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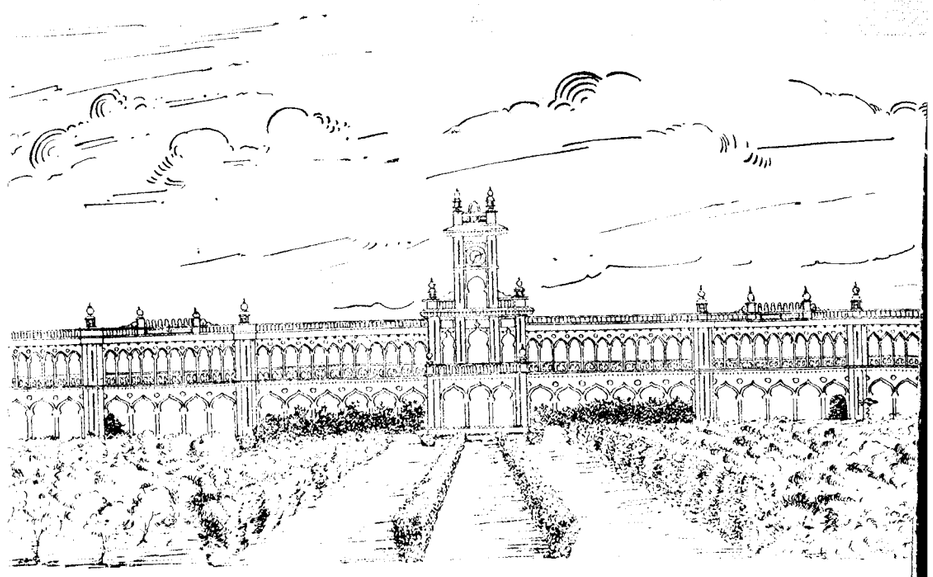

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The Madras Agricultural Journal

Vol. XLIX January 1962 No. 1

Editorial

We wish all our patrons, members, contributors and subscribers a very happy and prosperous New Year. We also thank them and all others who helped us in various ways in the successful conduct of the Golden Jubilee of the Madras Agricultural Journal and the 44th College Day & Conference.

The Madras Agricultural Journal has completed half a century of distinguished service in the cause of Agriculture and is on the threshold of the second half century, with its unlimited scope for continued service. While we are thus at the dawn of a second era of useful work it will be edifying to compare the conditions which prevailed at the beginning of the first half century with those of the second. This comparison will bring out clearly the vast difference between the scientific climate prevailing then and now.

The scientific work reported in the pages of the Madras Agricultural Journal fifty years back and now reveals this striking difference. Then it was the time for pioneering investigation in several fields. Most of the ground was not broken and any scientific work was useful and sure to be welcome. The farmer wanted answers to a few important questions—how to till the soil effectively, apply the best combination of manure and fertiliser and protect his crop from pests and diseases. As a result, experimental layout for agricultural research was comparatively simple and straightforward.

Compare with such research the type of investigation being undertaken in modern times. The quantitative aspect has legitimately been recognised as important, rather than the qualitative one. In Agronomy we now talk in terms of response curves and the Mitscherlich equation, and in Soil Science, about the host of different forms in which plant nutrient elements are capable of existing, with continual interconversions. Radio-isotopes are facilitating the assessment of soil nutrient availability and movement of applied fertiliser in the soil. In Genetics we have advanced over the general study of chromosomes and genes and are now tackling the myriad amino-acid sequences, regulated by ribo-nucleic acid, which is known to act as a template, based on which different proteins are given rise to, the whole process constituting the biochemical basis of heredity.

In Plant Physiology we are studying the initial products of photosynthesis, using radio-active carbon. The study of enzymes and plant hormones has taken us to the very heart of the mechanisms of biochemical transformations in the plant. Not remaining content with the gross effect of chemicals used as insecticides, pesticides and weedicides, we are probing into the chemical structure of the active compounds present in these formulations and are attempting to synthesise the same, with their efficacy increased manifold, by the introduction of new functional chemical groups.

Much of our research has received a tremendous boost through developments in the fields of instrumentation. It is now possible to study minute quantities of material, previously considered too small to be investigated, through chromatography, spectrography, polarography and flame photometry. With the advent of the electron microscope it has been possible to distinguish between the characteristic shapes of individual viruses or clay minerals.

The past half century has also witnessed the immense strides taken by statistical methods. Gone are the times when the arithmatic average was the nearest semblance to statistics. We now have a wide range of statistical methods, covering all phases of agricultural investigation, from the simple analysis of variance to probit analysis and multiple regression. No one rests content with saying that a difference is statistically significant. The level of significance also has now to be specified.

These comparisons have not been made here to disparage the quality of investigation of early workers. The various points covered only indicate the vastly improved conditions under which we begin the second half century of work, and publication of such work. It is but meet that the quality of work yet to be done match the great improvement of research facilities and increase of opportunity for work.

Now is also the time to look into the rich abundance of experimental data painstakingly accumulated over the past five decades, to sift and select, to subject the maze of apparently unconnected data to penetrating scrutiny, through statistical analysis, and to formulate proven theories with a true time perspective. The dimension time is really an asset in this kind of study, as it is impossible to benefit through it in short-term experiments.

The torch of scientific knowledge in agriculture has been handed over, as in a relay race, from one worker to the next, during the past five decades. The brilliance of the torch has increased through the years. We, who have taken it up from our illustrious predecessors, have to see that it glows still more brilliantly through the coming years. The Madras Agricultural Students' Union looks forward to witnessing spectacular developments in agricultural research in the State, in years to come, and to faithfully recording results of such research in the pages of the Madras Agricultural Journal.

Review Article.

A Review of Investigations on the Breeding of the Sweet Potato, *Ipomoea batatus* Lamk.* (Part II)

by

V. N. MADHAVA RAO†

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RESULTS OF BREEDING EXPERIMENTS: U. S. A.

Louisiana Agricultural Experiment Station (Miller 1955; Miller *et al* 1958):

1. New seedlings with higher sugar and twice the starch content of any of the table varieties were developed.
2. Seedlings with almost three times the carotene content of the standard variety Unit I Porto Rico were developed.
3. In 1944, over 6000 seedlings were grown. The progenies were analysed not only for disease resistance but also for starch, sugar, carotene and proteins.
4. The work under the co-operative breeding project with the U. S. D. A. resulted in the release of varieties, Pelican Processor, Queen Mary and Ranger. Pelican Processor, an industrial type was resistant to stem rot. In addition, the variety was only slightly susceptible to white rust. Queen Mary and Ranger are table types.
5. It appeared from crosses between resistant and susceptible lines that resistant × resistant gave a higher percentage of resistant seedlings, resistant × susceptible gave occasional resistant seedlings while the F_2 and back cross behaviour of resistant × susceptible suggested that resistance is recessive and conditioned by more than one gene and was somewhat complicated. In breeding for wilt resistance, certain lines were particularly valuable since they combined considerable resistance, high yield and starch content.
6. Whitestar, a variety intended for livestock consumption was released.

* Continued from page 421 of Vol. XLVIII, No. 11, 1961.

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7. Cooking tests with 23 promising seedlings showed that 18 of them had a better flesh colour than Porto Rico, the standard variety. Two to four proved to be equal or better than Porto Rico in quality.

8. At the end of 1956, there were three lines which were resistant to soil rot, two resistant to black rot, one to Fusarium wilt and black rot and one in which no internal cork had been found.

