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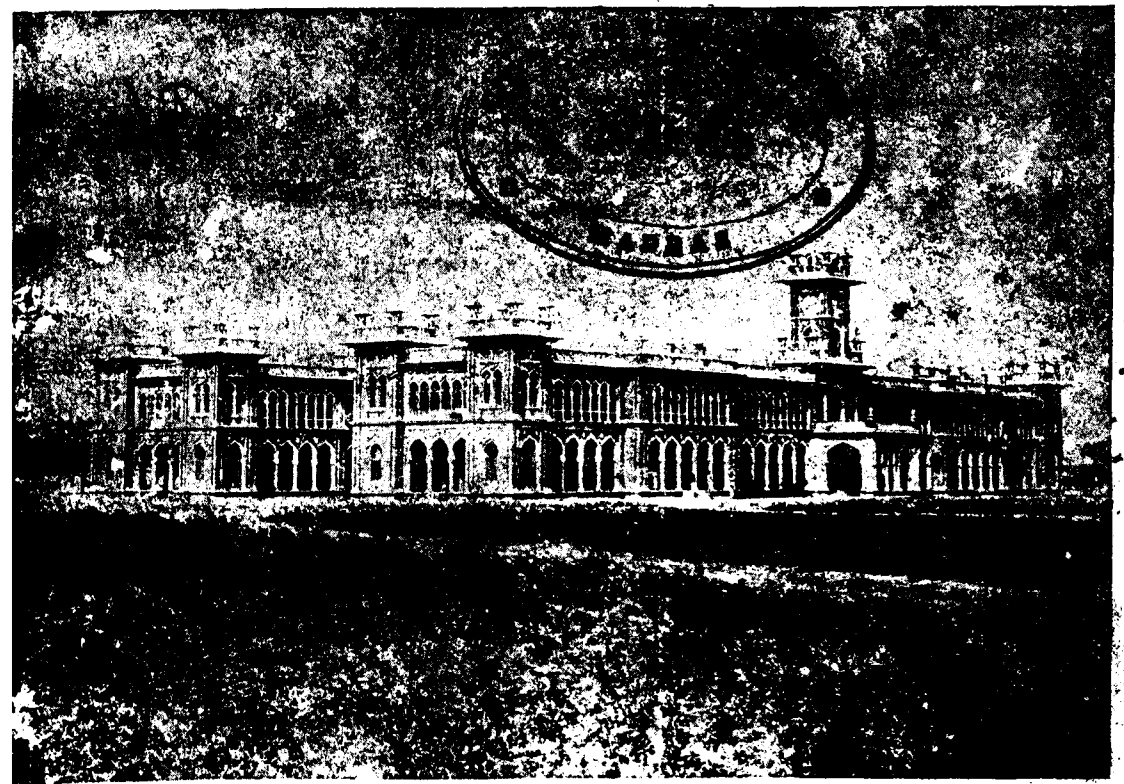
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THE
Madras Agricultural Journal

Vol. XLIII

January 1956 351

No. 1



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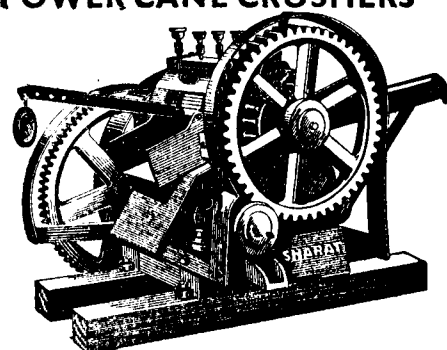
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A NEW YEAR REQUEST.

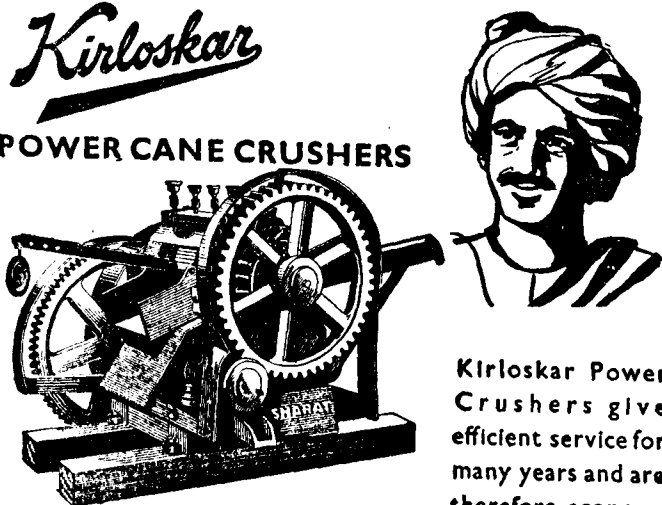
The Managing Committee of the Madras Agricultural Students' Union, wishes a very happy and prosperous New Year to all its members and well-wishers. Incidentally, the Committee also wishes to make an appeal to every one in the Agricultural Department to help the Union by enrolling as a member from the current New Year.

