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Preliminary steps for the formulation of selection index for yield in Groundnut (*Arachis hypogaea* Linn.)*

by

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Synopsis: Correlation studies were conducted on the spreading and bunch strains of groundnut between the various morphological characters and yield and also between the yield components. The final yield was significantly and positively correlated to number of pods and number of secondaries in the spreading strain whereas in the bunch it was correlated to 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, in the order mentioned. There existed a positively significant association between number of pods and number of secondaries in the spreading strain. The latter in turn was associated with number of nodes in the main axis, number of nodes in primaries and height of the main axis. In the bunch variety, each one of the yield components was influenced by the interaction of two or more other attributes.

Introduction

The importance of groundnut in the Indian economy as the major dollar earning oilseed crop need not be over emphasized. Research work on groundnut breeding with the object of improving the yield of pods and other qualitative characters is in progress at the various research centres in different states.

As a prelude to launching an exhaustive programme for breeding groundnut, it is essential to have a knowledge of the variations present in the different varieties and to assess the component morphological characters that go to make up the final yield of the crop. This aspect assumes greater importance in groundnut than in any other crop, due to the fact that the groundnut pods are formed underneath the ground, and unless correlations between the external plant characters and the yield are established, it may not be possible to effect proper selection of plants prior to harvest. Establishing the correlations between the yield and its components and formulating the "Selection Index" were developed by Smith (1936), based on Fisher's (1936) concept of discriminant function.

So far, experiments with this object of establishing a selection index for groundnut have been few. Attempts were made in the past to assess the correlation of length and breadth of the leaflets to seed size and to formulate an empirical equation for the estimation of

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seed size in terms of leaf characters. Previous work to correlate yield with morphological attributes other than leaf characters was much limited, and therefore the present investigation was taken up to study the correlation between yield and various plant characters and also between the yield components in groundnut as a preliminary step for the formulation of selection index.

Review of Literature

Selection Index and its importance in Plant Breeding: Yield is a complex character governed by a large number of cumulative, duplicate, nondominant genes and is quantitatively inherited. In the ultimate yield, a high proportion of non-heritable variations and heritable, fixable and unfixable variations are also expressed. Interaction between these heritable and non-heritable agencies makes the yield a highly complex problem for the breeder to solve. Hence, it is necessary to tackle the problem in a rational and more reliable manner so that selection is based on the genotypic values.

Hazel (1943) expressed that selection index gave the maximum genetic progress as it was based on the "Law of Regression". The interaction of yield components within the plant and within the population served as index for yielding ability (Stephens, 1942). Sikka and Guptha (1949) pointed out that though the morphological characters were variable, they might be the best indicators of yield and their relationship could be suggestive of selection index. The provision of an objective basis in the selection index for determining optimum relative weight to be given to any combination of characters based on quantitative measurement was understood by Manning (1956). Panse (1957) reported selection index to be indicative of the genotype of the individual characters as it could discriminate the environmental variation in the total phenotype and also represent the heritable proportion of the same.

While reviewing previous work on the subject, Panse *(loc. cit.)* and Sikka and Jain (1958) considered the following steps as necessary in the estimation of selection index: (i) Information on the correlation coefficients between yield and its different components, (ii) The relative contribution which each component of yield makes towards the overall yield, (iii) The magnitude of heritability of the individual components with reference to the analysis of variance of the different characters studied, (iv) The mutual correlations between the component characters and (v) The determination of the rate of improvement or "Discriminant Function".

Previous work done in groundnut: Correlation studies in *Arachis hypogaea* Linn. conducted by Mital and Mehta (1954) indicated that in spreading types leaflet length, breadth and length/breadth ratio have positive correlations with seed size. In erect types with decumbent branches, seed size was negatively correlated with oil content, but in spreading types no such indication was observed. Studies conducted in the Madras State (Anon. 1954) showed that a positive and significant correlation between the ratio of the average length of primaries to the height of the main axis and the weight of pods was found to exist in groundnuts. Correlation studies between seed size and leaf characters of groundnut conducted by Misra (1958) have shown that consideration of total correlation coefficients alone in case of several variates was hardly enough; partial regression coefficients drew a clearer and more definite picture of relationships with the help of an empirical equation capable of estimating seed size in terms of various leaf characters. He found significant correlation of leaf characters such as length, breadth and length x breadth with seed size.

Material and Methods

Material: Fifty plants in each of the spreading strain (TMV 1) and bunch strain (TMV 2) were chosen at random from the groundnut varietal plots at the Agricultural Research Institute, Coimbatore during 1961 summer.

