CORRELATION STUDIES AND THE APPLICATION OF DISCRIMINANT FUNCTION FOR SELECTION FOR YIELD IN BRINJAL (*Solanum melongena*, L.)

BY

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THESIS

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CERTIFICATE

This is to certify that the thesis herewith submitted contains the results of bona fide research work carried out by Shri K.A. Raphael, under my supervision. No part of the work embodied in this thesis has been submitted earlier for the award of any degree.

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INTRODUCTION

I N T R O D U C T I O N

Among the various vegetables in Kerala, brinjal constitutesan important group, eventhough they are mostly grown in rain-fed conditions.

Selection for high yield is the chief consideration in any crop breeding programme. However, yield is a complex character, polygenic in inheritance and subjected to large environmental variations. Any direct measure to evaluate or select for this character becomes difficult because such variations contribute so much to the phenotype that genic effects remain mostly undetected. Efficiency of selection under such circumstances can be improved by determining the association existing between yield and other less variable plant characters which would serve as simple guides for spotting out high yielders. The existence of association is determined by studying the correlation between these characters and yield.

Previously these correlation studies mostly utilised only the phenotypic variation in different characters. But with the recent advance in biometrics it has been made possible to estimate the genotypic and error components of these variations. With the help of this information a selection index or score can be evolved which will aid the plant breeder in making selection for yield based on a number of characters which govern yield. The technique of discriminant function developed by Fisher (1936) and adopted by Smith (1936) in plant breeding affords an efficient method for this purpose.

The technique of discriminant function has been adopted by several workers for the construction of selection indices in different crops. A number of reports on the use of selection indices based on yield or its components are now available that show a variable degree of efficiency over selection based on the single character yield. The efficiency of selection index for yield in various crops still remains as a debated point. According to Abraham et al. (1954) in rice, selection index using yield components in addition to or alternative to yield was not found to improve the selection efficiency over direct selection. However, Chandramohan and Ponnaiya (1961) in rice, Smith (1936) in wheat, Vishnu Swarup and Chaugale (1962) in sorghum, Sankar et al. (1963) in pearl millet, Mahadevappa (1962) in ragi, Kamalanathan (1962) in Gossypium arboreum and Johnson et al. (1955) in soybean do not seem to contribute to this opinion. The former authors indicated the usefulness of a selection index for yield.

So the present study was undertaken with a fairly large and divergent collection of brinjal varieties, and the various yield contributing characters were fully analysed and the efficiency of a number of selection indices was worked out.

R E V I E W   O F   L I T E R A T U R E

REVIEW OF LITERATURE

All economic characters which contribute to yield, are polygenic in inheritance unlike Mendelian characters, and the genotype for these characters cannot be directly measured, being masked by non-heritable variations due to the environmental effects. This fact has gradually resulted in the development of biometrics during the last decade or two. It has also been recognised that owing to the absence of such measure "the Mendelian approach is inapplicable to the study of polygenic inheritance for which statistical method alone has to be relied on (Panse, 1957). Yield being a complex character contributed by many factors variable due to environment, selection based on the over all performance viz., the ultimate yield itself may not give a true picture of the inherent capacity or the genotype of the breeding material.

The object of application of selection index is to find out the genotype worth of the yield components in arriving at the ultimate yield by excluding the environmental influence. This is achieved

(1) by working and correlations between yield and its components and (2) by giving weightage to the true or genotypic relationship.

The review of literature is made on the two aspects.

1. Correlations

Different characters of a plant are often correlated with each other. The correlations of characters may be due to pleiotropy, i.e., manifold effects of a gene or genes on different parts of a plant or due to genetic linkage (Aarland, 1959). The former correlation (pleiotropy) belongs to the category of physiological association.

Correlation studies are an important asset to the breeder of any crop; they are all the more important in case of fruit crops in which it is necessary to determine the relationship between yield and quality or between various factors that contribute to yield or quality. The correlations may be of physiological nature for qualitative or quantitative characters. These may belong to the category of genetic linkages or physiological associations. A knowledge of the former is of value to the plant breeder in order to know which desirable characters are present in the coupling phase and in which they occur in repulsion phase. While the information on physiological correlation is essential it is manifestly useless to separate characters which are just associated (Sikka and Afzal, 1946). Salient results of correlation studies in various crop plants are summarised.

1. Correlation of physiological characters

The relation between crop yield and environment conditions of a plant entails certain physiological principle.

Any study on the physiology of yield necessitates growth analysis and methods devised by Gregory (1917) and by West, Briggs and Kidd (1920) are used for this purpose.

Ball (1910) stated that in sorghum, brown or black coloured grains are associated with bitter taste due to the presence of tannins.

West, Briggs and Kidd (1920) and Gregory (1926) have shown that the net assimilation rate (NAR) varies by short term changes in climatic factor especially by temperature.

Watson (1947) while working on potatoes, have shown that the range of temperature affects the net assimilation rate (NAR); where NAR increased with increasing daily temperature range. The same was found in sugar beets also.

Chinoy (1947) found correlation of yield in wheat with 1000 grain weight.

Thuljaram Rao (1947) found that leaf midrib structure of sugarcane as correlated with resistance to top shoot borer. Krishna Rao (1948) reported that resistance to insect pest in millets was associated with pigmentation.

Ahmad et al. (1950) Afzal and Ghani (1950) reported that in cotton, resistance to jassids was highly correlated with pilosity of the plant, the more resistant types showing the greatest degree of hairiness on the under surface of the leaf. They considered tonghness of vein to be associated with jassid resistance.

Levitt (1951) attempted to correlate draught resistance to morphological, anatomical, physiological and physiochemical properties of the plants.

Asna and Mani (1955) recorded negative association between time of flowering and ear number; between grain number and size, and between grain number and ear number in Some varieties however, showed exceptions to this unfavourable association lending themselves to combine early flowering with reasonable high values of three ear characters.

Sprague (1955) reported significant correlation between popping expansion and size of kernel and proportion of stiff starch in maize.

Asna (1957) compared the behaviour of 260 varieties of both exotic and Indian wheats in different vegetative periods, grown with and without irrigation, and found that yield and 1000 grain weight were negatively correlated with temperature during the ripening period.

Aiyer (1958) observed that under dry cultivation yield of ragi was positively correlated with the total rainfall received.

Porter (1958) while studying the inheritance of shedding in wheat varieties, observed that correlation coefficients between seed length and shedding of F_1 plant were in all cases small and not significant. In the F_2 material of two crosses, he obtained significant correlation between seed width and shedding.

Correlation of quantitative characters

Cereals

Rice (*Oryza sativa*)

Vibar (1920) recorded that duration, height and length of panicles were positively correlated with yield in rice, although greater straw weight was not always associated with yield. Bhide (1926) found inter-varietal variation in correlation of many characters with yield. Bhide and Bhalerao (1927) reported high positive correlation between yield and number of ear bearing tillers. Mahalanobis (1930) while studying 146 varieties of rice, reported that mean yield was moderately correlated with number of tillers per plant and length leaf, but independent of characters like grain dimension, height, duration etc. Narasinga Rao (1937) reported high positive correlation of yield and ear bearing tillers followed by number of grains per ear and length of panicle.

Chakravarthy (1940) observed no significant relationship between minor characters like length, breadth and thickness of grain, flag leaf dimension, exertion etc.

Ganguli and Sen (1941) recorded positive correlation of yield with characters such as height of tillers, length of panicle and number of grains per panicle.

Ramiah (1953) reported that positive correlation existed between mean yield and number of tillers per plant. Height, ear-length and mean number of grains per ear were feebly correlated with yield.

Kikichi (1954) recorded high positive correlation of yield with tillering, weight of ear, length of ear, numbers of grains per ear etc.

Ghose et al. (1956) after a study of intervarietal correlation at Cuttack, taking into account the number of panicles, length of panicle and height of the plant at harvest, stated that contribution of height towards yield was negligible in all cases, while other factors showed positive correlation with variation in different degrees.

Syed and Krishnamoorthy (1956), in a biometrical study in rice under different spacings reported that length of ear-head and number of tillers mainly contribute to yield and ear-bearing tiller number was the most potent yield component in rice.

Chandramohan (1961) studied seven characters in a short duration variety of rice, TKM.6 and reported that the number of ear-bearing tillers, number of grains per plant and yield of straw have very high association with yield; plant height and number of grains per primary ear showing moderate correlation with yield. The other characters had feeble correlation with yield.

Jowar (Sorghum sp.)

Kottur and Chavan (1928) studied correlation between yield and number of internodes, thickness, length and weight of ear-head. They observed that weight of ear-head was highly correlated with yield.

Ayyangar et al. (1935) reported that the diameter of the peduncle, weight, length and thickness of ear-head and straw weight were positively correlated with yield. The length of peduncle was either not correlated or was negatively correlated with yield. The total grain yield of the plant could be predicted very closely, when the diameter of the peduncle, length and thickness of the ear-head, and weight of 1000 grains were known.

Kohle (1951) found that height of plant, number of internodes, circumference of stem, and length, thickness and weight of ear-head together contributed for the yield of grain and fodder.

Vishnu Swarup and Chaugale (1962), working on selection indices for the grain and fodder yields in Sorghum vulgare varieties, indicated that grain yield was positively correlated with plant height, but negatively correlated with stalk diameter and fodder yield. Characters like days for panicle emergence, number of leaves and seed weight did not have any correlation with grain yield.