It is a fact that the Madras Agricultural Journal is the only periodical that covers all aspects, scientific as well as popular, of the agriculture of Madras State, and as such it surely deserves the whole-hearted support of every member of the Agricultural Department. The Union has received very valuable support and encouragement from many of our departmental Officers, but it is rather regrettable that there should still be so many in the Department who are not members of the Union. We feel sure that every one of these is a genuine well-wisher of the Madras Agricultural Students' Union, who would like nothing better than to see the Union grow in both strength and popularity. This wish can very easily be put to practical effect if every officer in the department makes it a point not only to become a member himself, but also induce their subordinate staff, as well as farmer friends to enrol themselves as members of the Union. If this is done, the Union will be placed in a far better financial position than what it is now and will also be better able to serve the needs of those interested in agriculture and function more effectively as a medium for the exchange of agricultural knowledge between different regions in Madras State.

When other departments like Block Development, Market Committees etc., are so enthusiastically contributing their mite by mass-scale memberships, it is only appropriate that no one in our own Department of Agriculture should remain as a non-member but would respond to our appeal by becoming members from the current New Year.

Secretary.

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In view of the high cost of printing, contributions should be as concise as possible and should conform to the best usage in the leading Journals published in India and abroad.

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Tables: The number of tables should be restricted to those absolutely necessary, as numerous tables detract from the readability of the article. Each table should be numbered consecutively from 1 up and must have a heading stating its contents clearly and concisely. The tables are to be typed on separate sheets with their positions marked in the text.

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War II and the V2 weapons by the Germans. Basic research comes somewhere in between these two. It is one step (or sometimes even two or three steps) removed from the "pure undiluted thirst for knowledge" even though a good deal of basic research is carried out by scientific workers in faculties of Colleges and Universities. This differs in also another respect from pure research as it is liable to get an occasional nudge and even proddings and goadings from the money-giving agency, to make it move along faster in the desired direction. Human nature being what is, it is only natural for the financing body to feel they have the right to call the tune when they are paying the piper and even to speed up its tempo as well.

The objective in Government aiding scientific research and development is to utilise the practical results arising out of the investigations for the benefit of the nation, but the question has often to be faced as to how far and how much should government funds go into basic research in proportion to applied research.

One possibility which has not been hitherto tackled satisfactorily, anywhere in the world except perhaps in the U. K. and the U. S. A., is that funds are to be sanctioned by a body of persons who might have no touch with the field of study in question, so that they would naturally tend to favour the sanction of funds only to such items as appear to have a practical utility in the view of the sanctioning body.

To safeguard against such a possibility, it is necessary to recognise the principle that basic research is quite as essential as applied research for progress in scientific advancement. Sufficient funds should be made available to Universities and Research Institutes on a long-term basis. In an enlightened national organisation there will be no need to advance arguments to convince the persons controlling the allocation of funds regarding the need for furthering basic research, because in the tree of scientific achievement pure research forms the root-system, basic research the main stem and applied research the smaller branches and leaves. And it is needless to stress the fact that the trunk is quite as important as the twigs and leaves.

The Influence of Drying on the Germination of Seed Arecanuts (*Areca catechu* L.)

by
SHAMA BHAT KHANDIGE

Introduction: The importance of arecanut industry in the economy of the country has been recognised only recently. Except undertaking certain measures for combating some important diseases of the palm, very little work has been done regarding the fundamental breeding or agronomic aspects of this crop, though it occupies a total area of about 2,60,000 acres.

Amongst the agronomic practices followed in the cultivation of this crop, the treatments given to the seeds before sowing is observed to be of considerable importance. The seed arecanuts are usually partially dried before sowing or allowing them to germinate. It is not known if it is really essential to dry the nuts or to give a sort of dormancy period before sowing them, to get a successful germination. It is also believed that partial drying of nuts helps to disintegrate the husk at a later stage (when the nuts are irrigated) and ensures easy emergence of sprouts. Hence, with the object of determining the necessity or otherwise of partial drying of nuts to get successful germination of nuts, an experiment was conducted. The data collected and the results achieved are presented in this paper.

Review of Literature: Literature on this subject seems to be meagre. However, Nambiar (1949), Coleman and Venkata Rao (1918) and Yegnanarayana Iyer (1944) have mentioned that the arecanuts are dried before sowing. They have not mentioned the reasons for drying the arecanuts. To quote Sri K. K. Nambiar, the agronomic practices of areca are still "primitive, affording considerable scope for improvement of its cultivation."