TMV 1 is a spreading strain evolved by mass selection from the West African variety "Saloum". TMV 2 is a bunch strain evolved by mass selection from the North Arcot local bunch. The branching pattern of the bunch and spreading forms of groundnut has been described by Seshadri *et al* (1958).

The varieties were raised under well irrigation on red loamy soil, with a spacing of 9" x 9" for the spreading strain and 9" x 6" for the bunch strain. The plots received a basal dressing of 5 tons per acre of Farm Yard Manure.

Methods: *Characters studied:* (i) Height of the main axis in centimetres (the length of the main axis from the point of attachment of the uppermost of the primaries to the topmost node which had just unfurled its young leaf), (ii) Number of nodes in the main axis, (iii) Height/Number of nodes in the main axis, (iv) Mean length of primaries in centimetres (the length from the point of attachment of the branch to the main axis upto the topmost node that just unfurled its leaf), (v) Mean number of nodes in the primaries, (vi) Length/Number of nodes in the primaries, (vii) Height of the main axis/Mean length of primaries, (viii) Number of secondaries, (ix) Number of pods and (x) Weight of pods in grams (Yield). All the observations except the number of pods and weight of pods were recorded about 10 days before harvest.

Statistical Procedure: Correlation coefficients were worked out by variance x and variance y method as described by Panse and Sukhatme (1957) taking yield (i. e. weight of pods) and the components as one set and between pairs of components as another set, taking pairs of characters. Thus eight correlations with yield and fifteen correlations between yield components were worked out in the spreading strain whereas for the bunch strain eight correlations with yield and nineteen correlations between components were worked out.

Experimental Results

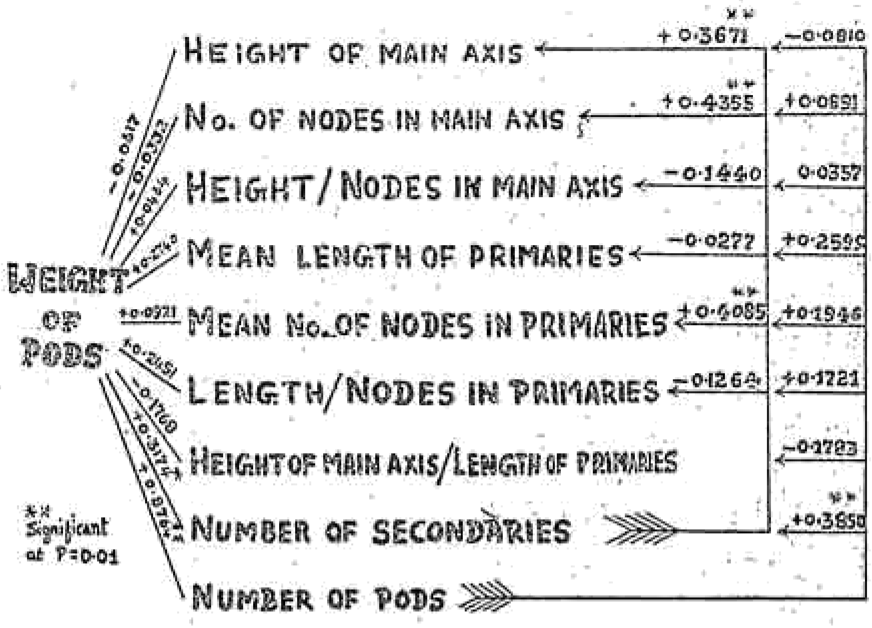
The quantitative characters recorded on the spreading and bunch strains of groundnut are presented in Tables I and II. The correlation coefficients between yield and different components and also between the components of yield in the spreading and bunch strains are depicted in the correlation charts (Figs. 1 and 2).

(a) **Correlation coefficients between yield and different components:** In the spreading strain TMV. 1. the correlation coefficient of $-0{\cdot}0617$ between the height of the main axis and weight of pods does not reach the level of significance. In the bunch strain TMV. 2, height of the main axis has a strong positive correlation to yield and the correlation coefficient of $+0{\cdot}4095$ is significant at a probability level of one percent.

The association between number of nodes in the main axis and weight of pods with a correlation coefficient of $-0{\cdot}0332$ has not reached the significant level in the spreading strain whereas it has a positively significant association with a correlation coefficient of $+0{\cdot}3964$ in the bunch strain.

