height of plants, number of mature pods per plant, number of immature pods per plant, number of pegs per plant, weight of haulms per plant, fresh weight of mature pods per plant, dry weight of mature pods per plant, 100-pod weight, 100-kernal weight and shelling percentage. In uplands also, significant differences among varieties were observed for the above characters except number of immature pods per plant, fresh weight of mature pods per plant and yield of mature pods per plant. However significant difference was noted among varieties for the number of days to flowering which did not differ significantly among varieties in rice fallows. EC.119704 gave the highest yield in rice fallows and uplands.

Pooled analysis indicated significant variety x environment interaction for the number of days to flowering, number of days to maturity, number of primary branches per plant, number of mature pods per plant, number of immature pods per plant, fresh weight of mature pods per plant, 100-pod weight and shelling percentage. Yield of dry pods per plant, height of plants and 100-kernal weight were the characters which were not influenced by environment and hence had stable performance.

High genotypic and phenotypic variances were recorded for the weight of haulms per plant in rice fallows. Height of plants, number of pegs per plant, 100-pod weight and fresh weight of mature pods per plant also had high values. Hence the heritability was moderately high for the above characters. Number of days to maturity had the highest heritability followed by number of primary branches per plant. Days to flowering had a high phenotypic variance but its environmental variance was also high which gave low heritability. For the dry weight of mature pods per plant, the heritability was low due to low genotypic variance.

High genotypic and phenotypic variances were exhibited in uplands by 100-pod weight, number of pegs per plant, weight of haulms per plant, 100-kernal weight, number of mature pods per plant and height of plants. These characters had moderate heritability. Number of days to maturity was completely heritable in uplands also. Yield of mature pods per plant had low genotypic variance compared to environmental variance and hence the heritability was low.

Number of immature pods per plant had the highest genotypic coefficient of variation in rice fallows followed by number of pegs per plant, number of primary branches per plant, weight of haulms per plant, fresh weight of mature pods per plant, 100-pod and kernal weights with the lowest value for number of days to flowering. Number of immature pods per plant had the highest phenotypic coefficient of variation with the lowest value for the number of days to flowering. In uplands, number of pegs per plant had the highest genotypic coefficient of variation followed by number of mature pods per plant and 100-pod weight with the lowest value for shelling percentage. The highest phenotypic coefficient of variation was for the number of immature pods per plant followed by number of pegs per plant and number of mature pods per plant. The lowest value was for shelling percentage.

Yield, in rice fallows was positively and significantly correlated with fresh weight of mature pods per plant, 100-pod weight and 100-kernal weight. Among themselves, these characters had significant positive correlation. Yield had significant positive phenotypic correlation with number of mature pods per plant, fresh weight of mature pods per plant and 100-pod and kernal weights. Significant, negative correlation was recorded with number of immature pods per plant. Number of mature pods per plant had significant positive correlation with fresh weight of mature pods per plant and shelling percentage. In uplands, yield had significant and positive genotypic correlation with only fresh weight of mature pods per plant. Yield had significant positive phenotypic correlation with number of mature pods per plant, fresh weight of mature pods per plant and number of immature pods per plant. Number of mature pods per plant had significant, positive correlation with fresh weight of mature pods per plant and shelling percentage.

Among the various characters studied, number of primary branches per plant, number of mature pods per plant and 100-pod weight were concluded to be economically important and contributing to yield. So these characters were selected for the formulation of selection index for the two locations. On exercising 30% selection, the twelve ranking varieties in rice fallows were identified as Ec.119704, Ah.6915, TG-17, EC.24412, TG-14, G.270, TMV-11, Gangapuri, EC.35999, Dh-3-13, Pollachi-I and TMV-7 in the descending order of their index values. In uplands the varieties TG-17, Ah.6915, EC.119704, G.270, EC.116596, EC.24412, TMV-11, TG-14, Gangapuri, EC.35999, Pollachi-I and TMV-2 were found to top the list. Varieties EC.24412, EC.35999, EC.119704, Ah.6915, G.270, TMV-11, TG-14, TG-17, Pollachi-I and Gangapuri were inferred to be of stable performance and could be grown at both the locations.