Material and Methods: The trial was conducted for a period of five months commencing from January 1955, at the Arecanut Research Station, Vittal, South Kanara district. Seed nuts were selected from healthy trees of regular and good yielding nature. Bunches which were almost uniformly ripe and from which ripe nuts had begun to drop were selected and the nuts selected for the trial were from the middle portion of the bunches. Immediately after separation of the nuts from the bunches they were dipped in cattle-dung solution. Sowings were commenced from the day of

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Editorial

Basic Research: Next to the instinct of self-preservation, the strongest urge in human affairs is curiosity. And when this is harnessed and directed into specified channels of inquiry, we have science. Science is often defined as organised common sense, but pure science is the systematic endeavour to increase our understanding of Nature, without any kind of pre-conceived bias or intention of exploiting the results. It is an intellectual adventure *per excellence*, an explorative expedition into untrodden domains of knowledge. In the good old days of not so long ago, it was quite possible for monied men of leisure to engage themselves in this kind of pure science and make substantial contributions to the sum total of our knowledge regarding the world around us. The names of Sir Issac Newton, Sir Humphrey Davy, Lavoisier, Gregor Mendel and Charles Darwin spring to our minds as shining examples of such research workers.

At present, however, it is extremely difficult, if not impossible, for anyone, however gifted he might be, to make much advance in scientific research, without the aid of public funds. For one thing, our knowledge has progressed so much in so many fields that it is impossible for anyone to build up the requisite foundation of basic principles without devoting eight or ten years and for another, tangible progress in large projects requires regular teams of research workers and involves financial commitments that are possible only from State resources. In recent times industrial concerns have also contributed very large sums towards scientific investigations and depending upon the immediate objectives, research is now divisible into three main types, pure, basic and applied research. Pure research is an inquiry after knowledge for its own sake, with no consideration or hope of practical gain, actuated by an almost abnormal thirst to find out what has not been found out before. Applied research is any investigation carried out in response to immediate, direct and obviously practical needs. As examples we may cite the invention of radar by the British during World

harvest up to after 21 days of drying. The nuts were dried by spreading them under a pandal. From each bunch 110 nuts were selected and ten nuts of each were sown on every alternate day, thus sowings were done on 11 days. Each day's sowing was done in separate rows and a uniform spacing was maintained throughout giving three inches between nuts along rows which were one foot apart. The nuts were dibbled with their top (or calyx) ends pointing upwards and level with the surface of soil. The experiment was repeated five times by obtaining nuts from 5 bunches of 5 different trees. Watering was done immediately after sowing by using a rose-head can daily, except during rainy days and it was ensured that the ground was kept continuously moist but without stagnant water at any time. The observation of the number of nuts germinated in each row was made on alternate days. The data regarding the number of days required for germination of the nuts sown on different dates and the percentage of nuts germinated in each group are given in the tables.

The following conclusions may be drawn from the data set out in the tables.

1. Cent per cent germination of seed arecanuts was obtained from those which have been sown either immediately after harvest or sown after one day's drying.

2. Drying of arecanuts does not seem to increase the capacity of nuts to germinate.

3. Seed-nuts obtained from the same bunch itself required varying number of days for germination under identical conditions.

4. Germination commences from about 47 days after sowing and extends up to 81 days after sowing. The average number of days required for germination is 63.

Discussion: From the enquiries made by the author and also as reported by Nambiar and Coleman it is known that drying of arecanuts for varying number of days before sowing is almost a universal practice. It is believed by some that successful germination could be obtained only by partial drying of arecanuts required a sort of dormancy period. With the object of finding out the necessity to dry arecanuts before sowing, the above experiment was conducted and the results go to show that it is not necessary to dry arecanuts before sowing. It was also observed from the morphological point of view that the seedlings that have come up

TABLE I
Percentage of nuts germinated (sown on different dates)

Repli- cations	Date of sowing											Mean
	31-1-55	2-2-55	4-2-55	6-2-55	8-2-55	10-2-55	12-2-55	14-2-55	16-2-55	18-2-55	20-2-55	
I	100	100	90	100	100	100	100	100	100	80	60	92.7
II	100	100	100	90	100	90	70	80	50	60	Nil	76.3
III	100	100	100	100	100	100	100	100	100	100	80	98.2
IV	100	100	100	100	100	100	100	100	90	80	60	93.6
V	100	100	100	100	100	100	100	100	100	50	60	91.8
Mean	100	100	98	98	98	98	94	96	88	74	52	--

TABLE II
Number of days after sowing required for germination of nuts sown on different dates