Rohewal et al. (1964) observed a positive correlation between yield and diameter and height and internode number. Those between yield and height and yield and diameter were significant at 5% level, while yield and internode number and yield diameter, were not significantly correlated.

Wheat (Triticum sp.)

Love (1912) noticed a positive correlation between height of plant and yield, and between yield and average weight of kernels.

Arny (1918) studied correlation of characters with special reference to the weight of seed and observed that increase in yield of kernels was very closely accompanied by an increase in number of kernels, number of culms, and total length of spikes and some what less closely with an increase in average weight of kernels and average height of culm.

Smith (1925) while studying a series of varieties over a number of years could find no uniform correlation between yield and the number of ears per plant.

Hayes *et al.* (1927) while studying correlation between yielding ability and reaction to certain diseases or other characters of spring and winter wheat recorded that there was significant positive correlation between height of plant and yield.

Bridgeford and Hayes (1931) working on red spring wheat, recorded positive correlation of yield with plumpiness of grain, weight of 100 kernels, date of heading and height. Among these characters, plumpiness of grain was positively correlated with 100 kernels, date of heading and number of heads per row, whereas it was negatively correlated with number of kernels per spike. Date of heading was positively correlated with heads per row. Height was positively correlated with kernels per spike.

Pal and Butany (1947) recorded dependence of yield to number of kernels per spike and average weight grains per plant.

Weibel (1956) observed that early flowering was phenotypically correlated with many heads, high grain yield, high kernel weight and high bushel weight. Other high correlations he noted were number of heads with grain yield, high grain yield with kernel-weight and high kernel-weight with bushel-weight.

Sikka and Jain (1958) reported that grain yield showed high positive correlation coefficients with number of ears per plant, number of grain per ear and 1000 grain weight.

Sikka and Maini (1962) studied 36 strains of Punjab wheats and concluded that yield was composed of two major factors, i.e., the number of ear-bearing tillers per plant and weight of individual ears. Yield showed negative correlation with high tillering. They also recorded strong correlation between yield and ear weight. The number of spikelets showed no correlation with yield while the effect of fertility of spikelets on yield was quite marked.

Bhide (1963) conducted inheritance and correlation studies in vulgare wheat population and applied the discriminant function technique to find out superiority of this technique over direct selection. He found positive correlation between the characters like tillers per plant and grains per ear, grains per ear and ear length germination and stand at thriving, and negative correlation in germination and number of days taken to flower.

Gandhi et al. (1963) observed that the grain yield was highly positively correlated with ear per plant and 100 grain weight. Grain number per ear showed negative correlation with 100 grain weight and highly positive correlation with spikelets per ear. Further, they reported that spikelets per ear had shown feeble negative correlation with ear per plant and 100 grain weight and feeble positive correlation with ear length with grain yield.

Ragi (Eleusine sp.)

Mahadevappa and Ponnaiya (1963) made investigations on 15 varieties of Eleusine corocana to formulate a selection index utilising the discriminant function technique. The results indicated that out of the six characters studied, three characters viz. the number of ear bearing tillers, number of fingers per plant and weight of straw per plant were positively and significantly associated with the yield of grain.

Pearlmillet (Pennisetum typhoides)

Ayyangar et al. (1936) reported that characters like length and weight of peduncle, number of grains and number and thickness of tillers correlated with yield in order of importance. They also reported that even though surface area of primary ear did not bear significant association directly with grain yield, it showed a strong genotypic correlation with other important attributes (length and diameter of peduncle and yield of straw).

Ahluwalia and Patnaik (1963) found evidence of broad association of yield with ear girth and in some of the high yielding hybrids of pearl millet while other ear characters appeared to be independantly inherited.

Shankar et al. (1963) observed that four components of yielding ability, namely length and girth of spike, spike density, seed size and plant height to be positively correlated with yield. They found a significant phenotypic and genotypic correlations. Two notable exceptions to this trend were the correlations of spike girth with plant height and spike length with yield.

Stafh *et al.* (1967) in study the 44 varieties of pearl millet reported that the height of main culm, length of main ear, seed weight, yield of main stem, ear and fodder yield indicated high genetic correlation coefficient of variability compared to other characters. The height of the plant, length and width of leaf, stem diameter and girth of main ear were positively and significantly correlated with yield. Magnitude of genotypic correlations, except for plant height and ear girth with yield, appeared to be higher than the phenotypic correlations in all the above pairs of characters. They observed very low correlations for days to flower and seed weight with yield.

Mahadevappa and Ponnaiya (1967) observed that yield of grain had strong and positive association with length and diameter of peduncle, density of grain yield of primary ear, tillering capacity and yield of straw, while it showed negative correlation with plant height and no correlation with surface area of primary ear and 1000 grain weight.

Italian Millet (*Setaria italica.*)

Ratnaswamy and Ponnaiya (1963) while studying 15 varieties of Italian millet reported strong association of the characters viz. the weight of panicles, the number of productive tillers, yield of straw and length of main panicle with the grain yield. The plant height and the total number of panicles had small association with grain yield.

Corn (Zea mays)

Jenkins (1924) found that within the inbred lines, yield was correlated significantly and positively with plant height, number of ears per plant, ear length, ear diameter while it was correlated significantly and negatively with date of silking and ear shape index.

Robinson et al. (1949) while estimating the heritability and degree of dominance, reported strong association between ear weight and yield.

Barley (Hordeum vulgare)

Bonnet and Woodworth (1931) reported that characters like number of tillers, number of ears and 1000 grain weight contributed appreciably to yield. Graphins et al. (1952) also obtained similar results.

Fluzat and Atkins (1953) observed association of heading and maturity dates with grain yield.

Jain and Upadhyay (1964) made a cross of E.406 and C.1.2256. They reported that F_2 test showed that the plant height was associated with lemma colour.

Oats (Avena sativa)

Stephens (1942) while studying yield characters found correlation between yield and number of tillers, number of spikelets, spikelet weight and size of grains.

Frey (1959) examined yield components in relation to response from nitrogen and recorded that increase in yield was dependent on increase in the number of heads per plant and number of seeds per head.

Pulses

Soybean (Glycine max)

Stewart (1925) reported that in determinate types height of plant was nearly associated with yield than in indeterminate types.

Bian and Konyuen (1930) analysed yield through its components. He found that number of pods and height of plant were highly correlated with yield of seed.

Whetherspoon and Wentz (1934) showed that number of pods per plant, number of nodes, number of pods per node and height of plant were significantly and simply correlated with yield. Whereas seed size was negatively correlated with number of pods, number of nodes and height.

Shih (1947) recorded positive correlations between yield and characters such as, plant height, number of branches, seed size, seed number, seed weight and pod number.

Bartly and Webber (1952) got positive and significant correlations between maturity date and yield and height and yield.

Brim *et al.* (1959) worked out multiple selection criteria and found strong association between yield and number of pods.

Murg bean (*Phaseolus aureus*)

Balaram and Bhatnagar (1964) in a study to determine correlation and regression in an F_2 population, reported that the number of days from seeding to harvesting can be fairly predicted fairly accurately from number of days from seeding to initiation of flowering. The characters are positively and significantly correlated.

Bengal gram (*Cicer arietinum*)

Venkataraman and Jagannatha Rao (1933) reported that pod weight, shoot weight and seed weight formed a very closely related group of characters.

Fibre crops

Cotton (*Gossypium* sp.)

Kearney (1928) observed negative correlation between seed index and number of seeds per boll, and seed index and ginning out-turn and lint index and number of seeds per boll.

Stroman (1930) while making a biometrical study reported that the main components of total lint production are the boll number and boll weight. Boll weight, in turn, was made up of number of seed per boll, lint index and seed index.

Brown (1935) noticed significant positive correlation between seed weight and boll contents in Egyptian cotton. However, between ginning out-turn and seed weight correlation was negative.

Panse and Khargenker (1949) found a positive correlation between lint yield, number of bolls weight of lint per boll and weight of lint per seed.

Christidis and Harrison (1955) stated that the oil content in cotton is positively correlated with lint length whereas correlation between the oil content and lint percentage or seed weight seemed to be negatively correlated.

Manning (1956) reported characters like number of bolls per plant, seed per boll and lint per seed were primary components of yield in cotton.

Kamalnathan (1962) correlated three characters - number of bolls per plant, number of speedsper boll, and lint index to yield.

Butany et al. (1966) studied 11 varieties of cotton. They observed that boll number was positively correlated with seed index and negatively with boll weight and ginning percentage. Boll weight had high positive correlation with ginning percentage and low correlation with lint index. Halo length had a high positive correlation with seed index and negative correlation with ginning percentage and with lint index. Ginning percentage and seed index were negatively correlated.

Kamalnathan (1966) worked out correlation between lint yield and its components. He noticed a positive correlation between lint yield and seed index, whereas boll index was negatively correlated with lint yield. Kamalnathan (1967) reported that among the seven characters studied for lint yield, number of bolls per plant, number of seeds per boll and lint index showed a very close association. These three characters together were capable of influencing lint yield to the extent of 64.83 per cent.

Rozalle (Hibiscus subdariffa)

Samyal and Dutta (1961) observed that height and base diameter of the plants were highly correlated with fibre yield.