9. In tests of the reaction of sweet potato seedlings to weevil attack it was noted that the potatoes of seedlings that showed the lowest infestation were high in moisture and carotene contents and low in starch and conversely those that showed the highest infestation were low in moisture and carotene contents but high in starch.

10. The most promising seedling in 1958 was 3-77 which out-yielded significantly all the other varieties and seedlings in the tests at Louisiana. It was one of the better bakers and canners with promising prospects.

11. A compatibility chart prepared showed that most of the seedlings and varieties were self-sterile. Only one seedling 3-80 was found to be highly self-fertile.

12. A viability test for pollen viz. the peroxidase test was developed.

North Carolina : A breeding programme was initiated in 1947 in the North Carolina Agricultural Experiment Station (Anon, 1948) to develop varieties resistant to wilt, black rot and internal cork. Preliminary studies showed that irregular chromosome behaviour giving rise to unbalanced and slowly germinating gametes was partly responsible for the sterility.

South Carolina : Selections combining high yielding quality, deep salmon flesh colour and resistance to internal cork were produced at the South Carolina Experiment Station (Anon, 1948).

Georgia : Over 3000 seeds from known crosses were produced in 1947 and some 2000 plants were grown from them in 1948 at the Georgia Coastal Experiment Station (Anon, 1948). Seedlings with exceptionally high carotene content and seedlings with high yield and stem rot resistance were obtained.

Mississippi : A canning variety named Australian Canner was introduced in co-operation with the U. S. D. A. at the Mississippi Agricultural Experiment Station (Anon, 1948).

Oklahoma : At the Oklahoma Agricultural Experiment Station, (Anon, 1950a) variety Allgold was developed from an open pollinated seedling of a parent which was the product of a cross between a selfed seedling of Creole and an open pollinated seedling of Triumph. In two years' test, it gave double the yield of Porto Rico and considerably higher contents of ascorbic acid and carotene. It showed resistance to stem rot in inoculation tests. Red Gold, another variety with moist golden flesh, attractive dark skin and a considerably higher vitamin content than Porto Rico was developed. This variety is tolerant of stem rot and wilt.

A study (Anon, 1950 b) of 40 seedlings and 4 varieties indicated that nematode resistance is a recessive character with a relatively simple mode of inheritance.

West Virginia Experiment Station : Of 14 new strains, 12 had a lower percentage of cracking than Porto Rico at the West Virginia Agricultural Experiment Station (Anon, 1950 c).

U. S. Bureau of Plant Industry Co-operative Projects : The U. S. Bureau of Plant Industry and the Maryland Agricultural Experiment Station evolved a strain called Sunnyside, a moist type with good canning quality and superior to Porto Rico in carotene content but has the disadvantage of a bland flavour, tan coloured skin and susceptibility to wilt. Four varieties were developed as sources for commercial starch (Anon, 1949).

Puerto Rico : Inter-varietal crosses were made between the Jersey and moist flesh types. Use of more vigorous plants and starting crosses at 7·00 A. M. are believed to be responsible for higher percentages of fruit and seeds obtained in 1949 than in the previous year. Numerous tests in emasculation and crossing technique indicated cross-fertility and a high degree of self-sterility and detrimental effects of bags for protection against insects and the inadvisability of removing petals during emasculation as such flowers had little attraction for bees (Anon, 1949, 1950 b).

Japan : Ten varieties were found resistant to the nematode *Heterodera marioni*. Resistance to nematode appeared to be due to a chemical substance produced by the plant and to be a dominant hereditory character (Hirama, 1941).

India : Two Chinese white skinned varieties of good eating quality F. A. 17 (V. 2) and Tie shin Tun (V. 12) proved greatly superior in yield to local Punjab varieties. Pusa Suffaid, a selection

from Chinese material and Pusa Sunehri (Puerto Blanco × Wannop) × Australian Canner outyielded over 100 other varieties in New Delhi (Singh, 1951). Unpublished data from Madras State show that besides V. 2 and V. 12 mentioned above, three other varieties, V. 6, V. 8 and B. 219 were isolated as being worthy of replacing the local variety.

U. S. S. R.: Certain varieties are reported (Anon, 1937) to have been produced by the Research Institute for Humid Tropics that are no sweeter than the common potato which they excel in fineness of flavour and nutritive properties.

DISCUSSION:

The sweet potato has been grown exclusively by vegetative means. This continuous asexual propagation appears to have greatly contributed towards the persistence of any type of sterility that might have existed in the original seedling or of any type of sterility which might have developed later. Asexual propagation is believed to allow the accumulation of recessive gene mutations which may be more often detrimental to sexual processes. If the original mutation had a tendency towards sexual incompatibility clonal multiplication seems to extend the incompatibility part to the individual and the entire variety.

The non-blooming habit is another obvious condition which enforces sterility of the species. The plant is adapted to long growing conditions and its blooming is conditioned by this adaptation. But the plant is able to thrive vegetatively and produce good crop of roots when the environment does not favour the formation of flowers. Throughout a certain area of its northern range, the plant seldom blooms. In the tropics, many, if not all, bloom and often in profusion. This may be a response to environmental factors such as temperature, length of growing season, length of day and intensity of light and perhaps a combination of these. Even in areas where flowers are readily and abundantly produced fruit and seed are most frequently not to be found.

The Cytological investigations of King and Bramford (1937) indicating that the cultivated species are hexaploids with approximately 90 chromosomes in somatic cells also help to contribute to an understanding of the high sterility in the species. It is probable that chromosomal non-disjunction and other irregularities are common. The high percentage of poorly formed pollen grains in commercial varieties strongly suggests that cytological abnormalities contribute to reduced fertility.

The Jersey type of sweet potatoes have been particularly difficult to flower in the continental United States. Hartman (1947) among others, has reported complete failure of flower induction in vine and bush types and several strains of Jerseys after a comprehensive series of investigations extending over a period of 8 years. Mikell, Miller and Edmond (1948) reported the production of six flowers on Maryland Golden, another Jersey type but no seed. Under tropical conditions, the Jerseys were less refractory. It would appear that Jersey varieties can be brought to flower and that they differ from other sweet potato varieties in being somewhat more exacting in their environmental requirements. Observations of Whittwer quoted by Miller (1957) lend support to the suspected influence of growth regulating substances on flower induction, also suggested by Lam and Wadner quoted by Miller (1937).

The flowering of sweet potato when grafted on other non-tuber forming Ipomoeas has been attributed by Miller (1959) to the accumulation of carbohydrates. Miller does not believe that translocation of any flowering substance takes place from the stock to the scion as suggested by Stino and Hassan (1954). Further investigations to determine the exact causes seem called for.

The past decade has witnessed a phenomenal progress in sweet potato research. The Louisiana Agricultural Experiment Station alone has been responsible for release of strains possessing such attributes as earliness, heavy yields, superior quality, attractive skin colour and high starch, carotene, ascorbic acid and protein contents. Strains resistant to wilt, soil rot, black rot and internal cork and to pests like weevils have also been produced. The work of the co-operative projects (Anon, 1948; 1949; 1950 b; 1950 c) has resulted in the release of varieties which are of great industrial value. Varieties with low susceptibility to white rust and leaf blight, two of the minor diseases and varieties for livestock consumption, baking and canning were among those newly evolved. Work in other States in the U. S. A. was centred on the production of high yielding varieties and those resistant to nematodes (Anon, 1950 a) and internal cork (Anon, 1948) both of which are dreaded by the sweet potato grower. While the work in other countries is more or less along the above lines, it is interesting to note that in U. S. S. R. a strain resembling the potato has been developed (Anon, 1937).