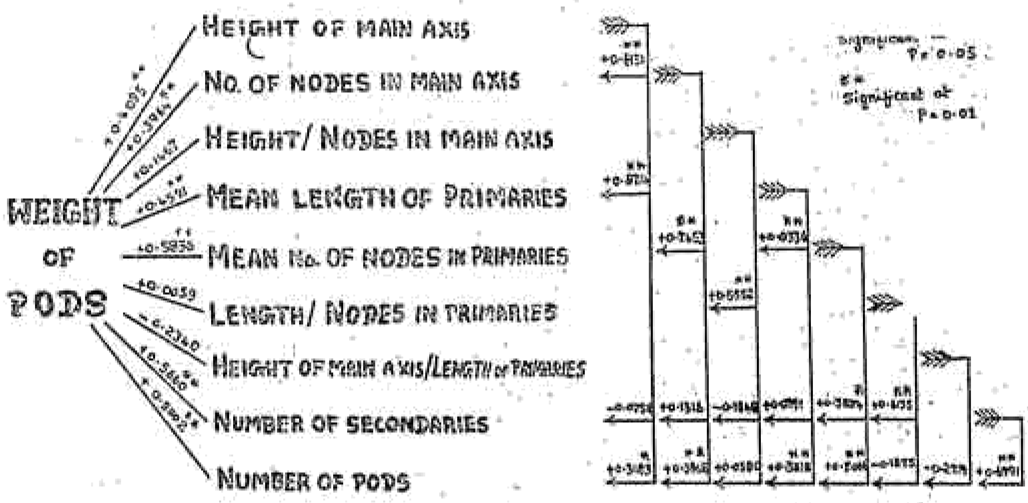
The values of correlation coefficients are $+0{\cdot}0464$ and $+0{\cdot}1467$ in the spreading and bunch strains respectively in the case of correlation between height/number of nodes in the main axis and weight of pods. But the values in both have not reached the significant level.

Mean length of primaries in both the strains has a positive association with yield, with only the bunch strain showing a highly significant correlation of +0·4591. However the spreading strain attains a border level of significance with r = +0·2740.



CORRELATION CHART FOR SPREADING STRAIN

FIG. 1.



CORRELATION CHART FOR THE BUNCH STRAIN.

FIG. 2.

Though the mean number of nodes in the primaries in both TMV. 1 and TMV. 2 strains is positively correlated to weight of pods, only the latter shows a significant trend with r = +0·5836.

The values of correlation coefficients are +0·2451 and +0·0059 in the spreading and bunch strains respectively in the case of the association between length/number of nodes in the primaries and yield and in both the cases the significant level has not been reached.

The ratio between height of the main axis and length of primaries when subjected for correlation with the individual plant yield does not show a significant trend and the values of 'r' are −0·1768 and —0·2348 in TMV. 1 and TMV. 2 respectively.

Number of secondaries is positively correlated with yield at a significant level of one percent in the spreading strain (r = +0·3174) and five percent in the bunch strain (r = +0·5660).

There exists a very high correlation between number of pods and weight of pods in both the spreading and bunch strains with the correlation coefficients of +0·8764 and +0·9002 respectively (Figs. 3 and 4).

(b) **Correlation coefficients between the components of yield :** (i) *Spreading variety :* In the spreading strain of groundnut, out of the nine characters that are correlated with yield, only two viz. number of secondaries and number of pods possess positively significant correlations to weight of pods. Hence simple correlations are worked out between each one of these two characters and the other morphological attributes.

Number of pods in the spreading strain which has a strongly positive association with yield, shows a tendency towards positive correlation to number of secondaries (r: +0·3850), mean length of primaries (r: +0·2599), mean number of nodes in primaries (r: +0·1946), length/number of nodes in primaries (r: +0·1721) and number of nodes in the main axis (r: +0·0891). Out of these characters, only the number of secondaries possesses a significant association, though the mean length of primaries can be said to have a border level of significance. Number of pods shows a non-significant association with height of main axis (r:—0·0810), height/number of nodes in main axis (r:—0·0357), and height of main axis/length of primaries (r:—0·1783).

Number of secondaries in strain TMV 1 has a positively significant association with number of pods, correlation coefficient being +0.3850 which is significant at one percent level. Number of secondaries is also correlated significantly and positively to number

CORRELATION BETWEEN NUMBER OF PODS AND WEIGHT OF PODS IN SPREADING STRAIN.