Oil seeds

Groundnut (Arachis hypogaea)

Long (1954) stated that the characters like number of pods per plant, and number of seeds per pod were found to have marked influence on yield.

Misra (1958) reported strong association between yield and seed size, number of pods and number of kernels per pod.

Dorairaj (1962) recorded, positive correlation between number of pods, number of nodes in primaries, number of secondaries, mean length of primaries, height of the main axis and number of nodes in the main axis on the one hand, and the final yield of groundnut on the other in the case of bunch variety.

Chandra Mohan _et al._ (1967) observed that number of mature pods and weight of plant (haulm) have high positive correlation with yield and between them there existed correlation.

Coconut (_Cocos nucifera_)

Krishnamurthy and Patel (1932) recorded positive correlation between yield and total number of leaves, height of trunk and number of female flowers. Liyanage and Abeywardena (1957) reported seednut weight and size to be highly associated with yield of nuts. They also reported percentage of husk and kernel weight as most affecting characters.

Linseed (_Linum usitatissimum_)

Despande and Mallik (1937), observed that number of branches, number of seeds, and seed weight were strongly correlated with oil content as well as yield. Gill and Singh (1958) had similar findings in their studies on a cross between K_2 and a local Punjab variety of linseed.

Rape (*Brassica* sp.)

Ramanujam and Rai (1963) while studying 48 cultures from the major yellow Baron found that most of the yield components were strongly and negatively correlated with each other. The number of nodes per plant and number of primary and secondary branches were found to be positively correlated. The seed size and seed yield were positively correlated.

Chaudhari (1967) reported that yield was highly associated with number of pods per plant, number of secondary branches and number of primary branches.

Gingelly (*Sesamum indicum*)

Sikka and Gupta (1949) while studying three varieties of sesamum found that amongst three characters studied - height of plant, number of branches and number of capsules - greatest contribution to yield was made by number of capsules followed in order by number of branches and height.

Mohammad and Dorairaj (1964) worked out correlation between yield and its components. They recorded (1) the absence of any association between capsule number and 100 seed weight; (2) a positive significant association between capsule number and capsule size in total classes and (3) a positive significant correlation between capsule size and 1000 seed weight in total classes.

Banana (*Musa sp.*)

Hasselo (1962) recorded that circumference of pseudostem of Gros Michael banana at the emergence of inflorescence was highly correlated with bunch yield.

TABLE I

A summary of the important characters contributing towards yield in the various crop plants

Sl.No.	Name of crop	Yield components	References
1	Rice	Duration, height and length of panicle .	Viber (1920)
		No. of tillers, No. of grains per earhead and length of panicle.	Narasinga Rao (1937) and Ramiah (1953)
		Tillering, weight of panicle, length of panicle and No. of grains per panicle.	Eikichi (1954)
2	Wheat	Height of plant and average weight of kernals.	Love (1912)
		No. of kernels, No. of culms and total length of spikes.	Arny (1918)
		Weight of plants.	Hayes <u>et.al.</u> (1927)
		Plumpness of grains, weight of 1000-kernels, date of heading and height	Bridgeford and Hayes (1931)
		No. of kernels per spike and average weight of grains per ear.	Pal and Butany (1947)
		No. of tillers, No. of earheads, length of ear and No. of grains per ear.	Sikka and Jain (1958)
3	Jowar	Plant height, No. of internodes, and thickness, length and weight of earheads.	Kottur and Chavan (1926)
		Plant height, stem thickness, No. of leaves, length, girth and weight of panicle, length of rachis, length of peduncle, and size of grains.	Vishnu Swarup and Chaugale (1962).

Sl.No.	Name of crop	Yield components	References
4	Corn	Plant height, No. of ears per plant, ear length, ear diameter and shelling percentage.	Jenkins (1924)
		Weight of ear, length of ear, leaf area, and 100-grains weight.	Robinson *et al.* (1949) and Murthy and Roy (1957).
5	Barley	No. of tillers, No. of ears and 1000-grain weight	Bonnet and Woodworth (1931)
		Heading date and maturity date	Fiuzat and Atkins (1953).
6	Oats	No. of spikelets, spikelet weight and size of grains.	Stephens (1942)
		No. of heads and No. of seeds per head.	Frey (1959)
7	Ragi	No. of ear bearing tillers, weight of straw and No. of fingers.	Mahadevappa (1962)
8	Pearl millet	Weight and length of panicle, No. of grains, and No. and thickness of tillers.	Ayyangar *et al.* (1936)
9	Italian millet	Weight of panicle, No. of productive tillers, yield of straw and length of main panicle.	Ratnaswamy (1962)
10	Soybean	Average weight of 100 seeds	Woodworth (1932)
		No. of pods per plant, No.of nodes, No. of pods per node and height of plant.	Weatherspoon and Wentz (1934)
		Plant height, No. of branches, seed size, seed number, seed weight and pod number.	Shih (1947)
		Period of flowering, length of pod, No. of pods and weight of pods.	Johnson *et al.* (1955).

Sl.No.	Name of crop	Yield components	References
11	Bengal gram	Pod weight, shoot weight and seed weight	Venkataraman and Jagannatha Rao (1933)
12	Cotton	Height of plant and No. of fruiting branches	Stroman (1949)
		No. of bolls, weight of lint per boll, weight of lint per seed, boll weight and seed per boll.	Panse and Kargonkar (1949) Manning (1950)
13	Groundnut	No. of pods per plant, weight of pods per plant and No. of seeds per pod.	Ling (1954) and Mishra (1958)
14	Linseed	No. of branches, No. of seeds and seed weight.	Deshpande and Mallik (1937)
		Ripening period and 1000-seed weight.	Batch (1959)
		Capsule number	Kedharnath et al. (1960)
15	Rape and White mustard	No. of pods.	Olsson (1960).
16	Gingely	No. of branches, No. of capsules and height of plant.	Kumar and Ranga Rao (1941) Sikka and Gupta (1949)

MATERIALS AND METHODS

MATERIALS AND METHODS

The present investigation was carried out in the Division of Agricultural Botany, Agricultural College and Research Institute, Vellayani.

A. Material

Twelve varieties of brinjal (*Solanum melongena* L) of variable characters, obtained from the collection maintained in the Division of Agricultural Botany were selected for this experiment. These varieties exhibited wide variation in growth habit, stature and branching and also in the morphology of different plant parts especially, flowers, fruits and seeds.

The list of varieties with some of their important characteristics are present in the Table

B. Methods

I. Experimental design

Plants were grown in randomised blocks with the twelve varieties replicated three times. Plot size was 5 metres x 4 metres. The spacing adopted for plants was 1 metre between rows and in the rows.

Fig. 1 Layout plan of the field experiment

LAY OUT PLAN OF THE FIELD EXPERIMENT

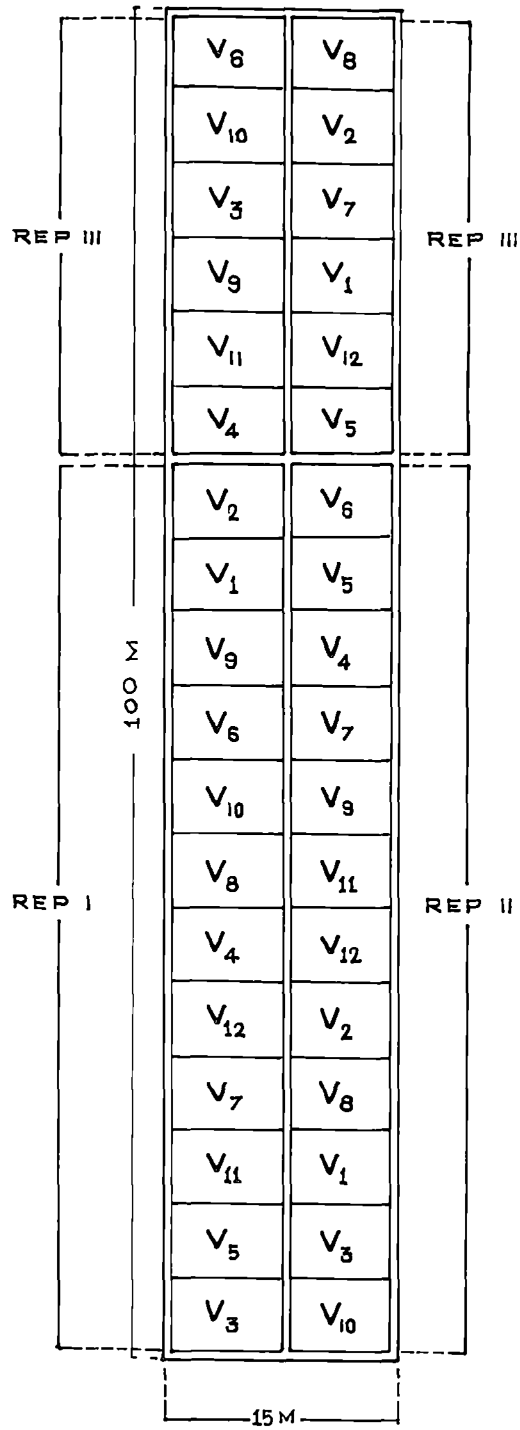


FIG 1

TABLE 2

Varieties used under study

Variety	1	Long Green Cluster
"	2	Banara's Gaint
"	3	Scarlet Long
"	4	Pusa Purple Long
"	5	Black Long
"	6	Early Round Market
"	7	White Long
"	8	Muktakesi Long
"	9	Round Black
"	10	Muktakesi Round
"	11	Black Beauty
"	12	Pusa Purple Long

II. Sowing and culture

Seeds were dibbled on raised seed beds on 30th September 1967 and when one month old, were transplanted to the main plot.