REFERENCES

REFERENCES

Aulakh, K.S., Sandhu, R.S. and Sunar, M.S. (1972). Resistance to 'Tikka' leaf spot in the groundnut germplasm. Indian J. agric. Sci., 42(10): 952-955.

*Badwal, S.S. and Gupta, V.P. (1968). Correlations of quantitative traits and selection indices for improving pod yield in groundnut. J. Res. Punjab agric. Univ., 5(2): 20-23.

Baliah, C., Reddi, P.S. and Reddi, M.V. (1980). Correlation studies of some yield components in the F_2 segregating population of the groundnut cross 'J.11 x Gurajat Narrow Leaf Mutant'. Indian J. agric. Sci., 50(3): 213-215.

Chandola, R.P., Dixit, P.K. and Saxena, D.K. (1973). Note on path coefficient analysis of yield components in groundnut. Indian J. agric. Sci., 50(9): 897-898.

Chandra Mohan, J., Ali, Mohammed, A. and Subramanian, C. (1967). Correlation studies in groundnut (*Arachis hypogaea* L.) Correlation of certain quantitative characters with yield in the strain TMV-2. Madras agric. J., 54(9/12): 482-484.

Dholaria, S.J. and Joshi, S.N. (1972). Effect of high and low fertilization on variability in groundnut. Indian J. agric. Sci., 42(6): 467-470.

Dholaria, S.J., Joshi, S.N. and Kabaria, M.M. (1972). Correlation of yield and yield contributory characters in groundnut under high and low fertility levels. Indian J. agric. Sci., 42(12): 1084-1086.

Dholaria, S.J., Joshi, S.N. and Kabaria, M.M. (1973). Selection indices under high and low fertility in groundnut. Madras agric. J., 60(9-12): 1388-1393.

Dixit, P.K., Bhargava, P.D., Saxena, D.K. and Bhatia, L.K. (1970). Estimates of genotypic variability of some quantitative characters in groundnut (Arachis hypogaea L.). Indian J. agric. Sci., 40(3): 197-202.

Dixit, P.K., Bhargava, P.D., Saxena, D.K., Bhatia, L.K. and Sharma, K.N. (1971). Variability in groundnut (Arachis hypogaea L.). Indian J. agric. Sci., 41(8): 685-691.

Dorairaj, M.S. (1962). Preliminary steps for the formulation of selection index for yield in groundnut (Arachis hypogaea Linn.). Madras agric. J., 49: 12-27.

Gregory, W.C. and Gregory, M.P. (1976). Groundnut (Arachis hypogaea. Leguminosae-Papilionatae) in Evolution of crop plants. Longman Group Ltd., London: 151-153.

Harisingh, Yadav, A.K., Yadava, T.P. and Chhabra, M.L. (1982). Genetic variability and heritability for morpho-physiological attributes in groundnut. Indian J. agric. Sci., 52(7): 432-434.

*Jaswal, S.V. and Gupta, V.P. (1966). Correlation and regression studies in spreading types of groundnut. J. Res. Punjab agric. Univ., 3: 385-388.

*Jaswal, S.V. and Gupta, V.P. (1967). Selection criteria in improving erect types in groundnut. J. Res. Punjab agric. Univ., 4: 188-191.

*Joshi, S.N., Kabaria, M.M. and Vaishanani, N.L. (1970). Environment x genotype interaction in varietal tests of bunch groundnut. Telhan Patrika, 11(4): 33-35.

Joshi, S.N., Vaishanani, N.L. and Kabaria, M.M. (1972). Stability parameters in bunch varieties of groundnut (Arachis hypogaea L.). Indian J. agric. Sci., 42(2): 145-147.

Khangura, B.S. and Sandhu, R.S. (1972). Path analysis in groundnut (*Arachis hypogaea* L.). Indian J. agric. Sci., 42(9): 792-795.