Sowing No. and Date	(Replication) I		II		III		IV		V		Mean	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1. (31-1-55)	57	77	67	63	67	64	57	73	57	65	59.0	71.0
2. (2-2-55)	59	79	69	55	73	68	59	75	55	75	58.2	74.6
3. (4-2-55)	59	77	68	57	73	65	53	73	55	73	56.2	72.6
4. (6-2-55)	55	77	66	57	75	66	53	71	53	63	55.0	71.4
5. (8-2-55)	53	73	63	59	71	65	49	59	49	63	52.6	65.8
6. (10-2-55)	53	57	55	53	58	53	47	67	49	57	51.0	63.0
7. (12-2-55)	53	65	59	53	59	54	57	61	49	63	52.6	62.2
8. (14-2-55)	51	59	55	55	55	55	57	69	61	67	53.0	64.2
9. (16-2-55)	51	67	59	61	67	59	61	77	69	65	55.4	71.4
10. (18-2-55)	47	67	57	51	67	63	63	75	69	62	55.0	69.8
11. (20-2-55)	49	65	57	Nil	67	62	63	75	69	67	56.0	68.5

from the nuts that have not been dried are not inferior to the seedlings obtained from those obtained from dried nuts. Hence it can be concluded that the drying of arecanuts before sowing is not necessary to get good areca seedlings. Even though the experiment was primarily intended to correlate the germination capacity of arecanuts with drying, the trial was further utilised to get a correct idea of the number of days required for the nuts to germinate. The fact that only 52 per cent of the nuts that have been dried for over 21 days have germinated, gives an indication that they begin to lose their viability after a certain stage of drying. However, since the ultimate aim of any experiment is only the yield per tree, it is quite necessary also to see and compare how these seedlings obtained from nuts of different stages of drying will fare when they begin to yield.

Summary: With a view to find out whether it was essential to dry ripe arecanuts before sowing to get a good germination, an experiment was conducted by sowing ripe arecanuts after drying for different number of days. The results obtained go to show that it is not necessary to dry arecanuts before sowing at all and the germination started after about 47 days of sowing. The process of germination continued up to 81 days.

Acknowledgment: The author is grateful to the Indian Central Arecanut Committee for having partly financed a scheme under whose auspices this work was carried out. He also wishes to express a deep sense of gratitude to Sri M. Kandaswamy, Government Mycologist, under whose guidance this work was done and to the members of the staff of the Arecanut Research Station, Vittal, for their kind co-operation in recording observations.

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Calopogonium for Control of Weeds in Coconut Gardens

by

S. D. S. ALBUQUERQUE,
Superintendent

and

P. A. MOHAMED IBRAHIM,
Assistant, Agricultural Research Station, Nileshtar

One of the important problems that confront the coconut grower, is the eradication of weeds in his garden. In competing with the coconut, the weeds utilise a considerable amount of plant food and soil moisture for their own growth, thereby lessening the available supply to the coconut trees, and consequently reducing their yield to an appreciable extent. Coconut is unique in that when it begins to yield, it produces nuts all through the year, unlike many other perennials and continues its productive phase almost to its entire life period of 70-80 years. Coconut plantations in general are not manured adequately and it becomes all the more essential to make the limited plant food available reach the main crop by eliminating the unwanted weeds which deprive the palm of a fair share of its requirements.

The subject of weed control in agricultural and horticultural cropping has engaged the attention of growers for a long time. The most common and universal practice adopted in controlling weeds is the mechanical method of uprooting the weed and destroying them. In annual crops this operation is a regular feature and periodical hoeing and weeding are included in the schedule of operations given to any particular crop. The crops are on the field for a few months from sowing to harvest and as such this method of eliminating weeds is quite effective and does not add unduly to the cost of production of the crop. Other practices that are in vogue to suppress weeds are burning leaves and rubbish spread over the ground to destroy the viability of weed seeds in the soil, scything before the weeds set seed, mulching, growing cover crops, spreading chemicals and spraying weedicides on the weed population. One or more of these measures are effective with varying degrees of success, but all the same they add to the cost of cultivation of the crop, which an ordinary ryot can ill afford to spend. The knowledge on weed control has so much advanced in the United States of America, that considerable sums are being spent for controlling weeds by the application of weed

killing chemicals to the soil or spraying on the weed vegetation. The figures for 1951 from U. S. A. reveal that 112 million pounds of phenoxyacetic acid derivatives alone have been consumed for weed killing purposes.

In plantation crops like coffee, tea, rubber, cardamom and oranges, the weed growth gets checked to an appreciable degree due to the shade provided by the growing trees or bushes and also by the mulch resulting from the shed leaves, which are allowed to accumulate in the plantations. Such a system was observed in the coconut groves in Car Nicobar in the Nicobar group of Islands. Here the coconut plantations, unlike those elsewhere, are thickly populated and the leaves, husks and other vegetable matter are allowed to accumulate on the surface soil of the plantations, the mulch thus formed inhibiting the growth of weeds. Besides adding to the humus content of the soil, it is also observed that the mulch suppresses weeds successfully. In the coconut gardens on the West Coast, however, the trees are spaced far apart and no leafy mulch is possible, as the few shed leaves are periodically removed and used for other purposes. Thus weed growth remains unchecked. Further, as the palms grow older, the application of manures aided by the high and continuous rainfall spread over a period of nearly six months from May to October every year, creates conditions which are very conducive to the spread of weeds. It is said that 'one year's seeding requires seven years' weeding'. Once the removal of the weeds is neglected, it becomes a difficult and costly item to eradicate them, as they take a permanent footing and rob the valuable plant nutrients, which would otherwise be available to the main crop. The weeds that are commonly met with in coconut gardens are the various grasses, *Hyptis*, *Mimosa pudica* and other herbaceous undergrowth, which thrive under the humid West Coast conditions.