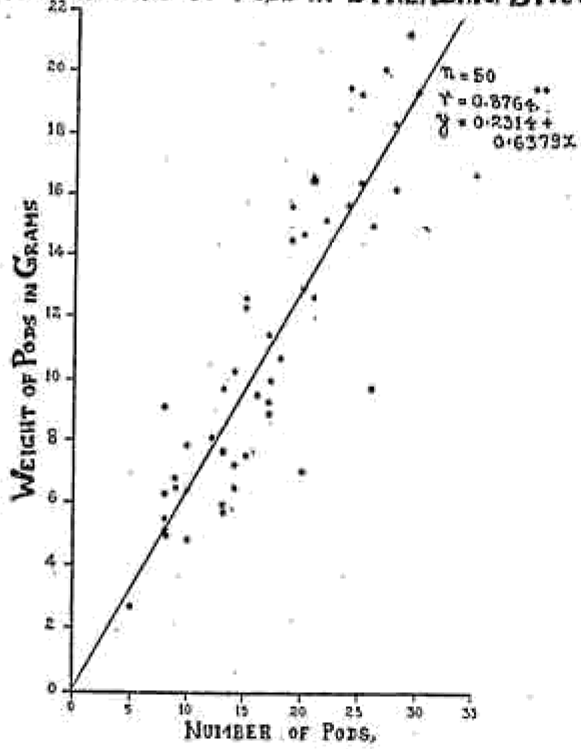


FIG. 3.

CORRELATION BETWEEN NUMBER OF PODS AND WEIGHT OF PODS IN THE BUNCH STRAIN.

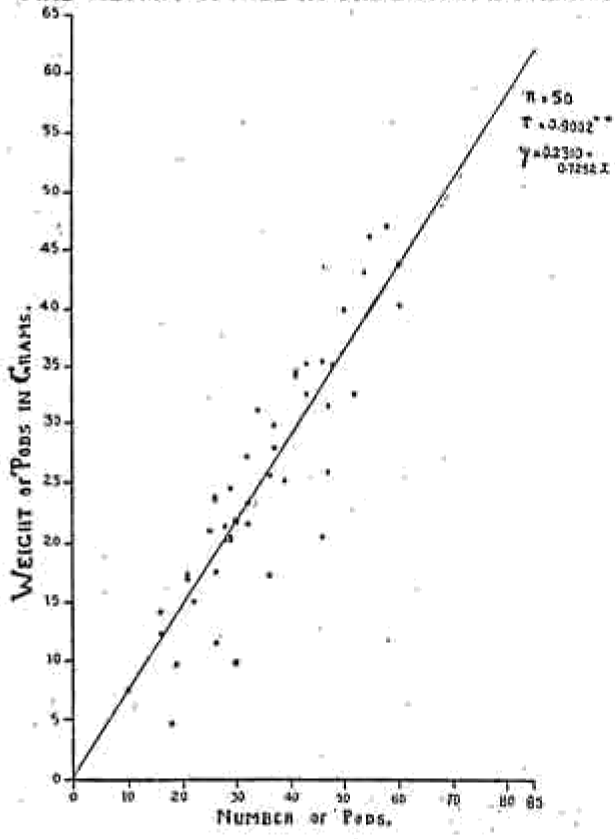


FIG. 4.

of nodes in the main axis, mean number of nodes in primaries and height of the main axis with the values of 'r' being +0.4355, +0.4085 and +0.3671 respectively. All these values are significant at a probability level of one percent. Number of secondaries possesses a negative trend of association with height/number of nodes in the main axis, length/number of nodes in primaries and mean length of primaries, the correlation coefficients of −0.1440, −0.1264 and −0.0277 respectively not reaching the level of significane in anyone of these cases.

(ii) *Bunch Variety:* Out of the nine characters of the TMV 2 strain that are subjected to correlation with yield, excepting height/number of nodes in the main axis, length/number of nodes in the primaries and height of the main axis/length of primaries, all the other six attributes have a significantly positive association towards yield. Therefore mutual correlations between these yield components are studied.

Number of pods which has the highest correlation coefficient (r : +0.9002) with yield, possesses positively significant correlation with number of secondaries (r : +0.6991), mean number of nodes in primaries (r : +0·5068), number of nodes in main axis (r : +0.3948), mean length of primaries (r : +0.3818) and height of the main axis (r : +0.3183). The association towards height/number of nodes in the main axis (r.: +0·380), height of main axis/length of primaries (r : −0.2714) and length/number of nodes in primaries (r : −0.1875) do not attain the level of significance, though the ratio between the height of the main axis and length of primaries shows a border level of significance.