Sweet potato research continues to make strides in many countries and notably in the U. S. A., where further work is being concentrated on bringing about major improvements in the breeding

methods and technique, selection of parent material, fertility studies on pollen and more rapid methods of selection of seedlings having superior qualities. The production of foundation seed which is the backbone of the sweet potato industry forms a major item of work. The Louisiana State University Agricultural Experiment Station, for instance, supplies each year 2000 bushels of foundation seed of the leading varieties for distribution to certified seed growers and individuals who grow seed. The Station not only furnishes seed to the Louisiana growers but also supplies research material to collaborating groups in the country and has distributed seed to most areas of the world where sweet potatoes are grown.

As far as the industry is concerned most canners in the U. S. A. are contracting with the growers to produce potatoes for canning. The research at the Louisiana State University has shown that if a uniform grade of sweet potatoes can be placed on the market the housewife will increase her purchase. Attempts are also being made to reduce the cost of production by introducing more mechanical aids for tillage and harvest.

Interest in sweet potato research has been aroused to such an extent, due mainly to the efforts of Dr. Julian C. Miller and co-workers of the Louisiana State University Agricultural Experiment Station that this University now possesses a 300 acre farm at Chase, intended solely for research on the sweet potato and for multiplication of seed material of promising strains. The ability of this crop to thrive under diverse conditions together with its food value which is considerably higher than that of the Irish potato, has served to advance it to the position of second place among the truck crops grown in the Southern States of the U. S. A. and to the seventh place among the standard agricultural crops of the nation.

Hardly more than a beginning has been made in India towards the improvement of the sweet potato through breeding. The results of research in the other countries discussed in these pages serve to bring out the scope for improvement of the crop and the lines along which research can be planned. India possesses all the potentialities necessary for successful culture of the crop and more especially the ideal climatic conditions to bring the plant to flower which in the temperate regions has been a serious limiting factor. The long growing seasons and the prospect of obtaining more than one crop per year are additional points in favour of tropical countries. Considering the wealth of information that has accumulated on the subject and

the attractive possibility of securing seed material of improved strains from other countries it is not hard to visualise a bright future for the sweet potato industry in India provided suitable steps are taken to initiate a comprehensive nation-wide programme of improvement of the crop through selection and hybridization. This should necessarily go hand in hand with a vigorous drive to inculcate in the minds of the public the healthful properties of this root crop and the important role that it can play in the daily diet as a rich source of carbohydrates and vitamins.

ACKNOWLEDGMENT:

Grateful acknowledgment is made to Dr. Julian C. Miller and to Dr. J. R. King, Horticulture Research Department, Louisiana State University, Baton Rouge, Louisiana, U. S. A. for their guidance and helpful criticism in the preparation of this review. The author is also indebted to the U. S. Technical Co-operation Mission and to the Government of Madras who sponsored his deputation to the United States of America under the Inter-Institutional arrangement with the University of Tennessee.

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

by

M. STEPHEN DORAIRAJ‡

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

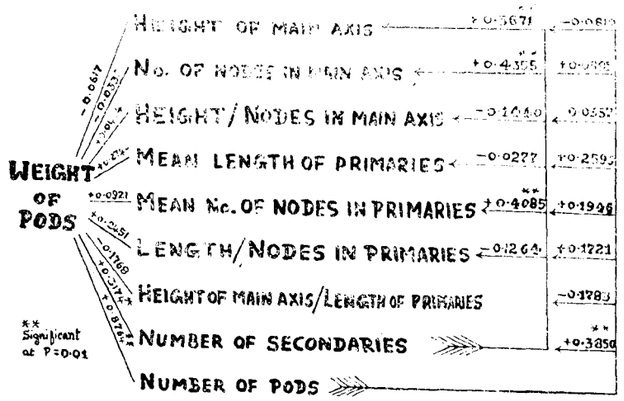
The quantitative characters recorded on the spreading and bunch strains of groundnut are presented in Tables I and II. The correlation coefficients between yield and different components and also between the components of yield in the spreading and bunch strains are depicted in the correlation charts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

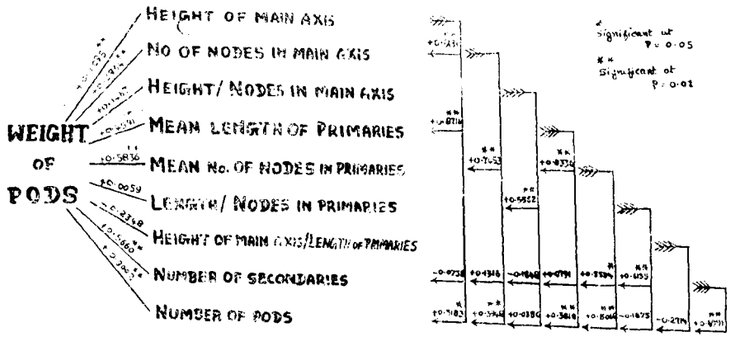
The values of correlation coefficients are $+0{\cdot}0464$ and $+0{\cdot}1467$ in the spreading and bunch strains respectively in the case of correlation between height/number of nodes in the main axis and weight of pods. But the values in both have not reached the significant level.

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

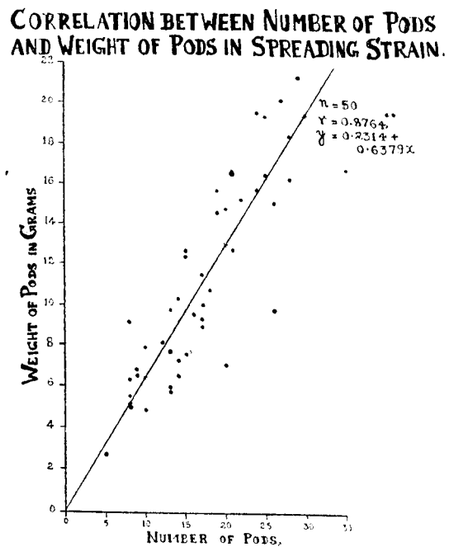


FIG. 3.

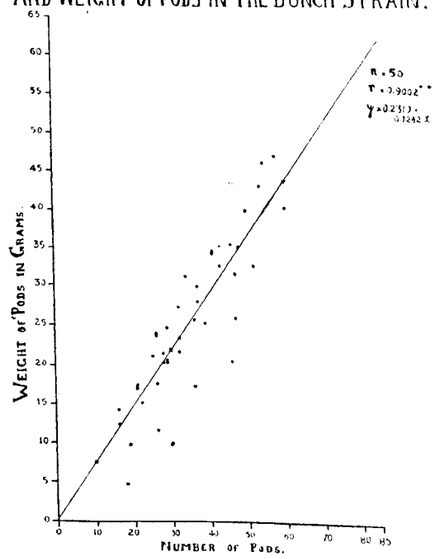


FIG. 4.

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 prevalence 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 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	35·4	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	29·74
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	25·5	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

An Economic Vegetable Cowpea *

Cowpea, *Vigna sinensis* L., one of the pulses cultivated extensively in India, belongs to the family Leguminosae. It is consumed both as tender green pod and grain. It is also a good green manure crop, an excellent fodder and an important soil improving cover crop.

It is classified into two groups i. e. the vegetable group and the grain group. Plants belonging to the former produce long, fleshy and non-fibrous pods, which can be consumed as green vegetables. In the latter group the green pods are fibrous and so this variety is cultivated mostly for grain purpose or for green manuring. The pods of the grain variety are erect and short, while those of the vegetable type are pendent and long.