In perennial crops like the coconut, which is on the field for a number of years, the eradication of weeds as done in annual cropping is not always a practicable proposition and is also expensive, considering the area that has to be tackled and the greater frequency of the control measures for visual results. It therefore becomes apparent that a cheap as well as effective control measure that can easily fit into any of the normal cultural or manurial operations given to the plantation, is very necessary.

It has been established from experiments in the Coconut Research Stations on the West Coast that regular cultivation of

coconut gardens increases the yield of trees to a remarkable extent and also minimizes the fluctuation in yield due to adverse seasonal conditions. Conservation of soil moisture in the dry season is ensured by such a practice. It has also been demonstrated that systematic manuring and incorporation of a green manure crop increases the yields. Jagoe R. B. (1939) has stated that experiments in Malaya have shown that growing of a cover crop of *Centrosema pubescens* checks the growth of *Lalang* grass and improves the yield of trees. Sampson (1923) has recorded that growing of a cover crop is beneficial to the coconut trees, but the choice of the crop should be such that it should not continue growing in the dry season and compete with the coconut for the limited supply of soil moisture in that period.

Such a crop is found in *Calopogonium mucunoides*, a green manure-cum-cover crop for coconut gardens, which has been raised successfully in the Coconut Research Stations at Pilicode and Nileshwar for the last two years. The way in which this crop with its quick growth and rapid spread of entwining foliage, makes it almost impossible for any weed to grow underneath, within a period of three months after germination, is really astonishing. The crop has been raised both as a self-sown and a sown crop. The rate of growth is quicker in the self-sown crop than the sown crop, but in either case it attains sufficient growth and spread to inhibit the progress of the weeds underneath. Besides this, the crop also gives an outturn of 10,000 to 20,000 lb. green leaf per acre. It acts as an effective cover to prevent soil erosion and dries up in summer, leaving a thick dry mulch 4-6 inches thick. This protective mulch conserves soil moisture, reducing the evaporation during the rainless summer months.

The method of raising *Calopogonium* as a green manure cum-cover crop and also as a means of controlling weeds in coconut gardens is indicated below. The land is ploughed once in April-May just after the receipt of summer showers. Seeds of *Calopogonium* are broadcast, using a seed rate of 8-15 lb. per acre and covered by working a cultivator or Junior Hoe. The seeds will germinate after soaking showers and by the time the South-West monsoon sets in, the plants would have grown sufficiently to cover the ground. Thereafter the vegetative growth increases and within a period of three months after germination, the entire surface area of the field is covered by this legume, the weeds and grass being smothered to a remarkable extent. From now onwards, there is little chance for

the weeds to grow any further, as the thick mass of entwining foliage suppresses them. The crop flowers in October–November and dries up in December–January. The dried leaves form a layer of 4–6" thick mulch, providing a protective screen against the severe heat of the summer sun. Just before the receipt of summer showers in April in the following year, the mulch should be broken by ploughing the area, which will ensure proper germination of the self-sown seeds. The seeds will germinate with the receipt of soaking showers and the crop will thus continue its useful service to the coconut.



FIGURE I

Three months' old crop of *Calopogonium mucunoides* in Block VIII of Coconut Research Station, Nilleshwar II. See how the weeds are smothered by the thick growth of legume.

One significant aspect to be considered while raising this crop in a coconut garden is the fitting in of cultural and manurial operations, which are as important as growing a cover crop for the coconut. This can be done successfully by adopting either of the following two methods. (1) A strip of four feet width on either side of the rows of coconut trees is dug with the mammutty in August–September. The required manures may be applied in this 8 feet wide strip and further digging given as and when necessary. Thus the tree will continue to receive the benefit of the cover crop as well as the cultural and manurial treatments. (2) The second method is to plough the green manure crop in August–September in the alternate interspaces between rows of trees.

This will facilitate the scheduled cultural and manurial operations to be done in alternate interspaces, the crop in the unploughed plots to be retained as, a mulch and allowed to set seeds. Soon after the setting of seeds one lopping can be given and the lopped material spread over the ploughed area. Thus the whole field gets the mulch in the summer months. Just after rains are received in April, the entire field is ploughed to incorporate the green manure and cover the shed seeds. By adopting this method, the coconut trees get the good effect of the green manure, mulch and a self-sown crop in the next season without losing the advantage of cultural and manurial operations.