Mean number of nodes in primaries which occupies the second place in the order of high significance with yield, has a positively significant correlation to mean length of primaries (+0.8336), number of nodes in the main axis (+0.7453), and number of pods (+0.5068), all of them being significant at one percent level. The coefficient value of +0.3594 with number of secondaries reaches five percent significant level.

The third yield component, viz., number of secondaries records a positively significant association at one percent probability level to number of pods (r : +0.6991) and length/number of nodes in primaries (r : +0.6135) and at five percent level to the mean number of nodes in primaries (r : +0.3594). The correlation coefficient values of number of secondaries with number of nodes in main axis (r : +0.1316), mean length of primaries (r : +0.0791), height/number of nodes in main axis (r : −0.1848) and height of main axis (r : −0.0758) have not attained the significant level.

Mean length of primaries which happens to be the fourth yield component is positively correlated significantly with mean number of nodes in primaries (r : +0.8336), height of main axis (r : +0.8714) and number of pods (r : +0·3818) but the correlation coefficient of +0.0791 with number of secondaries has not reached the level of significance.

The fifth of the yield components, viz., height of main axis is positively correlated with all the other compenents except number of secondaries (r : −0.0758) and all these components viz., mean length of primaries, number of nodes in main axis and number of pods have a significant correlation, the correlation coefficients being +0.8714, +0.6191 and +0.3183 respectively.

Number of nodes in the main axis, which works out to be the last component of yield establishes positively significant correlation with mean number of nodes in primaries (r : +0.7453), height of the main stem (r : +0.6191) and number of pods (r : +0.3948) and positive but nonsignificant association to number of secondaries (r : +0.1316).

Discussion

(i) **Attributes showing significant correlation with yield:** From the correlation charts, it may be derived that the final yield of groundnut (i. e. weight of pods) mainly depends on only two attributes viz., number of pods and number of secondaries in the spreading strain, whereas it is influenced more by the number of pods and also by the interaction between factors such as mean 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 in the bunch strain in the order mentioned.

(a) *Spreading Variety:* It is quite obvious that number of pods will have a highly significant positive association with weight of pods. But this information, as it is, will not help a breeder unless the other attributes which influence the number of pods are known. Thus, in the spreading strain, number of pods has positively significant association with number of secondaries alone, which itself, in turn, possesses positive and significant correlation to yield.

This latter association may be due to the fact that the more the number of secondaries, the more the chance for these secondary branches to produce many flowers and form greater number of pods.

Since secondary branches arise from the nodes of the primaries and they, in turn, from the nodes of the main axis, the possibility of producing more secondaries according to the increased number of nodes in the primaries and the main axis is great. This possibility finds support in as much as the correlation between them and the number of secondaries is positive and significant.

The prevalence of a significantly positive association between height of main axis and number of secondaries may not be accessible for an independent explanation, but the combined effect of all the three characters, viz., number of nodes in primaries and main axis and height of the main axis by interaction amongst them may produce the increase in number of secondaries in the spreading strain, TMV 1.

(b) *Bunch Variety:* As in the spreading strain, attributes such as number of pods and number of secondaries do have a positively significant association with yield and amongst themselves, they possess a strong correlation with r : +0.6991. Among other characters, height and number of nodes in main axis, length and number of nodes in primaries also have positive and significant association with yield. In other words, it may be said that the general vigour of the plant in strain TMV 2 goes hand in hand with higher yield.

The mutual correlation coefficients between the component characters depicted in the correlation chart for TMV. 2 (Fig. 2) show that each of these characters is governed or influenced by an interaction of two or more other attributes. For example, mean number of nodes in primaries which has an 'r' value of +0·5836 with yield is correlated to mean length of primaries, number of nodes in main axis, number of pods and number of secondaries. Thus, it is clear from the result that the yield in the bunch strain depends upon the general vigour of the plant and each of the yield components has a bearing on the interaction between two or more of the other attributes. Hence it may not be possible to specify anyone of the externally visible attributes as mainly indicating the final yield but to generalise that the overall vigour of the plant will prove to be responsible for yield in strain TMV. 2

(ii) **Attributes that do not have significant correlation with yield:** (a) *Spreading Variety:* Characters such as the height and number of nodes in main axis, length and number of nodes in primaries do not show any significant correlation to yield. The provalence of positively significant correlation between yield and number of secondaries and the absence of any such relationship with length and number of nodes in primaries may be explained by the fact that more than primary branches, the secondaries have the potentiality to give rise to more flowers and therefore, to produce more pods in the case of a spreading variety. But among the attributes that do not show any significant correlation with yield, number of nodes in main axis, mean number of nodes in primaries and height of main axis, by interacting between one another, produce an increase in the number of secondaries and thus influence the yield.