The performance of a vegetable type of cowpea of Phillipine origin, received in 1950 through the Indian Agricultural Research Institute, New Delhi is presented in this note.

Work on the evolution of high yielding strains in cowpea has been in progress from as early as 1935 at the Agricultural Research Institute, Coimbatore. In respect of vegetable cowpea as a result of earlier work, an economic selection C. 419 isolated from a variety obtained from Ganjam was maintained as a high yielding quality type. Subsequent to the year 1950, among the various types of cowpea received from the Indian Agricultural Research Institute and tried at the Agricultural Research Institute, Coimbatore one type E. C. 455 was found to be economic. Its description as compared to the type C. 419 is given below :

TABLE I.

Type	Habit	Pods	Seeds (Average Weight for 100 seeds)
Cowpea E. C. 455	Highly trailing	12" to 18" in length very fleshy	13·93 grams
Cowpea C. 419	Trailing	10" to 12" in length fleshy	10·94 grams

To fix up the better yielding type, observational yield trials were laid out to compare the performance of the above two types during 1951—'52 and 1952—'53. In each trial half the plots of each type were

set apart to assess the green pod production, while the other half was left for seed collection. The quantities of green pods and seeds collected are presented below :—

TABLE II

Production of green pods and seeds per acre

Year	Type	Green pods per acre in lb.	% of increase	Seed produced per acre in lb.	% of increase
1951—'52	E. C. 455	6500	144	406	124
	C. 419	4500	100	328	100
1952—'53	E. C. 455	1050	124	59	118
	C. 419	350	100	50	100

During 1952—'53 there was a heavy infestation of aphids and the yield was consequently very low. However, the production of E. C. 455 both in respect of green pods and grain was found to be higher than C. 419 by about 34% and 21% respectively on an average.

The results of the performance of this type in the districts also indicated its suitability as an economic vegetable variety for the entire State. Seeds of this type are being multiplied at the Millets Breeding Station, Coimbatore for supply to ryots.

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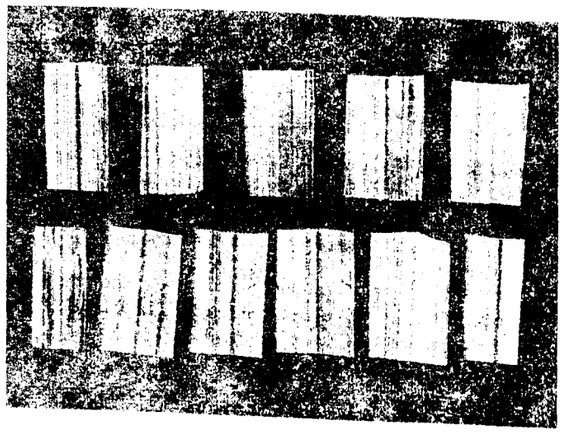
* Received on 12—10—1961.

Some Observations on Sugarcane Chlorosis*

Specimens of sugarcane leaves showing characteristic longitudinal white and yellowish stripes were received from Kunnathur (Coimbatore district). On the spot examination revealed that such a condition was confined to a few acres of land in one block while the neighbouring fields were free from it. The crop was about three months old and was considerably stunted in growth. It was gathered from the farmer that the symptoms get aggravated as the crop grows up, resulting in the severe stunting and heavy loss in yield and that the disease occurred only in one particular block.



Sugarcane leaves showing symptoms of the disease in different stages

The leaf tissue in between vascular bundles lose chlorophyll and hence the leaf bears longitudinal white or yellowish stripes alternating with normal green colour. When the chlorosis advances the entire leaf changes in colour to white or pale yellow and in advanced cases small reddish brown regions appear due to the death of tissues. On the whole, the crop will be stunted in growth. A careful study of the symptoms revealed that they closely resembled those of manganese deficiency described in sugarcane by Lee & Mc Hargue (1928) and 'Manganese chlorosis' or 'Pahala blight' described by Martin (1938).

With a view to correct the deficiency an observational field experiment was laid out for testing the efficacy of (a) application of sulphur to the soil, (b) application of manganese dioxide to the soil and (c) foliar spray with manganese sulphate at two levels at 0·1% and 0·2%. Sulphur and

* Received on 13—10—1961.

manganese dioxide were applied at 1 lb. and ½ lb. respectively per area of one cent. To avoid scorching, manganese sulphate was sprayed after mixing it with half the quantity of lime. The treatments were given twice at monthly intervals. Considerable improvement was observed twenty days after the first treatment. Sulphur treated plots were found to show remarkable improvements showing production of fresh green normal looking foliage and an increase in height of the plants. In the foliar spray treatment 0·2% manganese sulphate was found to improve the condition but to a lesser extent than sulphur. In both the above cases improvements were seen only in the freshly shooting up leaves. There was no beneficial result in manganese dioxide application.

Though the element manganese comes under 'Micro-nutrients' plants are very sensitive towards the paucity or non-availability of this element in the soil. Hoffer & Krantz (1949) indicated that this element is very essential for plant growth. It is also essential for the synthesis of chlorophyll. Despite the manganese present in the soil to an optimum level it may not be available to the plants since it is locked up in the soil complex due to its alkaline reaction. Martin (*loc. cit.*) and McGeorge (1926) suggested that if the soil is converted to acid reaction by addition of sulphur the locked up manganese will be released in an available form to the plants. The soil in the present case had a pH of 7·5 to 7·8. The results obtained from the above studies indicate the usefulness of sulphur in correcting manganese deficiency of sugarcane. Further studies are in progress.

Our thanks are due to Dr. K. Ramakrishnan, Professor of Plant Pathology for his valuable guidance in preparing this note.

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Activation of Dormant Meristems in the Cotyledonary Axils of *Cajanus cajan* (Linn.) Millsp. (Pigeon Pea)*

While examining a seedling crop of *Cajanus cajan* (Linn.) Millsp., the regular proximal association of two seedlings in certain isolated holes attracted attention and revealed, on closer scrutiny, that both the sprouts had a common primary root. Further examination under magnification clearly showed that the epicotyl had been snipped a little above the insertion of the cotyledons and that the two sprouts were actually axillary in origin, arising above the scars of the cotyledons which had shrivelled and degenerated by then. The sprouts arose about two inches below the soil surface and the length within the soil had developed secondary roots, showing that the sprouting axis had oriented itself for the functions of a root in the subterranean portion. In all instances one of the two sprouts was invariably less vigorous, which indicated delayed genesis, as of a bud in upper position, in an acropetal development.

The germination of the seed in *Cajanus cajan* (Linn.) Millsp. is hypogeal and in the axils of the buried cotyledons no buds are usually evident. From the present observations, it was apparent that there were meristematic tissues, in the axils of the cotyledons, remaining latent under the suppressive influence of the primary shoot. The injury to the growing point of the primary shoot (obviously, as it appeared due to predatory soil fauna) had activated the latent meristems into secondary sprouts, the condition approximating to the tillering found in graminaceous crops. The instance presented here appears to lend evidence to the concept of apical dominance and hence has been brought to record.

The authors are thankful to Sri V. Srinivasan, Millets and Pulses Specialist, Coimbatore for his guidance in the preparation of this note.

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* Received on 12—10—1961.

A case of Chimera in Cowpea (*Vigna sinensis* L.)*

Chimeric plants with green, green and white striped and fully white parts have been recorded in grain and wild sorghums, pearl millet and paddy (Chandrasekharan & Parthasarathy, 1960). A case of chimeric plant in Pigeon pea was recorded in the F2 of a cross between two mutants and the plant gave rise to a branch with half-small leaves and other half with normal leaves (Patil and Sandbhor 1958).