FIGURE II

For facilitating cultural operations, note how a strip of 8 feet is dug, leaving the remaining area covered by the *Calopogonium* crop.

Thus, with very little extra cost, a good crop of *Calopogonium mucunoides* can be grown as a green manure-cum-cover crop in coconut gardens and in about three months after germination this crop suppresses weed growth effectively. It provides an economical and practical method of controlling weed growth in coconut plantations. The crop can also be fitted in with the normal manurial and cultural operations so necessary in a coconut garden; at the same time it yields plenty of organic matter, serves as a cover crop to prevent soil erosion and also provides a mulch during the summer months to conserve soil moisture. Its cultivation is within the means of an average coconut grower and it is hoped that a fair

trial for this leguminous crop will be given in the coconut plantations on the West Coast.

Acknowledgment: The authors are grateful to Sri M. S. Sivarman, I. C. S., Director of Agriculture, Madras at whose instance the crop was introduced at the Stations and was grown successfully. They are also thankful to Sri C. R. Seshadri, Oilseeds Specialist, Coimbatore, for his helpful suggestions and advice rendered from time to time.

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Errata

(Review of Market Conditions of Commercial Crops in the areas of Market Committees for November, 1955, published in the December 1955 issue of the Madras Agricultural Journal).

Page No.	Line No.	Correction
554	18	505 instead of 5,050
554	20	2,070 instead of 2,075
558	Under disposal column in the I statement at Mangalore read 265 instead of 375.	
558	Under opening balance column in the II statement at Kozhikode read 1,333 instead of 1,833.	
	Under disposal column in the same statement at Badagara read 1,470 instead of 1,476.	
	Under closing balance column in the statement at Mangalore read 38 instead of 39.	
559	Under disposal column in the II statement at Kozhikode read 3,098 instead of 3,089. In the same statement at Ponnani read 2,800, 1,500, 2,500 and 1,800 respectively for 696, 1,510, 1,088 and 388.	
	Quantity mentioned as cwt. opposite to Ponnani under Arecanut may be read against Mangalore.	
560	Third line under Tobacco read candies instead of days.	

Studies on the Inheritance of some Anthocyanin and Corolla Colour Characters in Asiatic Cotton

by

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Introduction: From a crop survey of the Peninsular Indian *arboreum* cottons in the Cocanadas (race *indicum*) zone, Balasubramanyan, Ramaswamy and Jagannatha Rao (1946) reported on the occurrence of three new genotypes not recorded earlier in this region. They were (a) Green stem/Ghost Spot - $R_2^{os} R_2^{os}$; (b) Fully immature lint - *lm* and (c) Incomplete boll dehiscence - *de_b* and the inheritance of these characters in a few combinations of crosses has since been reported by Balasubramanyan *et al* (1950).

The Green stem/Ghost Spot type was characterised by the complete absence of anthocyanin pigment in all plant parts and by the presence of a white patch in the place usually occupied by the red spot in the petal. The corolla colour of the new type was yellow and hence the white patch designated as 'Ghost' (Hutchinson, 1932) was easily visible. The inheritance of this Green stem/Ghost spot complex in relation to different anthocyanin and corolla colour factors, in five inter-racial crosses in *G. arboreum* involving Sun-red and Deep-red; Yellow corolla, Pale-yellow and White corolla genotypes is reported in this paper.

Previous Work: (i) *Anthocyanin organisation:* The anthocyanin genetics of cotton has been the subject of detailed study by Hutchinson (1932) and Silow and Yu (1942). Yu (1932); Yu and Hsi (1934); Hutchinson and Ghose (1937); Ramiah and Bholanath (1944) and Balasubramanyan *et al* (1950) have also reported on the occurrence of newer members of the anthocyanin multiple allelmorph series in Asiatic cottons or established homology of new mutants with known genes. A survey of anthocyanin organisation in cotton has also been recently made by Ramiah (1945).

In Asiatic cottons, the distribution of anthocyanin pigment in the vegetative parts of the plant and on the flower petal is known to be controlled by the R_2 series of multiple allelmorphs, of which at least twenty members have now been established (Stephens and Cassidy, 1946). The extent and intensity of pigmentation of the plant body and the presence or absence of petal spot constitute the two main attributes of the anthocyanin system.