Khangura, B.S. and Sandhu, R.S. (1973). Genetic variability in some quantitative characters in groundnut (*Arachis hypogaea* L.). J. Res., 10(3): 262-267.

*Kumar, P. and Yadava, T.P. (1978). Interrelationships between yield and yield components in groundnut. SABRAO J., 10(1): 1-4.

Kumar, P. and Yadava, T.P. (1982). Character association in bunch group of groundnut (*Arachis hypogaea*). Indian J. agric. Res., 16(1): 61-64.

Kushwaha, J.S. and Tawar, M.L. (1973). Estimates of genotypic and phenotypic variability in groundnut (*Arachis hypogaea*). Indian J. agric. Sci., 43(12): 1049-1054.

*Kushwaha, J.S. and Tawar, M.L. (1974). Stability parameters of bunch varieties of groundnut (SABRAO J., 6(1):87-89.

*Ling (Lin), H. (1954). Studies on peanut characters and their correlations. Nungych Yenchiu/Agric. Res., 4(4): 46-67.

*Lin, H. and Chen, C.-C. (1967). Studies on the yield components of peanut.1. The path coefficient of yield components in different types of peanut. J. agric. Assoc. China, 57: 35-48.

*Lin, H., Chen, C.-C. and Lin, C.-Y. (1969). Studies on the yield components of the groundnut II. Analysis of yield components in spring and autumn crops of groundnut Chung-hua Nung-hsueh Hui Pao/J. agric. Assoc., 65: 22-31.

Mahapatra, L.N. (1966). Preliminary studies on correlation of yield with other characters in groundnut. Indian J. agric. Sci., 10: 97-106.

Majumdar, P.K., Prakash, R. and Fazlul Haque, M.D. (1969). Genotypic and phenotypic variability in quantitative characters in groundnut (Arachis hypogaea L.). Indian J. genet. Pl. Breed., 29(2): 291-295.

Majumdar, P.K., Prakash, R. and Hassan, M.A. (1970). Note on indices of maturity in groundnut varieties. Indian J. agric. Sci., 40(3): 292-293.

*Mercer-Quarshie, H. (1980). Genotype x environment interactions in groundnut (Arachis hypogaea). Tests in northern Ghana. Oléagineux, 35(4): 207-211.

*Merchant, N.M. and Munshi, Z. (1973). Correlation studies in Arachis hypogaea L. Semi-spreading habit of growth and certain characters. Part II. J. agric. Res., 11(9): 71-79.

*Miller, I.L. and Norden, A.J. (1980). Relationship of yield, maturity and susceptibility to leaf spot diseases in peanut (Arachis hypogaea L.). Agron. Abst., 62: 110-118.

Mishra, S.P. (1958). Correlation studies in groundnut. Indian J. Genet., 18: 49-53.

Moustafa, M.A.W. and Sayed, S.I.A. (1971). Study of correlation between some morphological characters and yield components in peanut (Arachis hypogaea L.). Agric. Res. Rev., 49(6): 65-76.

Muhammad, V.S. and Dorairaj, S.M. (1968). Note on the gradation of groundnut varieties to Cercospora resistance in Madras state. Indian J. agric. Sci., 38(6): 941-943.

Muhammad, V.S., Ramanathan, T. and Ramachandran, M. (1973 a). Variation in morphological characters in Arachis hypogaea L. Madras agric. J., 60(9/12): 1373-1379.

Muhammad, V.S., Ramanathan, T., Ramachandran, M. and Mohan Babu, G. (1973 b). Variations in kernal weight and shelling outturn in Arachis hypogaea. Madras agric. J., 60(9-12): 1394-1396.

Muheet, A., Chandran, L.S. and Agarwal, O.P. (1975). Relative resistance in groundnut to Sclerotial Root Rot (Scleratium rolfsii Sacc.). Madras agric. J., 62(3): 164-165.

Narain, P., Bhatia, V.K. and Malhotra, P.K. (1979). Handbook of Statistical genetics. IASRI, ICAR, New Delhi: 363.