In this note, a case of chimera occurring in cowpea C. 521 variety raised during summer 1960 season at the Millets Breeding Station, Coimbatore is reported. Three different kinds of branches were observed in the same plant. The main stem was green and normal. One of the branches at the basal one third had both green and white intermixed; the leaves of the branches exhibiting the same phenomenon. Another branch at slightly lower node, was white, having complete white leaves. While the normal branch had the usual number of inflorescences, no flower was noticed in the white and green intermixed branch. The white branch produced only one flower. Seeds selfed and collected from the white and normal branches were sown separately. They bred true, fully green branches producing normal plants while each seed from white branches gave rise to albino seedlings. The albino seedlings survived only for a week. As far as the author is aware, this is the first record of a chimera in cowpea.

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* Received on 12—10—1961.

AGRICULTURAL JOTTINGS

With these jottings, we now complete one year of twelve issues and many hints have appeared from month to month on newer concepts of farming from which you could profit.

From the farmers' point of view, February is a month of enjoyment and reflection. The harvests have been almost gathered and the results and achievements of the year are being reviewed. A good harvest is always some thing that gives satisfaction, but a poor harvest is a source of disappointment in which case it is good to pause, reflect and analyse the reasons that led to the poor harvests because, those nagative factors could be at least eliminated in the future. It is rarely that farmers make such a review but it is good to make a review of this kind and useful results are sure to follow. A good harvest is always a certainty for progressive farmers who adopt modern techniques of farming. When a poor harvest results, the review would show that many outmoded practices are at the bottom of the poor harvest and they should be replaced by modern scientific methods.

Farm Planning and Management: A good and profitable harvest is the result of a planned approach to utilise the land, labour, money and other resources at your disposal in the best possible manner so as to contribute to maximum productivity and profits. Every acre of land, every rupee invested in farming and every man, animal or labour unit employed in farming should be so utilised that they give the maximum profit. Such planned utilisation is possible in cropping, in the use of resources or money and also in labour utilisation. When a farm operation is done in a traditional way, there may be a better way of doing it. When a seed is sown, perhaps a better seed could have been chosen for sowing under the conditions that would give you a better yield. That applies to manuring, use of fertilizers, plant protection techniques, use of water etc. Modern science has given us the know-how on all these aspects and an intelligent farmer tries to know them and apply them in his farming technique so that whatever he does, he makes sure that there is no better way of doing it or a better time to do it. Such deliberate action comes only of deep planning and clear thinking. It is possible to plan properly and organize your farm for maximum productivity. The agricultural scientists have given many methods for increasing crop yields; may be, you are using only a few of them. Perhaps there are many others and you may not know what you are missing. These jottings appearing month by month may help to find the way. Your Extension Officer in Agriculture will give you more particulars. Please meet him and discuss your farming problems with him. You will certainly benefit thereby.

More Profit from Sugarcane Cultivation: The profitability of sugarcane cultivation in the future is dependent upon increasing cane yields, thus reducing the cost of production per ton. Plantings generally begin in February/March. How to increase yields is a problem facing every farmer. Yields can be increased by using improved varieties and by adequate and proper manuring. Many improved varieties like Co 419, Co 449, Co 527 are already under cultivation. The best variety suited to the area can be chosen from any of them. A few new varieties are also on trial. Proper manurial recommendations have been given in these jottings previously and they may be adopted. Many sugarcane diseases such as red rot, mosaic etc., and pests like the borer spread through setts, and contribute to reduce yields. Good, vigorous, healthy setts, free from pests and diseases should be carefully selected and planted. Unhealthy and poor setts should be rejected forthwith as they do not germinate well and even if they germinate, do not grow well.

Line planting, the adoption of proper spacing, intercultivation with improved implements like the intercultivator and the ridge plough, adequate plant protection when pests occur; all would go to increase yields, thereby reducing costs. The special Agricultural Demonstrators for sugarcane are there to help you in growing good sugarcane crops. Please contact them for more particulars.

How to Make Good Jaggery: Good quality jaggery always fetches a good price. The price of jaggery is dependent on its quality. A good quality jaggery is hard and crystalline and keeps well even during storage. Though the quality and colour of jaggery are dependent upon a number of factors like soil, climate, variety and method of cultivation, good jaggery can be made by taking a few simple precautions. Good jaggery can be got only from ripe or mature canes. Unlike grain crops it is not easy to determine maturity in cane by mere observation. Laboratory methods are beyond the scope of the farmers. A trial boiling may be therefore conducted and this is the best way of assessing maturity.

Milling should commence without delay after canes are cut, otherwise the crystallisable sugar called sucrose becomes non-crystallisable sugar or glucose, due to inversion. Immature cane has more glucose in it which becomes sucrose as the cane matures. When kept long after harvest, the sucrose again becomes glucose. The cane mill and all the receptacles for holding the juice should be well cleaned before milling is commenced to remove the sour juice.

When juice which is slightly sour is boiled, the sucrose becomes glucose and the jaggery becomes soft or sometimes does not even set or form cubes in the mould, but begins to run. The main point is that every care is to be taken to prevent souring of the juice. Fresh slaked lime may be added in small measured quantities to remove the sourness

or neutralise the acid in the juice. Normally five or six ounces will be sufficient for a pan of juice. This will help to get good and hard jaggery. Too much lime may lead to a black colour and therefore the lime should be added only in correct measured quantities. The cane juice contains some suspended matter which coagulate on boiling and these have to be removed to get a good jaggery by the addition of clarificants. The impurities present in the juice are precipitated thereby. Two types of clarificants are used in jaggery making, namely, vegetable clarificants and chemical clarificants. The vegetable clarificants are *bhendi* juice, some extracts of castor seed or groundnut kernels. The chemical clarificants are superphosphate, sodium carbonate, sodium bicarbonate etc. The easily available clarificant is *bhendi* juice and this is quite satisfactory. Clarificants assist in separating the impurities and are removed during the process of boiling as 'scum', with a ladle.

Quickness in boiling is essential for producing jaggery of good quality for which shallow pans are better than deep pans. For boiling the juice, it is always better to use a 'Sindhiwahi' furnace. This is an efficient and good furnace and there is considerable economy in fuel. Light yellow or golden colour goes with quality jaggeries. Use of bleaching agents like 'hydros' or 'hypo' is not desirable as the lighter colour so gained is very temporary and the addition of this decolourising chemical is sometimes bad for health.

Nitrogen from Green Manures: Above every acre of land, there floats in the atmosphere an estimated 37,500 tons of atmospheric nitrogen free to be used. In this form however, it is useless for our crops, but it can be made useful. Nature has endowed legumes to absorb this nitrogen from the atmosphere through the help of bacteria that live in the nodules found in the roots of legumes. Over 150 years ago Sir Humphrey Davy discovered this fact of utilisation of atmospheric nitrogen by legumes through the aid of some agency and further work showed that bacteria are associated in the process. These bacteria have power to absorb the free nitrogen from the atmosphere and use it for their own use and also give the surplus to the legume plant itself. You can get this free nitrogen by growing green manure crops. This is the time to grow green manures and it will be useful to know more about green manures and how they are useful to you and your crops.

It pays to grow green manure: With the shortage of fertilisers, green manuring is a very cheap way of manuring your rice crop; costs from Rs. 15 to Rs. 40 per acre, according to the way it is cultivated and ploughed in. Experiments in Research Stations and demonstrations in farmers' fields have shown that the increase in yield is about three to five bags of paddy per acre and the net profit may vary approximately from Rs. 40/- to 60/- per acre. Thus green manuring is very profitable, apart from many other advantages given below.