The experimental field received a basal dressing of three fifty kg. of farm yard manure and fifteen kg. of vegetable mixture. And when one month old another dressing of the twenty five kg. of vegetable mixture (7:10:5) was applied, and another fifteen kg. was applied after three weeks. The crop was grown under irrigation and was given four protective spraying against pests during the period of its growth. The harvest was completed on January 14th 1968

III. Sampling

Leaving a border row on all sides of the plot, fiv plants were selected at random from the central rows in each plot and labelled for observations. Care was taken that these plants represented the average population and were not surrounded by any gaps. Thus there were fifteen plants (5 plants x 3 replications) from each variety and the total number of plants subjected to study came to one hundred and eighty.

IV. Characters studied

One hundred and eighty plants selected as detailed before were studied in individually for the following characters.

(i) Height of plants

The maximum height of plants were recorded at full maturity of the plants.

(ii) Number of leaves

Total number of leaves produced per plant were counted by reference to the number of nodes on the main stem and branches, at full maturity.

(iii) Number of branches

All branches were counted and recorded at full maturity of the plants.

(iv) Total number of flowers

Total number of flowers in each plant were recorded.

(v) Style length of flowers

Style length of flowers were taken into consideration. They were grouped as short styled, long styled and medium styled based on whether the style was seen below the corolla neck, above the corolla neck or in between respectively. All the flowers were taken for sampling.

(vi) Date of first flowering

Date of first flowering in the individual plants was recorded.

(vii) Date of first maturing fruit

Observations were taken on the date of first maturity of fruits.

(viii) Total number of fruits

Yield of fruit for individual plants was recorded in terms of number of fruits.

(ix) Weight of fruits per plant

Total weight of fruits per individual plants was recorded.

(x) Mean weight of fruits

Mean weight of fruits were calculated for the individual plants.

(xi) Percentage of fruit set

The percentage of fruit set was calculated for individual plants.

V. Statistical proceedure

The whole data were processed and tabulated variety wise (for fifteen plants) and for all varieties taken together (one hundred and eighty plants), in order to suit the following analytical method.

(i) Study of varietal difference

Analysis of variance was worked out for eight characters.

1) Height

2) Branch

3) Leaves

4) Number of flowers

5) Yield of fruits

6) Yield

7) Per cent of fruit set

8) Mean weight of fruits

Analysis of variance

Source of variation	Degree of freedom	Sum of squares	Mean squares	Variance ratio
Replications	(r-1)	S.S.R	S^2R	$\frac{S^2R}{S^2E}$
Varieties	(V-1)	S.S.V	S^2V	$\frac{S^2V}{S^2E}$
Error	(r-1) (v-1)	S.S.V.R	S^2E	
Total	(rv-1)			

where, r is number of replications and v number of varieties.

'F' ratio, variance ratios, for varieties were calculated and compared with critical value of 'F' for (r-1) and (r-1) (v-1) degrees of freedom at five per cent and one per cent levels for significance.

(ii) Study of correlation and regression

Between yield and the other six characters in all the twenty varieties, coefficients of correlation and regression were worked out severally as well as jointly.

Simple, partial and multiple correlations were also calculated for the following five characters.

1. Height of plants
2. Number of branches
3. Number of leaves
4. Number of flowers and
5. Total number of fruits

Coefficients of simple correlations and regression were worked out by the formulae given by Hays et al. (1955).

$$r = \frac{SP\,x\,Y}{\sqrt{SSx\,SSy}} \quad \text{where}$$

SP x y denotes sum of products of the two variables x and y, SSx the sum of squares of the variable x SSy the sum of squares of the variable y.

$$by\,x = \frac{SP\,x\,y}{SSx}, \quad \text{where}$$

by x is the regression of y on x, Spxy is the sum of products of two variables x and xy and SSx.

For calculating the partial correlations, the formulae suggested by Yule and Kendall (1950) were used.

$$r_{12.3} = \frac{r_{12} - (r_{13})\ (r_{23})}{\sqrt{(1-r_{13}^2)\ (1-r_{23}^2)}}$$, where

r_{12}, r_{13} and r_{23} are simple correlation coefficients between the dependent variables x_1 and x_2, x_1 and x_3 and x_2 and x_3 respectively

$$r_{12.34} \quad \frac{r_{12.3} - (r_{14.3})\ (r_{24.3})}{\sqrt{(1-r_{14.3}^2)\ (1-r_{24.3}^2)}}$$

$$r_{12.345} = \frac{r_{12.34} - (r_{15.34})\ (r_{25.34})}{\sqrt{(1-r_{15.34}^2)\ (1-r_{25.34}^2)}}$$

where $r_{12.3}$, $r_{12.34}$ etc. are partial correlation coefficients for the different associations between the respective variables.

Multiple correlation coefficient was calculated by the formulae.

$$R_1\ (23) = \sqrt{1-(1-r_{12}^2)\ (1-r_{13.2}^2)}$$

$$R_1\ (234) = \sqrt{1-(1-r_{12}^2)\ (1-r_{13.2}^2)\ (1-r_{14.23}^2)}$$

$$R_1\ (2345) = \sqrt{1-(1-r_{12}^2)\ (1-r_{13.2}^2)\ (1-r_{14.23}^2)\ (1-r_{15.234}^2)}$$

where r_{12} is total correlation coefficient between characters 1 and 2 and $r_{13.2}$, $r_{14.23}$ and $r_{15.234}$ are partial correlation coefficients.

The significance of the simple, partial and multiple correlation coefficients was tested by reference to the table of critical values of correlation coefficients at the five per cent and one per cent levels of significance given by Snedecor (1931) and reprinted in the Appendix Table V of Hayes et al. (1955).

(iii) Discriminant function

The required discriminant function that could serve as best yard stick in the selection of plants for yield, was evolved by using the estimates of the genotypic components of yield (x_1) and three characters, namely, number of branches (x_2), height of plants (x_3) and total number of fruits (x_4) which were expected to have direct bearing on yield.

It is assumed that the genotype of a given plant for yield can be represented by function of type.

$$y' = a_1 x_1' + a_2 x_2' + a_3 x_3' + \ldots\ldots\ldots a_n x_n'$$

where, x_1', $x_2 2$, x_3' are the genotypic values of the components x_1, x_2, x_3, x_n and a_1, a_2, a_3, a_n are the weights attached to them depending on the relative importance of characters contributing to yield.

The phenotype can be represented by

$$y = b_1 x_1 + b_2 x_2 + b_3 x_3 \ldots\ldots b_n x_n$$

and the problem is to derive values of b_1, b_2, b_3 .... b_n

~~and the problem is to derive values of b_1, b_2, b_3 .....~~b_n

Phenotype = genotype + environment.

So the phenotype is highly correlated with genotype and consequently Y and Y' are also correlated. In the function weights b_1 b_2, $b_3 \ldots b_n$ should be estimated in such a way that the correlation between Y and Y' will be the maximum

Thus the selection of the phenotype using Y as a discriminant function will ensure a maximum concentration of the desired genes of in the plants selected.

The discriminant function chosen for the present study was

$$y = b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4$$

'b' values were calculated by selving the following normal equations with a view to maximise the regression of y on y'.

$$b_1 t_{11} + b_2 t_{12} + b_3 t_{13} + b_4 t_{14} = A_1$$

$$b_1 t_{12} + b_2 t_{22} + b_3 t_{23} + b_4 t_{24} = A_2$$

$$b_1 t_{13} + b_2 t_{23} + b_3 t_{33} + b_4 t_{34} = A_3$$

where

$$A_1 = a_1 g_{11} + a_2 g_{12} + a_3 g_{13} + a_4 g_{14}$$

$$A_2 = a_1 g_{12} + a_2 g_{22} + a_3 g_{23} + a_4 g_{24}$$

$$A_3 = a_1 g_{13} + a_2 g_{23} + a_3 g_{33} + a_4 g_{34}$$

$$A_4 = a_1 g_{14} + a_2 g_{24} + a_3 g_{34} + a_4 g_{44} \quad \ldots. (2)$$

The phenotypic and genotypic variances and covariances for the different characters were computed from the respective tables of analysis of variance and analysis of covariances. The sum of squares and sum of products at error and varietal levels were taken as error and phenotypic variances and covariances (eij and tij) respectively. For obtaining the genotypic variances and covariances (gij), the sum of square and sum of products at error level were deducted from their respective values at varietal level (Goulden, 1959).

A's were calculated from the data by substitution of the calculated values of gij and the assigned values as $a_1 = 1, a_2 = 0$, $a_3 = 0$ and $a_4 = 0$. These values were inserted in the equation (1) and solved for the values of b_1, b_2, b_3 and b_4.

The discriminant function was taken by setting up the equation.

$$z = b_1 x_1 + b_2 x_2 + b_3 x_3 \text{ and } b_4 x_4$$

where, b_1, b_2, b_3 and b_4 are the economic weights and x_1, x_2, x_3 and x_4, the contributing characters.