Natarajan, S.T., Sathiamoorthy, M.R., Venkateswaran, A.N. and Ramachandran, T.K. (1978 a). Estimates of the genetic parameters and correlation studies in bunch groundnut. Madras agric. J., 65(8): 497-501.

Natarajan, S.T., Sathiamoorthy, M.R. and Ramachandran, T.K. (1978 b). A note on the variability in kernal weight and shelling outturn in groundnut. J. Maharashtra agric. Univ., 3(1): 67-68.

Nigam, A.K. and Gupta, V.K. (1979). Handbook on Analysis of Agricultural Experiments, IASRI, ICAR, New Delhi:307.

Patra, G.J. (1975). Heritability and genetic advance of some quantitative characters in groundnut hybrids in the F_3 generation. Indian J. agric. Sci., 45(7): 308-311.

Patra, G.J. (1980). Multiple criteria selection in some hybrid populations of groundnut. Indian J. Genet. Pl. Breed., 40(1): 13-17.

*Pedrosa, A.M. Jr. (1977). Evaluation of several methods of taking disease severity readings for Cercospora leaf spot of peanuts. Dissertation Abstracts International, B, 37(9): 4251B-4252B.

*Phadnis, B.A., Ekbote, A.P. and Manka, A.R. (1973). Correlation studies in some metric characters in groundnut (Arachis hypogaea). JNKVV Res. J., 7(2): 68-72.

*Prasad, S. and Srivastava, D.P. (1968). Correlation studies in groundnut (Arachis hypogaea L.). Ranchi J. agric. Res. Univ., 3: 12-16.

Prasad, K.S.K., Hedge, R.K., Siddaramaiah, A.L. and Jayaramaiah, H. (1979). Screening groundnut varieties for Tikka disease resistance. Curr. Res., 8(6): 104-105.

Ramachandran, T.K. and Venkateswaran, A.N. (1980). An assessment of a Valencia bunch groundnut (Arachis hypogaea). In National Seminar on the application of genetics to improvement of groundnut. 16-17: 160-170.

*Rao, T.S. (1978). Heritable variation and interrelationship of economic characters in groundnut. Genetica Iberica. 30/31: 257-260.

Rao, T.S. (1980). An assessment of genetic variation in bunch groundnut. In National seminar on the application of genetics to improvement of groundnut. 7: 16-17.

Sandhu, B.S. and Khehra, A.S. (1977 a). Genetic analysis of shelling percentage in groundnut. Indian J. agric. Sci., 47(5): 229-231.

Sandhu, B.S. and Khehra, A.S. (1977 b). Genotype-environment interaction in groundnut. Crop Improvement, 4(2): 225-226.

Sandhu, R.S. and Sangha, A.S. (1974). Analysis of the diversity in groundnut (Arachis hypogaea). 1. Bunch group. Oilseeds J.,(14): 1-8.

Sangha, A.S. (1971). Analysis of diversity in groundnut (Arachis hypogaea)II. Spreading group. Madras agric. J., 58(12): 875-882.

Sangha, A.S. (1973 a). Genetic diversity in spreading groundnut. Madras agric.J., 60(9-12): 1380-1387.

Sangha, A.S. (1973 b). Genetic variability and correlation studies in spreading groundnut varieties (Arachis hypogaea L.). Madras agric.J., 60(9/12): 1446-1452.

Sangha, A.S. and Jaswal, S.V. (1975). Genotype x environment interactions in spreading groundnut.1. Elite strains. Oilseeds J., 5(1): 8-12.

*Sangha, A.S. and Sandhu, R.S. (1970). Genetic variability and correlation studies in groundnut (Arachis hypogaea L.). J. Res. Punjab agric. Uni., 7: 143-150.

Seshadri, C.R. (1962). "Groundnut". Indian Central Oilseeds Committee, Hyderabad: 274.

Shettar, B.I. (1974). Variability pattern and formulation of selection index for yield of groundnut (Arachis hypogaea L.). Mysore J. agric. Sci., 8(2): 296-297.