Advantages of growing green manures: Green manures improve the availability of other plant foods that are locked up in the soil and the succeeding crop of rice is able to utilise them more effectively. For instance the phosphate, an important plant food, that is insoluble and fixed to soil becomes partly soluble and is better utilised by the succeeding crop. The roots of green manure crops penetrate deep into the soil and remove plant foods from the deeper zones and build them up in the plant system and when they are ploughed in the foods become easily available to the next crop on the surface. Thus nutrients are brought in from lower zones. Of course this does not happen for ever, this occurs only so long as there are nutrients in lower zones. Chemical fertilisers are sometimes better utilised when applied with green manures and fixation of phosphates is very much reduced thereby.

Growing a green manure crop year after year adds more and more nitrogen and bigger crops result thereby. These bigger crops however remove more phosphorus and potassium from the soil thereby a shortage of these nutrients is likely to be created in the soil after some time. This shortage and consequent imbalance may result in subsequent fall in yields and lodging of the crop. To prevent this happening phosphatic fertilisers are regularly applied to green manured fields and potassic fertilisers once in a while, depending on the initial fertility of the soil and also based on soil tests.

More nitrogen from green manures: Recent researches have indicated that there are certain specific bacteria working along with a specific group of legumes. If the population of these bacteria is increased they help to fix more nitrogen from the atmosphere in association with the specific group of legumes.

The culture of bacteria is mixed with a little soil and then the soil and the green manure seeds are well mixed together and then sown. The seed is mixed with the culture, a day before sowing. Every seed of the green manure crop, carries with it a small quantity of the specific bacteria through the soil adhering on it which multiply under favourable conditions and form more and bigger nodules on the roots of the green manure crop and help to fix more nitrogen. The culture is available from the Bacteriologist, Agricultural College, Coimbatore 3. A flask of the culture sufficient to inoculate 30 pounds of seeds for an acre is sold at Rs. 2/- (packing and postage extra). As this is the time for sowing green manure, you may try this culture. Directions for inoculations, which are simple, are supplied with the culture.

What green manure crop to grow? There are a large number of green manure crops which are suitable to be grown under a wide variety of conditions in our State. Sesbania speciosa: This is a green manure crop that can be grown in all kinds of soils. It maintains well

even if there is not enough moisture in the soil. Very good yields can be obtained from 10,000 pounds per acre to even 30 or 50 thousand pounds, depending on the favourable soil and moisture conditions and time available for growth. Where the growth is good, the green manure crop from an area can be cut and used in the adjacent fields. About forty pounds of seeds are required to an acre. Sesbania seedlings can be planted on borders of fields along with a paddy crop for seed multiplication purposes and also to provide some green leaf to your next paddy crop.

Daincha is another green manure similar to Sesbania. This green manure crop thrives well even in alkali soils and, therefore, is the most suitable green manure for reclaiming alkali soils. Seed rate is from 30 to 40 pounds per acre, though a higher seed rate can be used, which helps to get a thick stand and a high yield. Higher seed rates give a thick stand resulting in thin stems and the plants can be easily pulled and ploughed in. A low seed rate and a poor stand make the plants thick and difficult to pull out and plough in.

Kolinji is another very popular green manure crop in many parts of the State. It grows well even with very little moisture and is not damaged much by cattle trespass. Another advantage is that it is self sown; that is if a crop is sown this year, the pods of the crop mature and the seeds fall down in the soil and remain there and germinate again next year. In this way a continuous stand is obtained. It is generally found however that the stand in subsequent years is not satisfactory when left to self sowing and it is better to sow every year to get a good stand.

(From the Extension Specialist, Agricultural College and Research Institute, Coimbatore-3.)

Review of market conditions of commercial crops in the Madras State for the month of December, 1961.

Cotton :

COIMBATORE DISTRICT : *Season :* There was a rainfall of 12·05 mi at Tiruppur, 28 mm. in Avanashi and 24 mm. in Coimbatore, while the were practically no rains in Pollachi, Udumalpet and Gobi Taluks. Mo or less drought conditions prevailed all over the district.

Arrivals and Transactions : Kapas : The kapas market at Tiruppu started with an opening stock of 9,800 quintals of cambodia ar 212 quintals of karunganni. The total arrivals into Tiruppur duri the month (upto 23—12—1961) were 18,730 quintals of cambod and 212 quintals of karunganni. The despatches during the month we 22,252 quintals of cambodia and 18 quintals of karunganni. At the er of the month the market was left with a stock of 6,278 quintals cambodia and 207 quintals of karunganni.

Lint : The lint market at Tiruppur started with an opening sto of 38,355 quintals of cambodia lint and 31 quintals of karungani Total arrivals were 21,325 quintals of cambodia (includes 5818 quinta locally ginned). The despatches were 26174 quintals of cambodia ar 23 quintals of karunganni. At the end of the month the market was le with a stock of 33,506 quintals of cambodia and 8 quintals of karungann

Prices : Cambodia Kapas (in Rs./nP.) : Pollachi 136·79; Tiruppu 135·08, Coimbatore 140·00, Avanashi 115·00; Erode 88·20 and Gobi a Bhavani 148·00. *Cambodia Lint* (in Rs./nP.) : Pollachi 322·70; Tiruppu 343; Coimbatore 375; Avanashi 360; Erode 275 and Gobi & Bhavani 3

RAMANATHAPURAM DISTRICT : *Season :* Rainfall during the mon was practically negligible except for a few showers received during t first and the last weeks of the month. The scanty rainfall of 0·93 cms the month was practically inadequate.

Arrivals and Transactions: Cotton kapas (in quintals): Opening stock 1,000 (Rajapalayam); Receipts 2,000 (Virudhunagar 500 and Rajapalayam 1,500); Disposals 3,000 (Virudhunagar 500 and Rajapalayam 2,500) and Closing stock—Nil.

Cotton Lint (in quintals): Opening stock 3500 (Virudhunagar 260 and Rajapalayam 3,240); Receipts 850 (Virudhunagar 150 and Rajapalayam 700); Disposals 2,210 (Virudhunagar 410 and Rajapalayam 1,800) and Closing stock 2,140 (Rajapalayam).

Prices: (in Rs. nP. per quintal).

Name of the Commodity.	*Lint.*	*Kapas.*	*Seed.*
Karunganni	255·00 to 263·00	93 33 to 100·66	35·17 to 37·33
Timy	183·00 to 217·00	60·00 to 88·66	37·77 to 39·52
Uganda IInd quality	——	96·66 to 106·66	——
Uganda IIIrd ,,	——	60·00 to 86·66	——
Uganga MU. 2 ,,	409·00	——	——
Uganda certified	377·00	——	——
Uganda uncertified	298·00 to 317·00	——	——
Uganda	——	——	26·31 to 33·33

TRICHIRAPALLI DISTRICT: *Season:* The rainfall recorded was about 30 mm. during the month. The rainfall is considered to be very beneficial for the standing cotton crop.

Arrivals and Transactions: During the month in Koilpatti market arrivals were 30 and 50 quintals of karunganni kapas and lint respectivey and in Sankarankoil market arrivals were 75 & 55 quintals of uganda kapas & lint respectively. Disposals were karunganni kapas 70 quintals and lint 120 quintals in Koilpatti and Uganda 175 quintals kapas and 150 quintals lint in Sankarankoil markets. There was no stock at the end of the month.