In such diverse organs and locations as stem, petiole, leaf pulvinus, leaf veins, leaf lamina, bracts, calyx, bolls, anther, filaments, petal, lamina and petal edge, anthocyanin finds expression and on the basis of vegetative anthocyanin, three groups viz. 'Green', 'Dilute red' or 'Sun-red' and 'Deep red' can be made out. With regard to the other attribute viz., the presence or absence of petal spot, three phenotypes are recognised viz. 'Red spot', 'Ghost spot' and 'Spotless'. 'Ghost' has a white spot in the place usually occupied by red spot in the petal, while in the case of 'Spotless', no spot is present. Excepting in the case of 'Ghost', which occurs only in the 'Green' class, 'Red spot' and 'Spotless' forms exist in all the three classes of vegetative anthocyanin viz. 'Green', 'Dilute red' and 'Deep red'.

(ii) *Corolla Colour Genetics*: Three main Corolla Colour types occur in Asiatic cottons viz., Yellow, Pale Yellow and White. Hutchinson (1931) showed that the inheritance of corolla colour in Asiatic cottons was controlled by a multiple allelomorph series at the Y_a locus (Gene symbol. after Hutchinson and Silow, 1939). Subsequent additions to this series were the 'Chinese Pale' at the Y_b locus and 'Anomalum Pale' at the Y_c locus (Silow, 1941). Bholanath (1942) let in confirmatory evidence for the complementary nature of Y_a and Y_b Loci for production of Yellow corolla.

Recently, Stephens (1954) has reviewed the position and summed up the situation as follows:

Type	Genotype	Phenotype	Distribution
1. Yellow	$Y_a Y_b Y_c$	Yellow	<i>G. arboreum</i> and <i>G. herbaceum</i>
2. Common pale	$Y_a^P Y_b Y_c$	Uniformly pale	<i>G. arboreum</i> only
3. Chinese pale	$Y_a Y_b^P Y_c$	Pale, with intensification around throat of Corolla	Chinese strains of <i>G. arboreum</i> only
4. Anomalum pale	$Y_a Y_b Y_c^P$	Uniformly pale	<i>G. anomalum</i>
5. White	$Y_a Y_b Y_c$	White	<i>G. arboreum</i>

Material and Methods: The present studies relate to crosses of the Cocanadas Green stem/Ghost spot, Yellow corolla type with 1) Sun-red spot, Yellow corolla; 2) Sun-red/Red spot, Pale yellow Corolla; 3) Sun-red/Red spot, White corolla; Deep red Spotted, red on Yellow corolla; and 5) Deep red/Spotted, red on white corolla types in *Gossypium arboreum*. The characteristics of the parents used in the study are furnished in table 1.

TABLE I
Characteristics of parents used in the study

S. No.	Type	Botanical classification	Anthocyanin	Corolla Colour	Genotype
1.	CST 3	<i>G. arboreum</i> race <i>indicum</i>	Green stem/Ghost	Yellow	$OS R_2$ $Y_a Y_a$
2.	Burma C 19	<i>G. arboreum</i> race <i>burmanicum</i>	Sun-red Spotted	Yellow	$AS R_2$ $Y_a Y_a$
3.	Cernuum	<i>G. arboreum</i> race <i>cernuum</i>	Sun-red Spotted	Pale Yellow	$AS R_2$ $Y_a^P Y_a$
4.	N. R. 5	<i>G. arboreum</i> race <i>bengalense</i>	Sun-red Spotted	White	$AS R_2$ $Y_a Y_a$
5.	Sanguineum 119	<i>G. arboreum</i> race <i>bengalense</i>	Full-red Spotted	Red on Yellow	$RS R_2$ $Y_a Y_a$
6.	Sanguineum major	<i>G. arboreum</i> race <i>bengalense</i>	Full-red Spotted	Red on White	$RS R_3$ $Y_a Y_a$

The following five combinations of crosses were effected and observations made on the F_1 , back crosses and F_2 populations.

1. CST. 3 x Burma C 19 ... (*indicum* x *burmanicum*)
2. CST. 3 x Cernuum ... (*indicum* x *cernuum*)
3. CST. 3 x N. R. 5 ... (*indicum* x *bengalense*)
4. CST. 3 x Sanguineum 119 ... (*indicum* x *bengalense*)
5. CST. 3 x Sanguineum major (*indicum* x *bengalense*)

Phenotypic classification in respect of pigmentation of plant parts and corolla colour in the yellow x pale yellow and yellow x white crosses, was made on the basis of visual scoring. In the case of crosses involving interaction of the deep red (anthocyanin genotype on corolla colour expression, colour plates of Hutchinson (1932) were utilised for grading. Freshly opened flowers were used for classification of corolla colour and petal grading was done with flowers on the plant, in the early period of the day before fading set in.

In analysing the results of segregation, the *Chi* square test was applied to test the goodness of fit to expected ratios and probability determined.

In dealing with the interaction of anthocyanin and corolla colour genotypes, the R_2^{os} segregants have been left out since only in the R_2^{as} back ground is the expression of the corolla colour gene modified.