Singh, K.P. and Singh, A.B. (1974). A selection index for yield in Indian Mustard. Indian J. agric. Sci., 44(3): 129-131.

Singh, M., Badwal, S.S. and Jaswal, S.V. (1974). Stability of pod yield in groundnut. Indian J. Genet., 35(1): 26-28.

Singh, R.K. and Chaudhary, B.D. (1977). Biometrical Methods in Quantitative genetic Analysis. Kalyan Publishers, Ludhiana: 301.

Sivasubramanian, P., Ramanathan, T., Mahalingam, R., Satyaprasad, K.N. and Adhivarahan, D. (1977). Genetic variability in certain metric traits of Arachis hypogaea L. Madras agric. J., 64(7): 447-450.

Sridharan, C.S., Thandavarayan, K. and Govinda Das, G. (1972). TMV-10. A semi-spreading groundnut variety with high oil content. Madras agric. J., 59(3): 190-191.

Tai, P.Y.P. and Hammons, R.O. (1978). Genotype x environment interaction in peanut by evaluation. Peanut Science, 5(2): 72-74.

Venkateswaran, A.N. (1980). Discriminant function as a tool in groundnut breeding. In National seminar on the application of genetics to improvement of groundnut. (7): 16-17.

*Williams, J.H., Hilderbrand, G.L. and Tattersfield, J.R. (1978). The effect of weather and genotype x environment interaction on the yields of groundnut (Arachis hypogaea L.). Rhodesian J. agric. Res., 16(2): 192-204.

Wynne, J.L. and Isleib, T.G. (1978). Genotype x environment interactions in peanut yield tests. Peanut Science, 5(2): 102-105.

Yadava, T.P. and Kumar, P. (1978 a). Stability analysis for pod yield and maturity in bunch group of groundnut (Arachis hypogaea L.). Indian J. agric. Res., 12(1):1-4.

*Yadava, T.P. and Kumar, P. (1978 b). Phenotypic stability of yield and its components in semi-spreading group of groundnut (Arachis hypogaea L.). Crop Improvement, 5(1): 45-49.

Yadava, T.P. and Kumar, P. (1979 a). Phenotypic stability for yield components and oil content in bunch group of groundnut. Indian J. agric. Sci., 49(5): 318-321.

Yadava, T.P. and Kumar, P. (1979 b). Studies on genotype x environment interaction for pod yield and maturity in groundnut (Arachis hypogaea L.). Haryana agric. Univ. J. Res., 9(3): 226-230.

Yadava, T.P., Kumar, P. and Yadav, A.K. (1980). Stability analysis for oil content and yield components in groundnut (Arachis hypogaea L.). Haryana agric. Univ. J. Res., 10(4): 560-563.

Yadava, T.P., Kumar, P. and Yadav, A.K. (1981). Correlation and path analysis in groundnut. Haryana agric. Univ. J. Res., 11(2): 169-171.

*Original not seen

APPENDICES

Appendix-1. Number of days to flowering

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	5.8265	2.9133	1.27
Treatments (Varieties)	39	116.1730	2.9788	1.30
Error	78	178.6935	2.2909	
Total	119	300.6930		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	1.1072	0.5536	1.27
Treatments (Varieties)	39	183.8147	4.7132	10.79**
Error	78	34.0728	0.4368	
Total	119	218.9947		

iii) Pooled Analysis

a) Weighted Analysis

Source	S.S.
Total	663.61
Environment	165.85
Variety	392.66
V x E	105.10**

b) Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	75.405		
Varieties	39	70.935	1.8188	1.38
V x E	39	51.307	1.3156	

**Significant at 1% level

Appendix-2. Number of days to maturity

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	0	0	0
Treatments (Varieties)	39	1599.3	41.0077	∞ **
Error	78	0	0	
Total	119	1599.3		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	0	0	0
Treatments (Varieties)	39	3468	88.9231	∞ **
Error	78	0	0	
Total	119	3468		

iii) Pooled Analysis

Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	756.45		
Varieties	39	1088.55	27.9115	1.81*
V x E	39	600.55	15.3987	∞ **
Pooled error	156	-	0	