Efficiency of the selection index was calculated by using the formula, suggested by Rao (1952).

$$\frac{\text{Genetic advance by discriminant function}}{\text{Genetic advance by straight selection}} \text{ is equal to}$$

$$\frac{b_1 A_1}{gij \,/\sqrt{tij}}$$

b_i's represent the attached weights in the function and A_i's are compound genotypes as defined in equations (2) g_{ij} and t_{ij} denote genotypic and phenotypic variance, respectively for yield.

R E S U L T S

The object of this experiment was

1) to study the relationship between yield of fruits and some of its contributory characters and

2) to formulate suitable discriminant functions for yield, by combining the best components of yield and to test their efficiency over direct selection.

1. Relationship between yield and some of its components

The characters studied are given below:

1. Height of plants
2. Number of branches
3. Number of leaves
4. Number of flowers
5. Number of fruits
6. Percentage of fruit set
7. Mean weight of fruit
8. Yield

a) Variability of characters

In a study of association of various characters with yield, it is desirable to know whether the varieties chosen differ significantly among themselves with regard to these characters.

TABLE 3

Varietal means

	Height	Number of branches	Number of leaves	Number of flowers	Number of fruits	% of fruit set	Mean weight of fruits	Yield
1	79.13	48.60	195.46	29.80	10.67	30.70	133.49	1262.65
2	79.13	51.87	196.46	14.00	6.20	42.81	206.31	1301.72
3	89.53	48.73	181.66	25.67	4.40	31.16	274.5	1159.12
4	92.33	54.53	239.80	38.33	14.80	38.62	123.3	1477.99
5	82.20	52.87	218.46	13.87	6.60	48.59	184.12	1179.32
6	81.73	48.60	240.06	46.47	20.27	43.09	79.39	1214.72
7	92.07	56.27	232.66	31.27	11.27	37.88	160.21	1499.05
8	90.33	48.20	199.13	18.87	7.60	43.26	199.63	1329.45
9	88.47	46.67	175.33	26.93	7.47	33.44	208.10	1425.19
10	81.47	60.53	238.33	19.93	10.67	49.61	154.30	1180.25
11	83.87	44.40	161.00	27.00	8.33	30.17	142.40	907.26
12	86.40	47.27	203.26	26.53	7.60	29.9	151.83	1060.66
General Mean	85.61	50.71	206.81	26.56	9.66	35.93	164.66	1249.79

Fig. 2. Graphical representation of the varietal variation in:

A. Height of plants

B. Number of branches

C. Number of leaves

D. Number of flowers

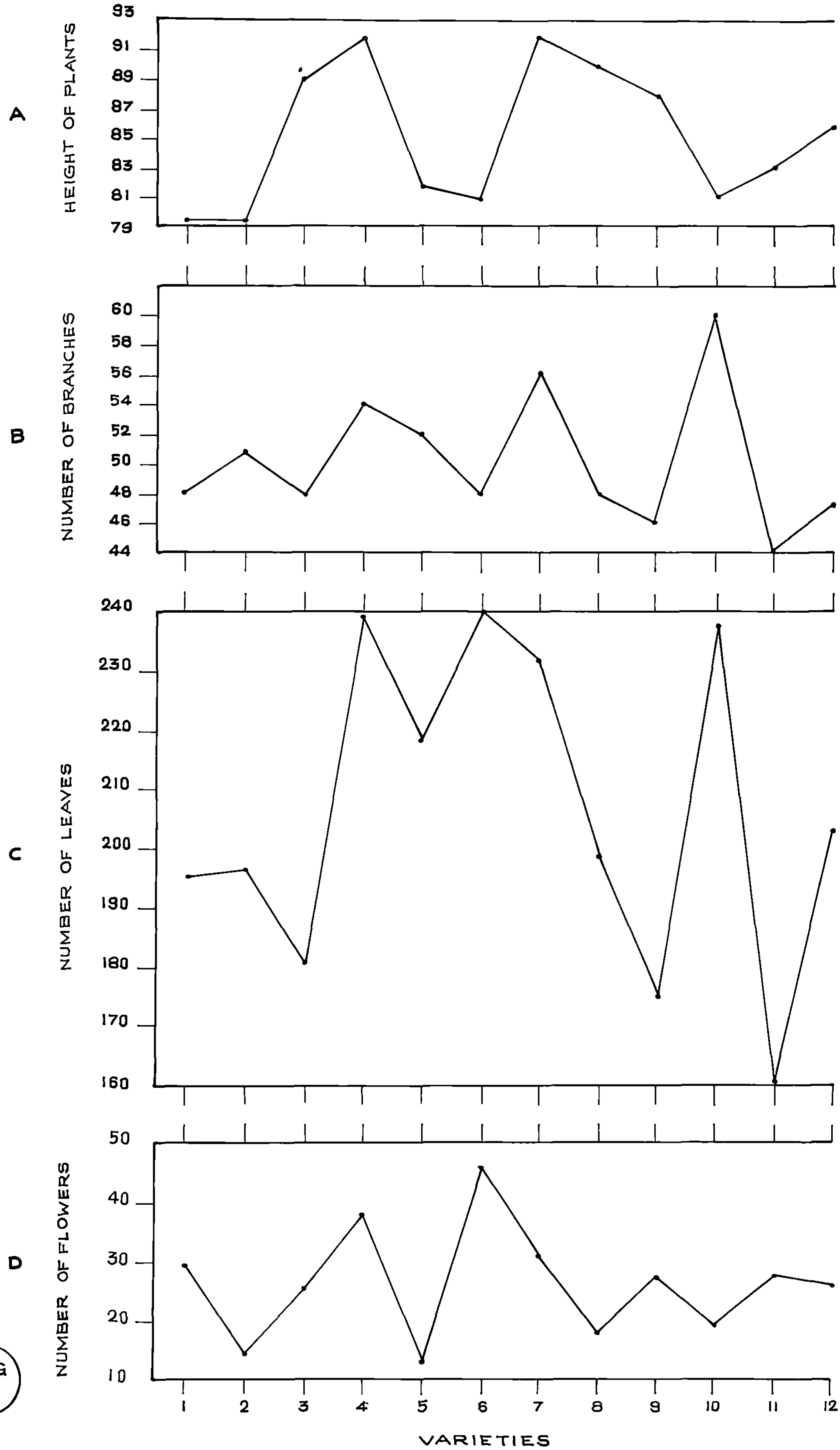

A
HEIGHT OF PLANTS
93
91
89
87
85
83
81
79
B
NUMBER OF BRANCHES
60
58
56
54
52
50
48
46
44
C
NUMBER OF LEAVES
240
230
220
210
200
190
180
170
160
D
NUMBER OF FLOWERS
50
40
30
20
10
1
2
3
4
5
6
7
8
9
10
11
12
VARIETIES

FIG 2

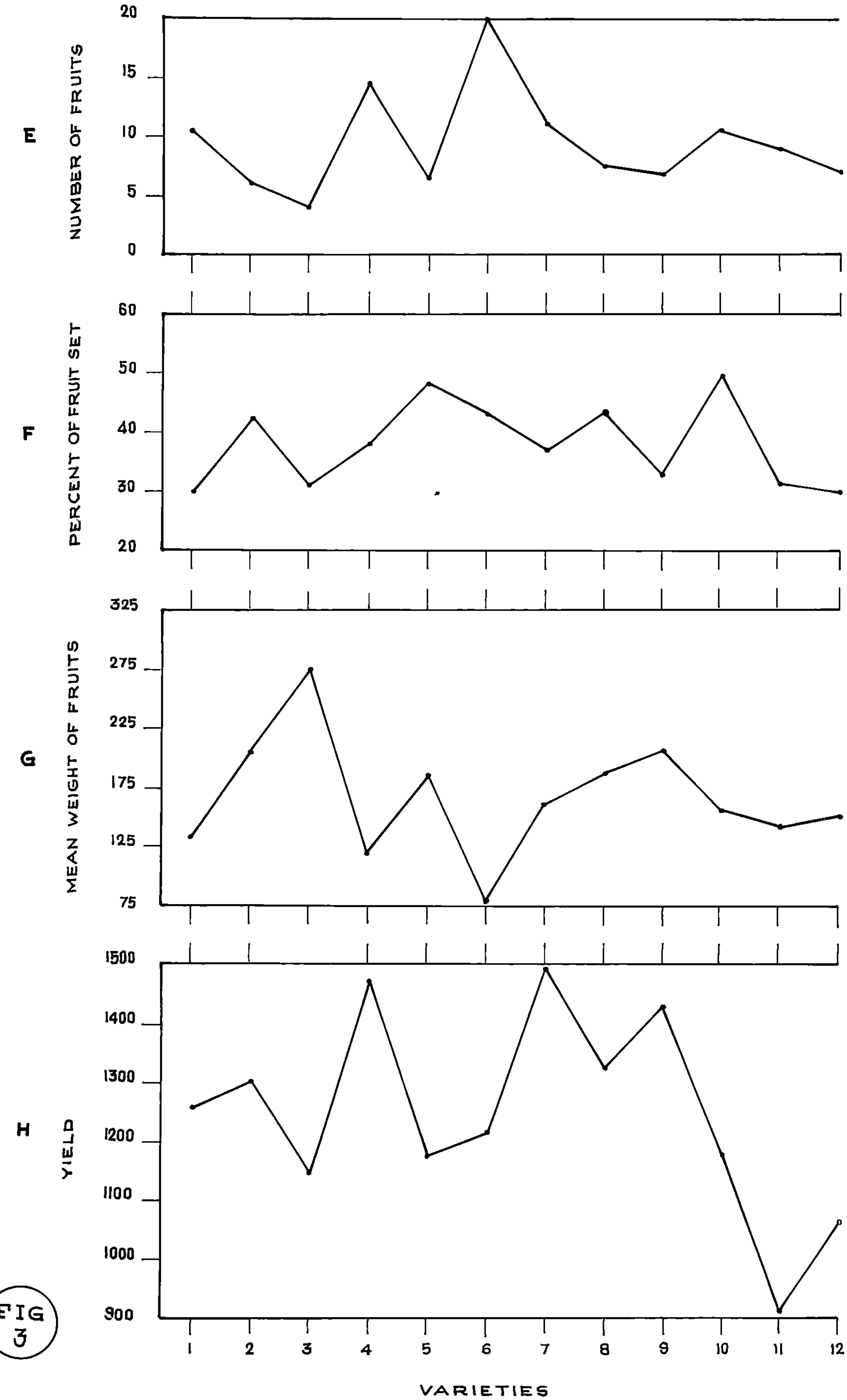
Fig. 3 Graphical representation of varietal variation in:

E. Number of fruits

F. Per cent of fruit set

G. Mean weight of fruits

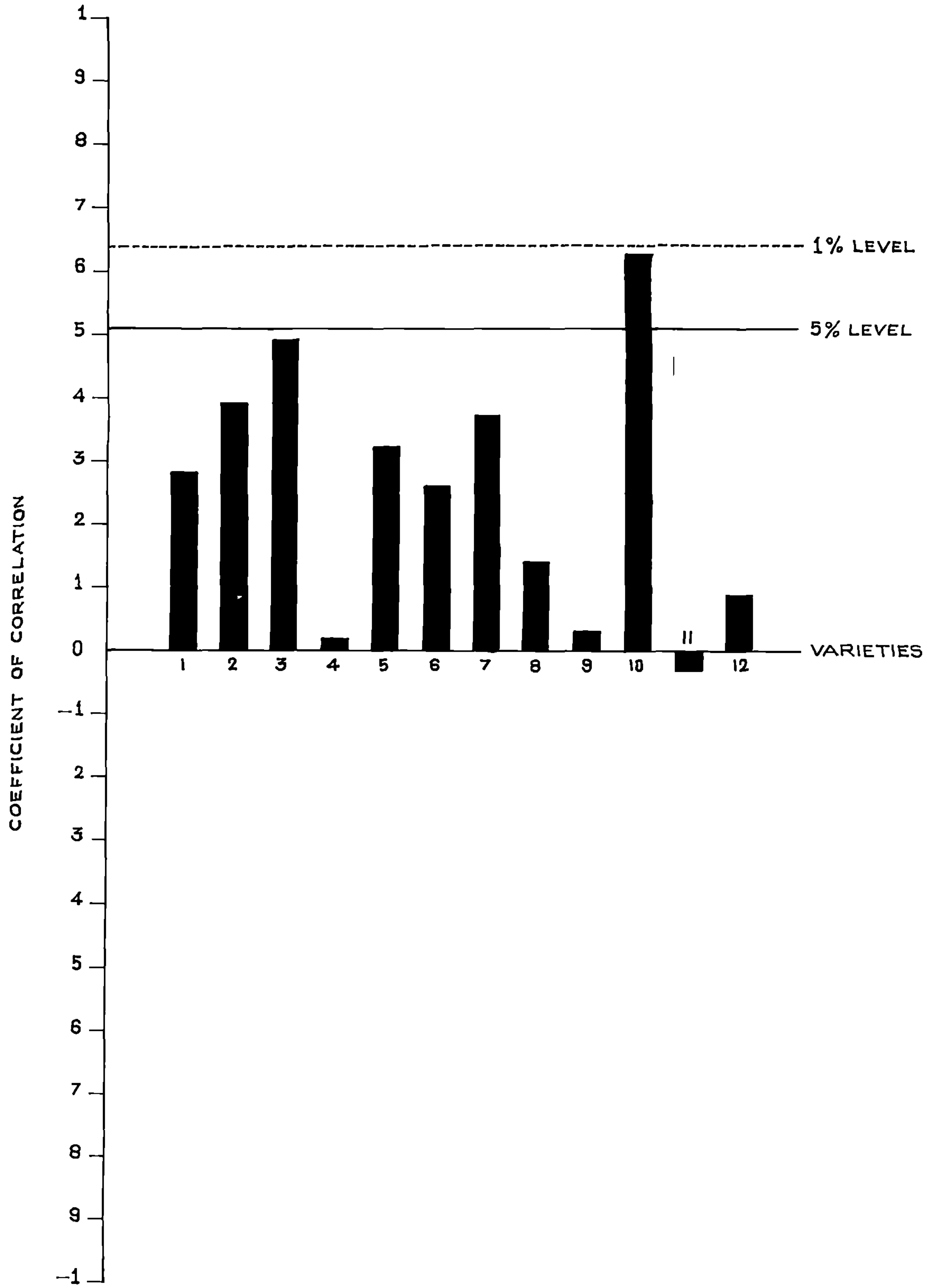
H. Yield



E
NUMBER OF FRUITS
20
15
10
5
0
F
PERCENT OF FRUIT SET
60
50
40
30
20
G
MEAN WEIGHT OF FRUITS
325
275
225
175
125
75
H
YIELD
1500
1400
1300
1200
1100
1000
900
1 2 3 4 5 6 7 8 9 10 11 12
VARIETIES

FIG 3

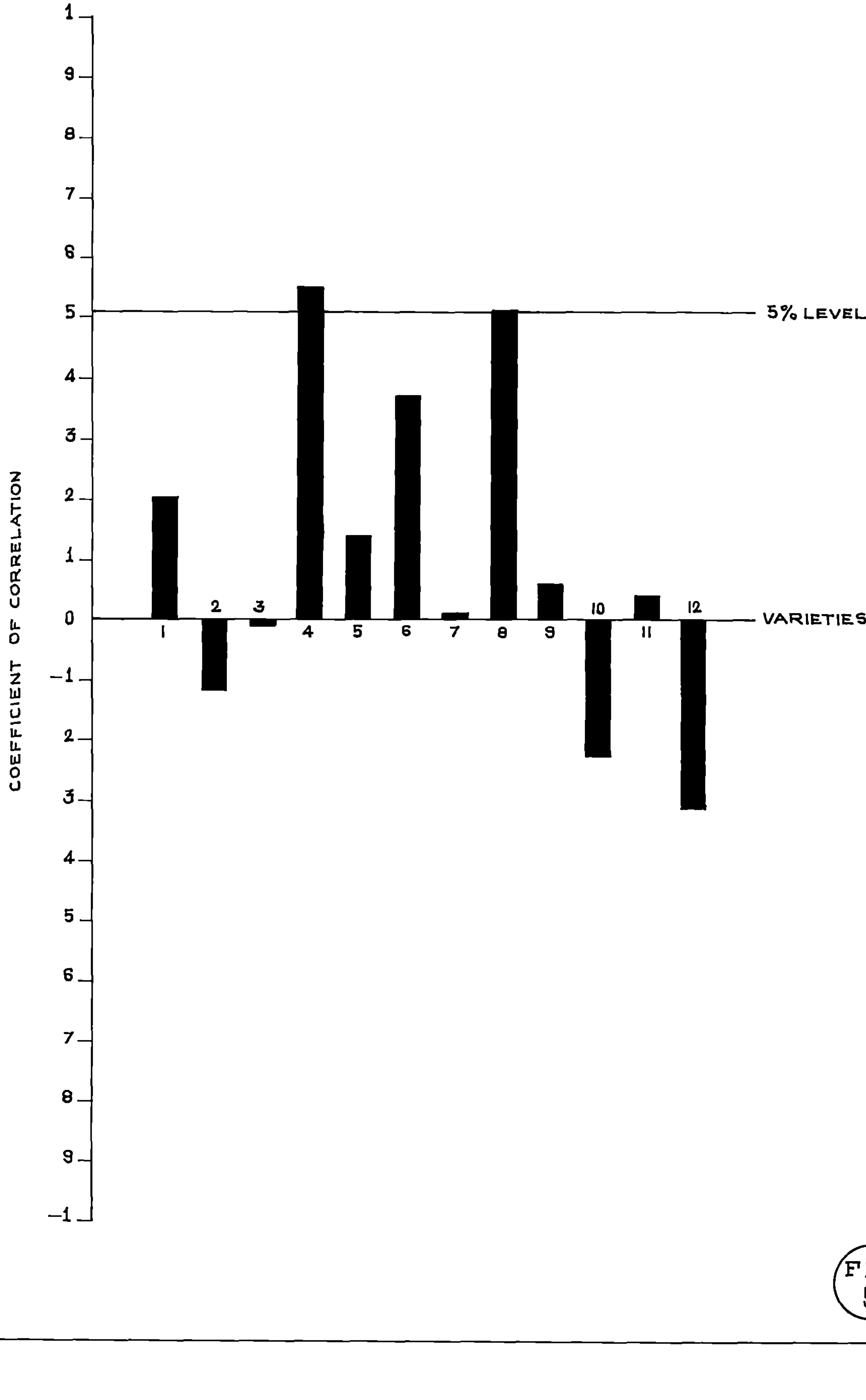
Fig. 4 Bar diagram showing coefficient of correlation for varieties between yield and height of plants.