Groundnut:

Arrivals and Transactions: Arrivals continued to be heavy at Villupuram, Tindivanam and Virudhachalam markets. A quantity of 13,092 tonnes from district produce and 757 tonnes from other districts was received for sale in all the markets put together. Despatches to other districts came to 6,358 tonnes besides, 57 tonnes to other states. Consumption in mills and country *chekkus* accounted for 5,069 tonnes and 674 tonnes respectively. Wastages were calculated at 700 tonnes. The stock with the trade at the end of the month stood at 6,295 tonnes.

Prices: The average price in the several markets ranged from Rs. 62·00 to Rs. 66·00 per bag of 80 Kg.

Gingelly:

Virudhachalam Market had an arrival of 3,919 bags while five other markets together had only 131 bags. Despatches to other districts amounted to 2,356 bag. The country *chekkus* consumed 1,258 bags. The trade had a stock of 1,146 bags at the close of the month.

Prices: The average prices varied from Rs. 84—90 per bag of 80 kg.

RAMANATHAPURAM DISTRICT: *Arrivals and Transactions:* During the month 18,500 quintals and 21,000 quintals of groundnut kernels and pods respectively were received and 18,500 quintals and 20,000 quintals of groundnut kernels and pods respectively were disposed of.

Name of Product	November 1961	December 1961
Groundnut kernels Pucca	65·00 to 71·66	66·66 to 73·33
Groundnut kernels Katcha	53·33 to 68·66	58·33 to 70·00
Groundnut Pods (37 kgs.)	...	22·00 to 25·00
Groundnut oil (226·80 kg.)	357·14 to 371·42	371·42 to 385·71
Groundnut oil cake (226·80 kg.)	79·30 to 95·59	75·23 to 87·43

NORTH ARCOT DISTRICT: *Season:* Winter conditions continued to prevail in the district with dry weather and chilly winds and cold nights throughout the month. Practically there was no rain throughout the month.

Arrivals and Transactions: Arrivals during the month were 54,195 bags (40 kg./bag) of pods and 106,731 bags (80 kg./bag) of kernels and disposals were 55,296 bags and 109,478 bags of pods and kernels respectively. Closing stocks were 13,600 bags and 10,687 bags of pods and kernels respectively.

Prices:

Groundnut Pods Per bag of 40 kgs.	Rs. 16·00 to 25·00
Groundnut Kernels per candy of 240 kgs	Rs. 185·00 to 210·00
Groundnut Oil per candy of 226 kgs.	Rs. 382·00 to 430·00

TIRUCHIRAPALLI DISTRICT: *Season:* Mainly dry weather conditions prevailed in the area during the month under review. The harvesting of winter groundnut was completed in the major portion of the district and the yield was reported to be below normal in almost all the parts of the district.

Arrivals and Transactions: The Regulated Market at Jayankondan received the heaviest arrivals viz. 12,557 bags of kernels. Ariyalur and Karur Regulated Markets received only 13 bags and 158 bags respectively.

Prices: The prices of kernels ranged between Rs. 200 to 215 on an average for pucca type per candy of 240·85 kg.

Tobacco:

COIMBATORE DISTRICT: At the end of the month under report there was a stock of 32,575 quintals of chewing tobacco and 1,850 quintals of cheroot tobacco. About 7,281 quintals of chewing tobacco and 680 quintals of cheroot tobacco were exported to places in Salem, Tiruchi, Tanjore, North Arcot and Chingleput districts of Madras State and to places in Kerala, Mysore and Andhra States.

The month witnessed moderate activity in the tobacco market, as demand from outside markets was not encouraging. The prices of the Meenampalayam variety ranged from Rs. 105·00 to 240·00 per quintal according to quality in Gobi area.

Prices: (Prices per quintal in Rs./nP.)

Variety	Ist Grade	II Grade	III Grade
1. *Chewing tobacco sun-cured:*			
(a) Meenampalayam	Rs. 225 to 240	191 to 200	106 to 135
(b) Other varieties	Rs. 180 to 225	120 to 170	70 to 115
2. *Cheroot varieties sun-cured:*			
Grown in Erode and Bhavani Taluks	Rs. 132 to 231	110 to 176	44 to 90
3. *Chewing tobacco pit-cured:*			
Grown in Palladam and Sulur areas	Rs. 250 to 297	160 to 240	100 to 130

Cardamom:

During the month there was good rainfall in the first two weeks, in most of the cardamom plantation areas in Madurai district, as well as in Kerala Hills adjoining Madurai District. The condition of the standing crop was good.

Prices: (per lb.)

1. *Bodinayakanur:*			2. *Virudhanagar:*		
Motta green	Rs.	7·30 — 7·90	Extra bold	Rs.	8·00 — 8·25
Extra green	,,	6·00 — 6·97	Shipment	,,	5·80
Green	,,	5·98 — 6.00	Rabin	,,	7·35 — 7·62
Thakkolam	,,	1·66 — 3·90	Green	,,	6·87 — 6·94
Splits	,,	4·25 — 5·43	Small	,,	6·25
Seeds	,,	3·95 — 7·80	Seeds	,,	8·25 — 8·50

3. *Pattiveeranpatti.*	*Sundried.*	*Store green.*
Superior	Rs. 7·30	Rs. 7·11 to 9·08
Medium	,, 6·17 to 7·24	,, 6·32 to 8·33
Inferior	,, 4·50 to 6·32	,, 3·55 to 6·50

Review of administrative activities of market committees in the Madras State during the month of December 1961

The Market Committees of South Arcot, North Arcot, Coimbatore, Trichirapalli, Tirunelveli and Ramanathapuram continued to function during the month under report.

Enforcement:

Name of the Market.	Section 5 (1) A	Section 5 (1) B	Section 5 (3) A	Section 5 (3) B	Weighmen. A	Weighmen. B
South Arcot	635	3749	583	2809	537	2539
North Arcot	807	4592	798	4509	89	974
Coimbatore	152	2243	68	1600	24	635
Trichirapalli	172	2303	136	2087	179	1924
Tirunelveli	4	279	1	102	1	241
Ramanathapuram	23	506	14	418	10	321

N. B.: A: Licences issued during the month. B: upto the month.

Meetings:

A meeting of the Tirunelveli Market Committee was held on 14th December 1961. But due to want of quorum the meeting was adjourned to 19th December 1961. About 9 subjects were dealt with in the meeting. The sixth ordinary meeting of the Ramanathapuram Market Committee was held on 21st December '61. The Committee discussed 22 subjects. The Committee has resolved to request the Government to permit the Market Committee to establish Regulated Markets at Virudhunagar, Sattur, Rajapalayam and Aruppukottai even under the Madras Commercial Crops Markets Act 1933. The Committee has also resolved to request the Government to include chillies and jaggery as notified crops for the district of Ramanathapuram. The sixth ordinary meeting of the North Arcot Market Committee was held at Vellore on the 23rd December 1961, when 7 out of the eleven members were present and 28 subjects were disposed of. The important resolutions of the committee at this meeting were the resolutions requesting the Government for opening a Regulated Market at Arkonam and permission to close the Regulated Market at Chetpet. No meetings were held during the month by South Arcot, Coimbatore and Tiruchirapalli Market Committees.

Quality Analysis and competition: Nil.

Weather Review — for December, 1961.