*Significant at 5% level

**Significant at 1% level

Appendix-3. Number of primary branches per plant

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	0.4372	0.2186	0.83
Treatments (Varieties)	39	273.7063	7.0181	26.71**
Error	78	20.4962	0.2628	
Total	119	294.6397		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	0.9252	0.4626	0.75
Treatments (Varieties)	39	88.6213	2.2723	3.70**
Error	78	47.8615	0.6136	
Total	119	137.4079		

iii) Pooled Analysis

a) Weighted Analysis

Source	S.S.
Total	1229.0755
Environment	88.8339
Variety	872.1215
V x E	268.1201**

b) Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	39.4367		
Varieties	39	242.6831	6.2226	2.04*
V x E	39	119.0287	3.0520	

*Significant at 5% level

**Significant at 1% level

Appendix-4. Height of plants

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	2040.0755	1020.0378	13.75**
Treatments (Varieties)	39	9748.6386	249.9651	3.37**
Error	78	5786.9512	74.1917	
Total	119	17575.6653		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	164.2835	82.1418	1.24
Treatments (Varieties)	39	6987.7997	179.1744	2.71**
Error	78	5152.1898	66.0537	
Total	119	12304.2730		

iii) Pooled Analysis

Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	2149.15		
Varieties	39	4289.60	109.9897	0.9272
V x E	39	1253.64	32.1446	0.2292
Pooled Error	156	-	140.2452	

**Significant at 1% level

Appendix-5. Number of mature pods per plant

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	13.6862	6.8431	0.29
Treatments (Varieties)	39	1642.0917	42.1049	1.78*
Error	78	1846.2138	23.6694	
Total	119	3501.9917		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	3196.3865	1598.1933	26.86**
Treatments (Varieties)	39	7558.6170	193.8107	3.26**
Error	78	4641.8335	59.5107	
Total	119	15396.8370		

iii) Pooled Analysis

a) Weighted Analysis

Source	S.S.
Total	179.9585
Environment	0.0025
Variety	119.0314
V x E	60.9271*

b) Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	0.1188		
Varieties	39	6396.1079	164.0028	2.39**
V x E	39	2669.9754	68.4609	

* Significant at 5% level

**Significant at 1% level

Appendix-6. Number of immature pods per plant

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	12.7352	6.3676	0.73
Treatments (Varieties)	39	2421.9859	62.1022	7.02**
Error	78	681.4448	8.7365	
Total	119	3116.1659		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	240.9702	120.4851	5.21**
Treatments (Varieties)	39	1185.6859	30.4022	1.31
Error	78	1803.9298	23.1273	
Total	119	3230.5859		

iii) Pooled Analysis

a) Weighted Analysis

Source	S.S.
Total	355.4769
Environment	33.4054
Variety	235.2030
V x E	86.8685**

b) Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	177.4172		
Varieties	39	721.6280	18.5033	1.56
V x E	39	462.1118	11.8490	

**Significant at 1% level

Appendix-7. Number of pegs per plant

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	2088.9871	1044.4936	3.93*
Treatments (Varieties)	39	40691.3802	1043.3687	3.93**
Error	78	20717.6333	265.6107	
Total	119	63498.0007		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	2214.5180	1107.2590	12.07**
Treatments (Varieties)	39	24098.3453	617.9063	6.74**
Error	78	7155.7087	91.7399	
Total	119	33468.5720		

iii) Pooled Analysis

a) Weighted Analysis

Source	S.S.
Total	453.6127
Environment	36.0474
Variety	282.9437
V x E	134.6216**

b) Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	2145.97		
Varieties	39	12278.76	314.8400	1.33
V x E	39	9242.55	236.9885	