COEFFICIENT OF CORRELATION
1
9
8
7
6
5
4
3
2
1
0
−1
2
3
4
5
6
7
8
9
−1
1% LEVEL
5% LEVEL
VARIETIES
1
2
3
4
5
6
7
8
9
10
11
12

FIG 4

Fig. 5 Bar diagram showing coefficient of correlation for varieties between yield and number of branches.



1
9
8
7
6
5
4
3
2
1
0
−1
2
3
4
5
6
7
8
9
−1
COEFFICIENT OF CORRELATION
5% LEVEL
VARIETIES
1
2
3
4
5
6
7
8
9
10
11
12

FIG 5

If the variability is narrow, correlation study will be of little value in estimating the association between such characters. Hence a study of twelve varieties in relation to differences in these major yield contributes were made. Mean values of yield and seven associated characters are given in the Table 3. The variability is graphically represented in Fig.

The significance of variability in each of the character selected was tested by method of analysis of variance for randomised block design. The results of analysis are given below.

I. Height per plant

TABLE 4

Analysis of variance for height per plant in cm.

Source of variation	Degrees of freedom	Sum of squares	Mean squares	Variance ratio (F)
Replications	2	3657.4	1828.70	0.702
Varieties	11	19254.33	1750.39	0.672
Error	22	5729.27	2604.24	..

The analysis of variance for height shows that the difference between varieties with regard to this character is not significant at 5 per cent level and 1 per cent level.

Mean values for the height of plants (vide Table 3) range from 79.13, in the varieties Long Green Cluster and Banara's Gaint to 92.33 in the variety Pusa Purple Long.

ii. Number of branches per plant

TABLE 5

Analysis of variance for number of branches per plant

Source of variation	Degrees of freedom	Sum of squares	Mean squares	Variance ratio (F)
Replications	2	5687.05	2843.52	1.04
Varieties	11	17633.55	1603.05	0.58
Error	22	60102.29	2731.92	..

The varieties do not differ significantly in the character, namely, number of branches per plant as indicated by the low value of the variance ratio.

Mean values for this character (vide Table 3) range from 44.40, in the variety Black Beauty to 56.27 in the variety White Long.

iii. Number of leaves

TABLE 6

Analysis of variance for number of leaves per plant

Source of variation	Degrees of freedom	Sum of squares	Mean squares	Variance ratio (F)
Replications	2	1082795	541397.5	9.291 **
Varieties	11	3099619	281783.5	5.09 *
Error	22	121651	55291.6	..
Total	35	4304065	..	..

** indicates 'F' value significant at 1% level.

The varieties differ significantly in the character, namely number of leaves as indicated by the high value for the variance ratio.

Mean values for this character (vide Table 3) range from 161.00, in the variety Black Beauty to 240.06 in the variety Early Round Market.

Graphical representation of the variability is represented in Fig. 4.

iv. Number of flowers

TABLE 7

Analysis of variance for number of flowers per plant

Source of variation	Degrees of freedom	Sum of squares	Mean squares	Variance ratio (F)
Replications	2	7080.46	3540.23	2.37
Varieties	11	74298.30	6754.4	4.7*
Error	22	32839.54	1492.70	..
Total	35	114218.3	..	..

* Indicates 'F' value significant at 1% level.

The varieties differ significantly in the number of flowers produced by them as shown by high value of variance ratio.

Mean values for this character (vide Table 3) range from 13.87, in the variety Black Long to 46.47 in the variety Early Round Market.

Graphical representation of the variability is represented in the Fig.

v. Number of fruits

TABLE 8

Analysis of variance for number of fruits per plant

Source of variation	Degree of freedom	Sum of squares	Mean squares	Variance ratio (F)
Replications	2	257.05	128.52	0.17
Varieties	11	15760.89	1432.81	1.97
Error	22	16017.94	728.09	..
Total	35	25230.89	..	..

The varieties do not differ significantly for the character, namely, number of fruits as shown by the low variance ratio.

Mean values for the number of fruits (vide Table 3) range from 4.40 (Scarlet Long) to 20.27 (Early Round Market).

vi. Percentage of fruit set

TABLE 9

Analysis of variance for per cent of fruit set per plant

Source of variation	Degrees of freedom	Sum of squares	Mean squares	Variance ratio (F)
Replications	2	648.2	324.1	0.09
Varieties	11	42455	3859.6	1.02
Error	22	78951	3588.7	..
Total	35	122055	..	..

The varieties do not differ significantly for this character as indicated by the low variance ratio.

Mean values for this character (vide Table 3) range from 29.9 (Purple Long Dutta) to 49.61 (Muktakesi Round).

vii. Mean weight of fruits

TABLE 10

Analysis of variance for mean weight of fruits per plant

Source of variation	Degrees of freedom	Sum of squares	Mean squares	Variance ratio
Replications	2	28468	14234.43	0.14
Varieties	11	2093747	190340.11	1.92
Error	22	2170466	98657.63	..
Total	35	4292678	..	..

vi. Percentage of fruit set

TABLE 9

Analysis of variance for per cent of fruit se per p[illegible]

Source of variation	Degrees of freedom	Sum of squares	Mean squares	[illegible]
Replications	2	648.2	324.1	[illegible]
Varieties	11	42455	3859.6	[illegible]
Error	22	78951	3588.7	[illegible]
Total	35	122055	..	[illegible]

The varieties do not dif[illegible] significantly for [illegible] character as indicated by the [illegible]riance ratio. Mean values for this [illegible]cter (vide Table 3) [illegible] from 29.9 (Purple Long Dutta) [illegible] of (Muktakesi Round).

vii. Mean [illegible] of fruits

[illegible] 10

Analysis of varian[illegible]n weight of fruits per pl[illegible]

Source of variation	Degrees of freedom	Sum of squares	Mean squares	Variance ratio
Replications	[illegible]	[illegible]168.87	14234.43	0.14
Varieties	[illegible]	[illegible]741.27	190340.11	1.92
Error	[illegible]	[illegible]468.0	98657.63	..
Total	[illegible]	[illegible]2678.13	..	..

vi. Percentage of fruit set

TABLE 9

Analysis of variance for per cent of fruit set per plant

Source of variation	Degrees of freedom	Sum of squares	Mean squares	Variance ratio (F)
Replications	2	648.2	324.1	0.09
Varieties	11	42455	3859.6	1.02
Error	22	78951	3588.7	..
Total	35	122055	..	..

The varieties do not differ significantly for this character as indicated by the low variance ratio.

Mean values for this character (vide Table 3) range from 29.9 (Purple Long Dutta) to 49.61 (Muktakesi Round).

vii. Mean weight of fruits

TABLE 10

Analysis of variance for mean weight of fruits per plant

Source of variation	Degrees of freedom	Sum of squares	Mean squares	Variance ratio
Replications	2	28468.87	14234.43	0.14
Varieties	11	2093741.27	190340.11	1.92
Error	22	2170468.0	98657.63	..
Total	35	4292678.13	..	..

The varieties do not differ significantly for the character namely, mean weight of fruit per plant as indicated by the low value of variance ratio.

The mean values for this character (vide Table 3) range from 79.36, in the variety Early Round Market to 274.45 in the variety Scarlet long.

viii. Yield per plant

TABLE 11

Analysis of variance for yield per plant

Source of variation	Degrees of freedom	Sum of squares	Mean squares	Variance ratio (F)
Replications	2	5426828	2713414	1.34
Varieties	11	24490104	2226373	1.09
Error	22	44538973	2024498	..
Total	35	74455905	..	..

The varieties do not differ significantly for character, namely, yield as shown by the low value of the variance ratio.

The mean values for the yield (vide Table 3) range from 907.26 to 1499.05, the lowest yield recorded in the variety Black Beauty, and the highest in the variety White Long.

(b) Correlations

1. Simple correlation coefficients in varieties

Coefficients of simple correlation between yield and other five components calculated, for each twelve varieties are presented in the table 12.

The correlation coefficients between yield and height of plants have no significant positive correlation in all the varieties except in the variety Muktakesi Round.

With regard to the yield and the number of branches no significant correlation is found except in two varieties (7.8) and in three varieties negative correlation is recorded.

Between yield and number of leaves also no significant correlation is found except in the variety Muktakesi Round. Where as in three varieties negative correlation is recorded.

The character, namely, number of flowers are found to be correlated with yield only in three varieties. Negative correlation was also recorded in some varieties. All other varieties showing no significant correlation.

Correlations

TABLE 12

Simple coefficient of correlation between yield and associated characters

Variety	Height	Number of branches	Number of leaves	Number of flowers	Number of fruits
1	0.28	0.20	-0.10	0.52*	0.24
2	0.397	-0.127	-0.287	0.22	0.78
3	0.49	-0.014	0.052	0.0014	0.054
4	0.019	0.553*	0.447	0.684*	0.18
5	0.32	0.14	0.30	0.40	0.49
6	0.26	0.37	0.35	0.16	0.39
7	0.37	0.0022	0.235	-0.127	0.242
8	0.141	0.5139	0.281	-0.46	0.168
9	0.033	0.065	0.408	0.427	0.517*
10	0.632*	-0.231	-0.54*	-0.67*	0.417
11	-0.024	0.047	0.063	0.115	0.154
12	0.09	-0.31	0.07	0.59*	0.58

* Indicates 'F' values significant at 5% level.