None of the ratios has any significant association with yield. The nonsignificant trend existing between the ratio of the mean length of primaries to the height of main axis is not in concurrence with the earlier findings of work done in Madras State (Anon. 1954) in which a positively significant correlation has been reported.

(b) *Bunch Variety:* Among the nine attributes correlated with yield, only three, viz., height / number of nodes in main axis, length / number of nodes in primaries and height of main axis / length of primaries show no significant association with yield.

The values of the inter-componental correlations show the absence of a significant but positive correlation between number of secondaries with number of nodes in main axis and mean length of primaries and negative correlation between number of secondaries and height of main axis.

(iii) *Yield and its components:* From the results it is obvious that yield in groundnut depends upon certain component morphological attributes. These components among themselves possess certain relationship and the product of an interaction between them makes the final yield. Yield, thus, is a complex character governed by numerous morphological characters which are qualitative and quantitative in inheritance. Though these characters are variable due to the influence of the environment, as pointed out by Sikka and Guptha *(loc. cit)*, they are still the best indicators of yield and their relationship could be suggestive of selection index.

Though it has to be accepted that consideration of correlation coefficients alone is hardly enough (Misra, *loc. cit)* and formulation of selection index which could discriminate environmental variation in the total phenotype and represent the heritable proportion is considered essential (Panse, *loc. cit)* the scope of the present work has been restricted in finding out the correlation between yield and its components and between the yield components taking into consideration morphological attributes other than leaf characters, in which not much work has been done in the past.

Therefore, just two of the preliminary steps for the estimation of selection index for yield in groundnut have been considered in this investigation. It may be necessary to pursue the work with more number of varieties and a large number of variates in each variety so as to get at a more reliable information and then to proceed with other steps till a selection index is established as suggested by Sikka and Jain (1958).

Summary and Conclusions

(1) With a view to assess the correlations between the various morphological characters and yield and also between the yield components in groundnut as a preliminary step towards the formulation of selection index, plant characters such as height and number of nodes in main axis, length and number of nodes in primaries, number of secondaries and number of pods recorded on fifty plants selected at random from each of the spreading (TMV 1) and bunch (TMV 2) strains were subjected for correlation with yield (weight of pods) as also with certain of the ratios between these attributes.

(2) The results show that the final yield of groundnut is significantly and positively correlated to number of pods and number of secondaries in the spreading strain whereas in the bunch, it is correlated to 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 in the order mentioned.

(3) None of the ratios between the height and number of nodes in main axis, length and number of nodes in the primaries, and height of the main axis and length of primaries have any significant correlation to yield.

(4) Intercomponental correlations reveal the prevalence of positively significant association between number of pods and number of secondaries in the spreading strain. Number of secondaries in turn is associated with number of nodes in the main axis, mean number of nodes in primaries and height of the main axis.

(5) In the case of the bunch variety, each one of the yield components is influenced by the interaction of two or more other attributes.

(6) This preliminary investigation brings out the prevalence of significant association between yield and certain of the morphological attributes and the inter-componental associations and indicates the possibility of intensified work for the formulation of selection index for yield in groundnut.

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TABLE I.

Quantitative observations subjected for correlation in the Spreading Groundnut Strain TMV. 1.