RAINFALL DATA (in inches)

Region	Stations	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)*	0·4	-0·4	36·4
	Tiruttani	0·7	-3·9	46·3
	Vellore	0·2	-2·5	36·2
	Cuddapah*	0·4	-1·7	33·4
East Coast	Pattukkottai*	0·7	+1·5	54·4
	Tindivanam*	1·1	-2·0	37·9
	Cuddalore	8·8	+1·3	58·0
	Nagapattinam	10·3	0·7	37·8
	Adutturai*	5·2	0·1	43·1
	Tanjore*	3·0	-2·9	38·3
Central	Salem	0·9	-0·1	39·6
	Coimbatore (A. M. O.)*	1·1	-0·3	30·2
	Coimbatore	1·0	-0·1	28·9
	Tiruchirapalli	2·2	-0·3	39·1
South	Madurai	1·9	-0·1	21·2
	Pamban	4·6	-3·0	30·6
	Koilpatti*	2·8	+0·7	31·2
	Palayamcottai	2·7	1·6	30·8
	Ambasamudram*	4·5	1·2	42·1
	Nagercoil*	1·1	0·6	34·9
	Capecomorin*	1·0	-0·7	46·1
Hills	Kodaikanal	8·4	+3·2	54·7
	Coonoor*	6·2	+1·0	85·7
	Ootacamund*	2·4	+0·3	56·6
	Nanjanad*	2·4	-0·7	80·7

* Meteorological Stations of the Madras Agricultural Department.

The month began with a fairly widespread rain in Madras State. Dry weather prevailed on 2-12-'61. In the subsequent two days there were localised rains, particularly in the South. On 5-12-'61 rains were fairly widespread throughout the State. Dry weather prevailed on 6-12-'61 and 7-12-'61. From 8-12-'61 to 11-12-'61 rains were either scattered or localised. From 15-12-'61 to 29-12-'61 the weather was mainly dry. In the last two days either scattered or localised rains were received. Night temperatures were below normal on 20-12-'61 and 26-12-'61 to 28-12-'61.

Noteworthy Rainfall (in inches)

S. No.	Date	Name of Place	Rainfall in inches
1.	4-12-1961	Nagapattinam	3·91″
2.	5-12-1961	Ambasamudram	2·25″
3.	do.	Coonoor	3·20″
4.	do.	Kodaikanal	4·33″
5.	8-12-1961	Pamban	3·54″

(From the Agricultural Meteorologist, A. C. & R. I., Coimbatore-3).

College and Estate News

Republic Day Celebrations: The Republic Day was celebrated in the Agricultural College and Research Institute campus with Dr. S. Krishnamurthi, the Dean and Additional Director of Agriculture hoisting the National Flag and inaugurating the celebrations by the N. C. C. Officers and cadets of the Agricultural College. It was a gay occasion in which the students, staff and residents of the Agricultural College Estate participated.

Tours: The II year B. Sc. (Ag.), students left on 16th and 17th of this month in three batches on study tour to places of interest in the Madras State.

Academy of Agricultural Sciences: Sri U. Narasinga Rao, Deputy Agricultural Commissioner with the Government of India addressed the Academy of Agricultural Sciences on certain aspects of Cocoa cultivation on 20—1—'62.

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Prizes for 1960—1961 Awarded by the Madras Agricultural Students' Union.

S. No.	Name of Prize	Purpose	Name of the Winner
1.	Ramasastrulu Munagala Prize	For the best account of original research	Sri M. Stephen Dorairaj
2.	V. C. Vellingiri Gounder Gold Medal	For the best research worker of the department	Sri A. Subramaniam
3.	N. Veeraragavalu Naidu Rolling Shield and Medal	For the best research worker in Agricultural Botany (including Plant Breeding)	Sri G. Thulasidas
4.	T. Konda Reddy Rolling Shield & Medal	For the best research worker in Agronomy	Not awarded
5.	O. M. Lakshminarayana Reddy Shield & Medal	For the best research worker in Horticulture	Sri V. N. Madhava Rao
6.	P. S. G. Ganga Naidu Medal	For the best research worker in Sugarcane	Not awarded
7.	Ramakrishna Medal	For the best research worker in Cotton	Sri S. Kamalanathan
8.	M. Bhaktavatsalam Medal	For the best student in Horticulture	Sri C. R. Nagarajan
9.	C. Subramaniam Medal	For the best student in Plant Pathology	Sri C. R. Nagarajan
10.	S. Sambamurthi Medal	For the best student in Agricultural Economics	Sri S. Shanmugasundaram
11.	Krishnaswami Naidu Medal	For the best student in Practical Agriculture in the First Year	Sri R. Meganathan

Departmental Notifications

Gazetted Officers - Madras Agricultural Department
Postings and Transfers during the month of January, 1962

Name and Designation	Posted or Transferred to
Sri K. Radhakrishna Alwa (on leave)	Superintendent, A. R. S., Nanjanad vice Sri M. Mahalingam posted as Assistant Horticulturist, Arecanut Development Scheme, Coimbatore.
,, R. H. Krishnan (on return from training)	Superintendent, A. R. S., Aduthurai vice Sri R. Veeraswamy posted as Supdt., A. R. S., Pattukottai.
,, R. Sambandam (on leave)	Gazetted Assistant to the Certification Officer, Rajapalayam.
,, S. Iyemperumal, Rajapalayam	Investigation Officer, Coimbatore.
,, R. Subramaniam, Coimbatore	Assistant Extension Specialist, Coimbatore.
,, V. Krishnamurthy, Cane Assistant, Lakshmangudi	Assistant Agronomist, Cuddalore.
,, V. Srinivasan, Pulses Specialist	Placed in additional Charge of the post of Paddy Specialist, Coimbatore.
,, A. Shanmugasundaram, Asst. Paddy Specialist	Millets Specialist, Coimbatore.

Upper Subordinates - Agricultural Department
Postings and Transfers during the month of January, 1962

Name and Designation	Posted or Transferred to
Sri S. Ranganathan, Farm Manager, State Seed Farm, Deevanbalapattinam	Instructor in Agriculture, R. E. T. C., Pattukottai.
,, R. Jayaraja, Technical Assistant	Plant Protection Assistant, Thanjavur.
,, K. V. Srinivasan, P. P. A., Thanjavur	Instructor in Agriculture, R. E. T. C., Pattukottai.
,, D. Thamburaj, P. P. A., Vellore	Information Assistant, Madras.
,, S. Ramiah, P. P. A., Sivaganga	Special A. D., Udumalpet.
,, M. K. Thankappan Nair, Horticultural Department Asst., Salem	Coconut Development Assistant, Salem
,, R. Govindan, Coconut Development Assistant, Salem	Horticultural Development Assistant, Salem.
,, Samuel Verghese	Plant Protection Assistant, Vellore.
,, S. Thyagarajan, Thanjavur	Asst. in Paddy, Peravurni.
,, K. G. Somasekaran Nair	Asst. in Horticulture, Coimbatore.
,, George Mathew	Assistant, Lecturer in Agronomy, Coimbatore.
,, T. K. Satyamurthi, Ramnad	Statistical Asst., Coimbatore.
,, V. T. Thomas, Alleppey	Extension Officer for Agriculture, Thayagadurgam.
,, A. Balasubramanian	Paddy, Asst., Thalainayar.
,, A. Thyagarajan, Srirangam	Asst. in Entomology, Coimbatore.
,, R. Sivaramakrishnan, Trichy	Cane Assistant, Lakshmangudi.
,, G. Elludurai Ernest Rajasekar, Coimbatore	Asst. in Chemistry, Coimbatore.
,, V. P. Jayaraman	Statistical Asst., Coimbatore.

Regd. No. M 5155

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