In case of number of fruits, all the varieties showed positive correlation with yield, though significance is obtained only in few cases. The graphical representation of coefficients of correlations are given in Fig.

2. <u>Simple correlation coefficients for all the varieties taken together</u>

Coefficients of correlation between yield of fruits and seven characters for all the twelve varieties taken together are furnished in the Table.

TABLE 13

Coefficients of correlation between yield and associated characters for all varieties

Sl.No.	Particulars	Coefficient of correlation
1.	Height and yield	0.81**
2.	Branches	0.045*
3.	Number of leaves	0.036*
4.	Number of flowers	0.807**
5.	Number of fruits	0.984**

* Indicates 'F' values significant at 5% level

** Indicates 'F' values significant at 1% level

The coefficient of correlation in the Table above indicates correlations between yield and the five characters are highly significant and positive. The characters namely, plant height, number of flowers, number of fruits show strong correlation with yield.

Graphical representation of coefficient of correlation is given the Fig. 8.

B. Discriminant function

i. Genetic components of variance of characters

The estimates of phenotypic, genotypic and error variances were calculated for six characters, (Table 14) namely, number of leaves, number of flowers, number of fruits, per cent of fruit set and mean weight of fruits.

ii. Selection indices

The discriminant function technique helped in computing the selection for yield of fruit. The following characters were included in the discriminant function.

1. Number of leaves
2. Number of flowers
3. Number of fruits
4. Percentage of fruit set
5. Mean weight of fruit

The index was calculated by taking yield index as 100. The character, namely, number of flowers yielded high value of index.

Estimate of phenotypic, genotypic and error variances of different characters

TABLE 14

Character	Variances		
	Phenotypic	Genotypic	Error
1. Height	1750.39	..	2604.24
2. Branches	1603.05	..	2731.92
3. Leaves	281783.5	226491.9	55291.6
4. Flowers	6754.4	5261.7	1492.70
5. Number of fruits	1432.81	704.72	728.09
6. % of fruit set	3589.6	270.9	4508.7
7. Mean weight of fruit	190340.11	91682.48	98357.63
8. Yield	2226373	201675	2024498

Genetic coefficient of variation, Heretability, genetic advance and mean for various characters

TABLE 15

Character	Genetic coefficient of variation	Heretability percentage	Index of genetic advance as per cent of genetic advance yield	Mean
1. Height	..	..	..	5.61
2. Branches	..	..	..	50.71
3. Leaves	230.1	80.41	31.54	205.81
4. Flowers	273.1	77.90	4.73	26.56
5. Number of fruits	274.7	49.18	13.76	9.66
6. Percentage of fruit set	42.7	48.1	15.534	39.35
7. Mean weight of fruit	..	..	..	168.17
8. Yield	34.07	9.06	100	1249.79

Phenotypic variations in various plant characters

TABLE 16

Character	Unit	Range	General mean	S.E. (M)	C.D. (0.05)
1. Height	Centimetres	51 - 124	85.61	29.47	86.43
2. Number of branches	Count	20 - 97	50.71	30.17	88.48
3. Number of leaves	Count	101 - 411	206.81	135.77	398.21
4. Number of flowers	Count	10 - 70	26.56	22.30	65.40
5. Number of fruits	Count	1 - 36	9.66	15.58	45.69
6. Per cent of fruit set	Count	41.14- 420.0	36.93	181.3	531.76
7. Mean weight of fruit	Count	11.76- 81.48	164.66	34.58	101.42
8. Total yield	Grams	320 -2537	1249.79	821.48	2409.4

D I S C U S S I O N

D I S C U S S I O N

The formation of a yard-stick in selection for plant yield is of prime importance in any breeding programme. But yield is a complex character, polygenic in inheritance, resulted by the interaction of genetic factors and environmental conditions. So a selection based on phenotypic characters are likely to give misleading results.

Panse (1957) stated "the Mendelian approach is inapplicable to the study of polygenic inheritance ....". Harland (1939) stressed the importance of taking correlation between simple morphological characters while making selection indices.

The present study was underta en to form appropriate selection index for yield in brinjal. The use of correlation coefficients between yield and important morphological characters was adopted in such a way that the phenotypic value of characters was correlated with their genotypic value. This was best done by the application of discriminant function.

1. Intervarietal variability of different characters

The mean values of the characters, viz., height, branches, leaves, flowers, fruits, percentage of fruit set, mean weight of fruits and yield were observed to be distinct in all the varieties (Table 3). The range of the mean was also found to be distinct.

Another point of interest noticed was that the high yielding varieties, Pusa Purple Long, Early Round Market, Muktakesi Long and Muktakesi Round gave high mean values, when compared to other varieties, for the characters studied viz., height, branches, leaves, flowers, fruits and percentage of fruit set.

From the analysis of variance set up for the different characters (Tables 4, 5, 6, 7, 8, 9, 10 and 11) it is clear that the varieties do not show any significant difference except for the characters viz., number of leaves and number of flowers.

As Mather (1955) stated greater the variability available in a character the greater is the possibility for selection. The variability has direct bearing on the correlation coefficient between two related characters, (Hayes et al. 1955). Thus the high values of correlation coefficient, for all the varieties taken together, showed their advantageous use in selection for yield.

At this juncture it may be pointed out that the non significant values of the variance ratio for different characters may be due to the fact that the varieties taken for study may not be showing greater variability for the characters and secondly, due to the limited number of varieties selected for the study.

A bird's eye view of a comparison of mean value of the mean weight of fruits and number of fruits render an interesting feature. Generally, in the varieties having more fruit number the mean weight of fruits seems lower, thus making the total yield almost similar in most of the varieties.

2. Correlations between fruit yield and some of the yield components

Yield and height of plants did not show any significant correlation in most of the varieties (Table 12). However, the variety Muktakesi Round rendered significant positive correlation. The combined estimate of correlation for all the varieties appears to be positive and highly significant (Table 13).

Similar findings were recorded in rice by Ramiah (1953) who found feeble correlation between yield and height and mean number of grains per ear. Ghose et al. (1956) confirmed the same results. Chandramohan and Ponnaiya (1961) had also reported feeble correlation between height of plant and length of primary ear.

On the other hand positive correlation between plant height and yield has also been reported.

In wheat Love (1912) reported positive correlation between yield and plant height. Similar findings were reported by Kottur and Chavan (1928), Kohle (1962) and Vishnu Swarup and Chaugale (1962) and in pearl millet Sankar et al. (1963). In soybeans Stewart (1928), Shih (1930) and Bartley and Webber (1952) and in coconut Krishnaswamy and Patel (1932) had also reported similar findings.

Yield and number of branches

Yield of fruits and number of branches also seen to show no significant correlation, although individually the varieties showed positive correlation. The joint correlation though significant is feeble (Table 13).

The feeble correlation between these characters seems to show the contradictory association of number of branches with yield. In brinjal it seems possible that yield and number of branches per plant are not significantly related. This is interesting in that in many plants close relationship had been observed between number of branches and yield.

Shih (1947) in soybean, Despande and Mallik (1937) in linseed and Kumar and Ranga Rao (1941) in gingelly, reported high significant correlation between yield and number of branches.

Yield and number of leaves

The correlation coefficient between the number of leaves and yield did not show any significant valves (Table 12). The varieties seems to render feeble correlation or tend to be negative. However, the joint correlation is positive and significant, though very feeble (Table 13).

This is quite unexpected when viewed from the results of De Arunda (1957) who reported positive correlation between number of leaves and pod yield in beans and Vishnu Swarup and Chaugale (1962) in jowar.

Yield and number of flowers

In all the varieties studied the correlation between number of flowers and yield was found to be very low and in one or two or three instances they were found to be even negative (Table 12). The joint correlation shows highly significant values. This character though flexible seems to have a bearing on the yield.

Krishnaswamy and Patel (1932) reported a high positive correlation between number of female flowers and the yield in coconut.

<u>Yield and number of fruits</u>

In all the twelve varieties studied the correlation coefficient showed positive values, though significant values are shown by only two varieties, Round Black and Pusa Purple Long (Table 12). The total correlation shows high significant values.

This is in accordance with the findings of Weatherspoon and Wentz (1934), Shih(1947), Johnson <u>et al</u>. (1955) and Bruin <u>et al</u>. (1959), who reported high significant correlation between number of pods and yield in soybean. In groundnut Ling (1954) and Mishra (1958) confirmed the same results.

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The present study was carried out with view to formulate suitable selection index for fruit yield using discriminant function technique and to test its efficiency over direct selection. Twelve established varieties of brinjal were studied for yield and associated characters.

The characters studied were, plant height, number of branches, number of leaves, number of flowers, number of fruits, percentage of fruit set, mean weight of fruits and yield. The analysis showed that these varieties do not differ significantly except for the characters, namely, number of leaves and number of flowers.

Simple correlations between yield of fruit and the above characters were worked out singly as well as jointly. The characters did not show any significant correlation. However, the total correlation coefficients were found to be highly significant.

The above characters which showed strong association with yield of fruits were exploited for the construction of selection indices by the discriminant function technique.

R E F E R E N C E S

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