*Significant at 5% level

**Significant at 1% level

Appendix-8. Weight of haulms per plant

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	5171.2828	2585.6414	1.52
Treatments (Varieties)	39	290670.1760	7153.0814	4.39**
Error	78	132552.3570	1699.3892	
Total	119	428393.8160		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	10664.6206	5332.3103	13.86**
Treatments (Varieties)	39	38211.2845	979.7765	2.55**
Error	78	30000.8451	384.6262	
Total	119	78876.7503		

iii) Pooled Analysis

a) Weighted Analysis

Source	S.S.
Total	847.1741
Environment	581.5797
Variety	170.3095
V x E	95.2849**

b) Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	611128.7740		
Varieties	39	228658.8030	5863.0463	2.28**
V x E	39	100224.6290	2569.8623	

**Significant at 1% level

Appendix-9. Fresh weight of mature pods per plant

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	99.3503	49.6751	0.89
Treatments (Varieties)	39	10779.5836	276.3996	4.99**
Error	78	4315.8951	55.3319	
Total	119	15194.8290		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	6092.9967	3046.4983	25.06**
Treatments (Varieties)	39	6825.0022	175.0001	1.44
Error	78	9482.9077	121.5757	
Total	119	22400.9065		

iii) Pooled Analysis

a) Weighted Analysis

Source	S.S.
Total	243.8499
Environment	1.4285
Variety	175.0583
V x E	67.3630*

b) Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	133.6086		
Varieties	39	11166.4419	286.3190	1.77*
V x E	39	6300.2942	161.5460	

*Significant at 5% level

**Significant at 1% level

Appendix-10. Dry weight of mature pods per plant

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	90.8732	45.4366	2.26
Treatments (Varieties)	39	1907.1951	48.9024	2.43**
Error	78	1567.1507	20.0917	
Total	119	3565.2191		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	2657.9235	1328.9618	22.12**
Treatments (Varieties)	39	3408.9433	87.4088	1.46
Error	78	4685.6627	60.0726	
Total	119	10752.5295		

iii) Pooled Analysis

Weighted Analysis

Source	S.S.
Total	227.1165
Environment	75.4471
Variety	100.7348
V x E	50.9346

**Significant at 1% level

Appendix-11. 100-pod weight

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	12.2483	6.1242	0.14
Treatments (Varieties)	39	31228.6378	800.7343	14.85**
Error	78	4206.0834	53.9241	
Total	119	35446.9694		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	116.6167	58.3083	0.62
Treatments (Varieties)	39	74771.9812	1917.2303	20.40**
Error	78	7330.0500	93.9750	
Total	119	82218.6479		

iii) Pooled Analysis

a) Weighted Analysis

Source	S.S.
Total	1670.2451
Environment	294.0746
Variety	1254.5769
V x E	121.5937**

b) Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	21716.6722		
Varieties	39	96987.0527	2846.8475	10.80**
V x E	39	8979.3878	73.8475	

**Significant at 1% level

Appendix-12. 100-kernal weight

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	1.9865	0.9933	0.13
Treatments (Varieties)	39	3296.5676	84.5274	11.33**
Error	78	581.9218	7.4605	
Total	119	3880.4759		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	2.0802	1.0401	0.13
Treatments (Varieties)	39	5763.2603	147.7759	17.89**
Error	78	643.9682	8.2560	
Total	119	6409.3087		

iii) Pooled Analysis

Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	2332.42		
Varieties	39	2322.40	59.8051	3.71**
V x E	39	694.91	17.8182	1.13
Pooled error	156		15.7165	

**Significant at 1% level

Appendix-13. Shelling percentage

i) Summer rice fallows - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	1.4124	0.7062	0.03
Treatments (Varieties)	39	3069.7233	78.7109	3.45**
Error	78	1780.4629	22.8264	
Total	119	4851.5986		

ii) Kharif uplands - ANOVA

Source	df	S.S.	M.S.	F
Blocks	2	0.8531	0.4265	0.11
Treatments (Varieties)	39	967.4667	24.8068	6.12**
Error	78	315.9681	4.0509	
Total	119	1284.2879		

iii) Pooled Analysis

a) Weighted Analysis

Source	S.S.
Total	727.75
Environment	355.26
Variety	237.28
V x E	135.21**

b) Unweighted Analysis - ANOVA

Source	df	S.S.	M.S.	F
Environment	1	1591.65		
Varieties	39	808.95	20.7423	1.51
V x E	39	535.15	13.7218	

**Significant at 1% level

SELECTION PARAMETERS IN GROUNDNUT

BY

RADHIKA, C.

ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT

FOR THE DEGREE OF

MASTER OF SCIENCE IN AGRICULTURE

FACULTY OF AGRICULTURE

KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF PLANT BREEDING

COLLEGE OF AGRICULTURE

VELLAYANI, TRIVANDRUM

1984.

ABSTRACT

Forty divergent varieties of groundnut belonging to the bunch and semi-spreading groups were subjected to preliminary evaluation in summer rice fallows and kharif uplands. Studies on the various aspects like variability, heritability, stability and correlations were undertaken. A selection index was also formulated and the superior, stable varieties for the two locations were identified.

The varieties were found to differ significantly for the various characters like number of days to maturity, number of primary branches per plant, height of plants, number of mature pods per plant, number of immature pods per plant, number of pegs per plant, weight of haulms per plant, fresh weight of mature pods per plant, dry weight of mature pods per plant, 100-pod and kernal weights and shelling percentage in rice fallows. In uplands, the varieties differed significantly for the number of days to flowering, number of days to maturity, number of primary branches per plant, height of plants, number of mature pods per plant, number of pegs per plant, weight of haulms per plant, 100-pod weight, 100-kernal weight and shelling percentage.

Pooled analyses were done for the various characters to determine the influence of environment on them. It was found that number of days to flowering, number of days to maturity, number of primary branches per plant, number of

mature pods per plant, number of immature pods per plant, number of pegs per plant, weight of haulms per plant, fresh weight of mature pods per plant, 100-pod weight and shelling percentage were influenced by environment to various degrees. But height of plants, dry weight of mature pods per plant and 100-kernal weight were found to have stable performance.

High genotypic and phenotypic variances were recorded in rice fallows for the weight of haulms per plant, number of pegs per plant, 100-pod weight, fresh weight of mature pods per plant, number of days to flowering and height of plants. Hence these characters were moderately heritable. Though the number of primary branches per plant had low genotypic variance, it was a highly heritable character due to low environmental variance. The highest heritability was for the days to maturity. In uplands also high genotypic and phenotypic variances with moderate heritability were exhibited by 100-pod weight, number of pegs per plant and 100-kernal weight. Days to maturity was the most heritable character. Yield of mature pods per plant had low heritability.

The highest genotypic coefficient of variation in rice fallows was for the number of immature pods per plant, followed by number of pegs per plant, number of primary branches per plant, weight of haulms per plant, etc. Number of immature pods per plant had the highest phenotypic coefficient of variation also. In uplands, number of pegs per plant had the highest genotypic coefficient of variation.

Number of immature pods per plant had the highest phenotypic coefficient of variation followed by number of pegs per plant.

Positive significant genotypic correlations were recorded for yield with fresh weight of mature pods per plant, 100-pod weight and 100-kernal weight in rice fallows. Yield had significant positive phenotypic correlations with number of mature pods per plant, fresh weight of mature pods per plant, 100-pod weight and 100-kernal weight. With number of immature pods per plant, it had significant negative correlation. In uplands, yield had significant positive genotypic correlation with fresh weight of mature pods per plant. Yield also had significant positive phenotypic correlation with number of mature pods per plant, number of immature pods per plant and fresh weight of mature pods per plant. Correlations among the various characters at the genotypic and phenotypic levels were also worked out separately for the two locations.

A simultaneous selection model was fitted for the two locations using yield and yield contributing characters like number of primary branches and mature pods per plant and 100-pod weight. EC.24412, EC.35999, EC.119704, Ah.6915, G-270, TMV-11, TG-14, TG-17, Pollachi-I and Gangapuri were concluded to be of stable performance and could be grown in uplands as well as rice fallows.