S. No.	Height of the main axis (in Cms.)	No. of nodes in the main axis	Height/nodes in main axis	Mean length of Primaries (in Cms.)	Mean No. of nodes in Primaries	Length/nodes in Primaries	Height of main axis/Mean length of Primaries	No. of Secondaries	No. of Pods	Weight of pods (in grams)
1	2	3	4	5	6	7	8	9	10	11
1.	11.5	14	0.82	24·4	15	1.63	0.47	9	17	10.01
2.	13.6	14	0.97	29.5	16	1.84	0.46	10	9	6.51
3.	14.7	20	0.74	36.0	20	1·80	0·41	17	28	16.26
4.	9.2	15	0·61	29.2	19	1.54	0.32	9	27	20.10
5.	12.3	17	0.71	29.4	18	1.63	0.42	12	24	15.78
6.	10.4	13	0.80	51.1	18	2.86	0.20	12	29	21.38
7.	12.5	14	0.89	26.2	15	1.75	0.48	7	8	5.53
8.	11.2	15	0.75	31.8	17	1.87	0.35	14	14	10.33
9.	12.3	17	0.17	30.7	18	1.71	0.40	14	25	16.45
10.	14.4	15	0.96	26.2	15	1.75	0·55	12	17	11.46
11.	20.4	18	1.13	25.9	15	1.73	0.78	6	10	4.84
12.	10.6	13	0.82	29.7	18	1.65	0.36	10	16	9.56
13.	12.6	15	0.84	28·7	19	1.51	0·44	8	13	9.78
14.	14.6	17	0.86	31.0	15	2.07	0.47	7	12	8.11
15.	12.6	13	0.97	28.3	17	1.67	0·45	14	30	19.45
16.	23·0	15	1.53	25.6	15	1.71	0.90	11	21	16.57
17.	16.5	25	0.66	22.4	16	1.40	0.72	13	21	12.70
18.	13.2	14	0.94	27.6	17	1.62	0.48	9	8	6.35
19.	12.4	16	0.78	25.4	19	1.34	0.49	12	19	15.61
20.	18.2	14	1.30	27.2	18	1.51	0.67	9	15	12.30
21.	15.6	21	0.74	35.3	19	1.86	0.44	10	15	7.59
22.	12.6	14	0.90	28.8	19	1.52	0.44	14	24	19.48
23.	16.4	19	0.86	21.2	17	1.25	0.77	12	8	5.04
24.	11.5	14	0.82	25.3	18	1.41	0.46	9	26	9.86
25.	12.2	13	0.94	26.4	17	1.55	0.46	9	8	5.14
26.	22.4	19	1.18	25.8	18	1.43	0.87	11	14	6.54
27.	12.5	16	0.78	26.3	16	1.64	0.48	8	10	6.41
28.	9.7	17	0.57	26.8	18	1.49	0.36	17	26	15.08
29.	13.2	18	0.73	27.1	19	1.43	0.49	11	17	9.33
30.	11.8	16	0.74	26.2	20	1.31	0.45	13	9	6.80
31.	11.7	16	0.73	22.4	17	1.32	0.52	14	17	8.95
32.	15.3	20	0.77	29.8	16	1.86	0.51	21	22	15.20
33.	9.8	13	0.75	25.6	19	1.35	0.38	10	13	7.77
34.	24.2	19	1.27	31.6	18	1.76	0.77	5	8	9.18
35.	10.4	12	0.87	27.3	17	1.61	0.38	4	20	14.68

TABLE I. *(Contd.)*

1	2	3	4	5	6	7	8	9	10	11
36.	20.4	18	1.13	31.5	23	1.37	0.65	18	13	7.75
37.	8.3	18	0.46	32.0	20	1.60	0.26	14	20	7.08
38.	13.0	15	0.87	29.5	19	1.53	0.44	10	13	5.75
39.	12.0	14	0·86	27.3	17	1.61	0.44	8	19	14.54
40.	18.2	18	1.01	30.1	21	1,43	0.60	18	28	18.38
41.	20.6	19	1.08	20.0	17	1.18	1·03	12	20	12.93
42.	19.7	21	0.94	29.2	18	1.62	0.67	18	25	19.29
43.	15.0	18	0.83	37.1	18	2.06	0.40	9	10	7.88
44.	11.5	16	0.72	32.9	20	1.65	0·35	8	18	10.75
45.	18.5	17	1.09	30.6	19	1.61	0.60	16	5	2.68
46.	11.8	18	0.66	22.3	18	1.24	0.53	11	13	5.96
47.	22.6	19	1.19	37.2	19	1.96	0.61	12	35	16.76
48.	15.6	15	1.04	30.3	16	1.90	0.51	8	13	8.42
49.	22.6	20	1.13	30.6	20	1.53	0.74	18	14	7.28
50.	12.5	15	0.83	26.5	17	1.57	0.47	11	15	12.61
Total	727.8	822	44.30	1449.3	890	81.24	25.90	574	861	554.19
Mean	14.56	16.44	0.89	28.99	17.80	1.62	0.52	11.48	17.22	11.08

TABLE II.

Quantitative observations subjected for correlation in the Bunch Groundnut Strain TMV. 2.

S. No.	Height of the main axis (in Cms.)	No. of nodes in the main axis	Height/nodes in main axis	Mean length of Primaries (in Cms.)	Mean No. of nodes in Primaries	Length/nodes in Primaries	Height of main axis/Mean length of Primaries	No. of secondaries	No. of Pods	Weight of Pods (in grams.)
1	2	3	4	5	6	7	8	9	10	11
1	26·6	19	1·40	32·7	17	1·92	0·81	2	32	21·59
2	40·5	23	1·76	43·4	20	2·17	0·93	6	55	46·10
3	25·2	17	1·48	25·5	12	2·13	0·95	—	25	21·10
4	19·7	20	0·99	25·1	17	1·48	0·78	8	47	25·85
5	21·0	18	1·17	27·0	15	1·80	0·77	3	34	31·16
6	30·4	22	1·38	36·4	16	2·28	0·83	1	26	23·84
7	18·4	16	1·15	23·4	14	1·67	0·79	7	43	35·26
8	36·8	21	1·75	55·0	21	2·62	0·67	1	50	39·95
9	19·8	15	1·50	23·3	15	1·55	0·85	7	48	32·17
10	22·6	19	1·19	30·0	16	1·88	0·75	8	29	20·51
11	30·2	22	1·37	38·8	17	2·28	0·78	—	29	20·40

TABLE II. *(Contd.)*

1	2	3	4	5	6	7	8	9	10	11
12	26·5	18	1·47	37·8	14	2·70	0·74	—	29	20·42
13	19·4	15	1·29	28·0	15	1·87	0·69	1	26	17·58
14	31·2	21	1·49	40·9	20	2·05	0·76	6	39	25·28
15	36·0	23	1·57	42·6	18	2·37	0·85	11	81	64·57
16	29·4	23	1·28	38·3	21	1·82	0·77	1	32	23·37
17	35·7	22	1·62	51·0	19	2·68	0·70	3	46	35·41
18	13·4	13	1·03	17·8	13	1·37	0·75	2	28	20·35
19	24·9	16	1·56	28·4	13	2·18	0·87	1	26	23·67
20	22·0	25	0·88	45·6	23	1·98	0·48	15	52	32·77
21	22·8	19	1·20	27·0	13	2·08	0·84	3	29	24·53
22	34·7	24	1·45	47·6	20	2·38	0·73	5	43	32·68
23	21·8	16	1·36	23·4	13	1·80	0·93	1	47	31·55
24	18·8	16	1·18	26·5	15	1·77	0·71	4	41	34·70
25	28·6	17	1·68	32·4	14	2·31	0·88	—	16	14·26
26	18·2	17	1·07	20·9	14	1·49	0·87	3	18	4·69
27	21·6	17	1·27	25·4	14	1·81	0·85	6	46	20·60
28	29·5	15	1·97	39·9	17	2·35	0·74	7	36	17·32
29	30·2	18	1·67	45·3	18	2·52	0·67	8	37	20·74
30	25·2	19	1·33	30·8	17	1·81	0·88	9	58	46·99
31	23·2	15	1·55	24·7	11	2·25	0·94	—	16	12·36
32	35·6	21	1·70	51·9	18	2·88	0·69	3	46	35·40
33	30·5	22	1·39	36·5	16	2·28	0·84	1	26	33·86
34	30·0	20	1·50	29·0	13	2·23	1·03	1	26	11·56
35	36·1	25	1·44	46 6	19	2·45	0·77	3	60	40·42
36	25·8	17	1·52	26·4	11	2·40	0·98	—	19	9·66
37	25·6	20	1·28	27·5	12	2·29	0·93	—	30	9·95
38	31·8	17	1·87	31·0	16	1·94	1·03	5	36	25·53
39	36·0	23	1·57	42·6	18	2·37	0·84	11	81	64·57
40	31·0	18	1·72	36·6	14	2·61	0·84	—	21	17·39
41	23·6	19	1·24	27·3	13	2·10	0·86	9	62	26·53
42	25·2	17	1·48	25·3	12	2·13	0·99	—	25	21·09
43	28·5	18	1·58	39·4	17	2·32	0·72	9	54	43·19
44	42·4	27	1·57	57·2	21	2·72	0·74	1	32	27·14
45	22·4	13	1·72	29·1	15	1·94	0·77	8	36	27·95
46	37·8	25	1·51	46·5	19	2·45	0·81	1	28	21·38
47	29·8	21	1·42	38·0	18	2·11	0·79	3	41	34·42
48	19·2	15	1·28	23·2	11	2·11	0·83	1	21	16·96
49	26·4	15	1·76	31·4	13	2·42	0·84	—	22	15·07
50	36·8	21	1·75	55·0	21	2·62	0·67	—	50	39·84
Total	1378·9	955	72·36	1735·6	799	108·74	40·47	184	1880	1365·43
Mean	27·57	19·10	1·44	34·71	15·98	2·17	0·81	3·68	37·60	27·31