Results and Discussion: The data relating to the inheritance of anthocyanin, inheritance of corolla colour, anthocyanin—corolla colour combined assortment and interaction of genotypes on the expression of corolla colour are presented below and discussed under the respective heads.

(i) *Inheritance of anthocyanin:* The anthocyanin system in Asiatic cottons has two main attributes viz., the pigmentation of plant parts and the presence of petal spot. The results of segregation in the five crosses involving the Green stem/Ghost spot type on the one hand with three Sun-red/Red spotted and two Full red/Red spotted types are furnished in Table 2.

TABLE II
Inheritance of anthocyanin (Petal spot)

S. No.	Nature of cross and germination	No. of plants with		Total	Monogenic segregation	
		Pigmented/ Red spot	Green stem/ Ghost spot		χ^2	Value of P. between
1.	CST. 3 x BC 19	F ₁ 33	..	33	..	..
	Back cross with CST. 3	49	44	93	0.269	0.50 — 0.70
	Back cross with BC. 19	102	..	102	..	..
	F ₂ Total of 6 families	276	84	360	0.266	0.50 — 0.70
2.	CST. 3 x Cernuum	F ₁ 32	..	32	..	..
	Back cross with CST. 3	58	52	110	0.328	0.50 — 0.70
	Back cross with Cernuum	98	..	98	..	..
	F ₂ Total of 4 families	299	99	398	0.003	0.95 — 0.98
3.	CST. 3 x N. R. 5	F ₁ 37	..	37	..	..
	Back cross with CST. 3	35	34	69	0.014	0.80 — 0.90
	Back cross with N. R. 5	26	..	26	..	..
	F ₂ Total of 7 families	199	73	272	0.491	0.30 — 0.50
4.	CST. 3 x Sanguineum 119	F ₁ 20	..	20	..	..
	Back cross with CST. 3	66	50	116	2.206	0.10 — 0.20
	Back cross with Sanguineum	55	..	55	..	..
	F ₂ Total of 3 families	191	68	259	0.217	0.50 — 0.70
5.	CST. 3 x Sanguineum major	F ₁ 8	..	8	..	..
	Back cross with CST. 3	79	97	176	1.840	0.10 — 0.20
	Back cross with Sanguineum major	52	..	52	..	..
	F ₂ Total of 3 families	232	80	312	0.068	0.70 — 0.80

Cross 1: CST. 3 x Burma C. 19 (*indicum* x *burmanicum*)
Green stem/Ghost x Sun-red/Red spot.

The F_1 was observed to be Sun-red/Red spot and in the back-cross with the recessive parent, Green stem/Ghost, segregation was obtained in the ratio of 1:1 for the two phenotypes. The segregation in F_2 also accorded well with expectations on the basis of monogenic inheritance.

Cross 2: CST. 3 x Cernuum (*indicum* x *cernuum*)
Green stem/Ghost x Sun-red/Red spot.

In this cross also, Sun-red/Red spot was dominant over Green stem/Ghost and the segregation in backcrosses and F_2 conformed to monogenic inheritance.

Cross 3: CST. 3 x N. R. 5 (*indicum* x *bengalense*)
Green stem/Ghost x Sun-red/Red spot.

The F_1 was again Sun-red/Red spot and a good fit for 3:1 segregation of Spot: Ghost in F_2 and 1:1 segregation in the back cross with the recessive parent CST. 3 was obtained.

Thus, in all the above three inter-racial crosses within *G. arboreum*, the Cocanadas Green stem/Ghost has proved to be a simple recessive to the Sun-red/Spotted types, confirming previous behaviour of the Green stem/Ghost (R_2^{os}) allele in other crosses with the Sun-red spotted (R_2^{as}) allele.

Cross 4: CST. 3 x Sanguineum 119 (*indicum* x *bengalense*)
Green stem/Ghost x Full red/Red spot.

The Sanguineum 119 parent carries the R_2^{rs} allele, the deepest member of the anthocyanin series and this was dominant over the Green stem/Ghost R_2^{os} genotype in the F_1 . In the back cross with recessive parent, the segregation gave a good fit to 1:1 ratio for the two phenotypes, while in the F_2 , Spot and Ghost were inherited in the ratio of 3:1.

Cross 5: CST. 3 x Sanguineum major (*indicum* x *bengalense*)
Green stem/Ghost x Full red/Red spot.

The Sanguineum major parent also carries the R_2^{rs} allele, but differs from the Sanguineum 119 parent only in respect of its corolla colour genotype.

The behaviour of the F_1 , back crosses and F_2 in this cross was similar to that of Sanguineum 119 cross in respect of anthocyanin inheritance.

The Cocanadas Green stem/Ghost which carries the R_2^{os} allele of the anthocyanin multiple allelomorph series has thus confirmed its behaviour, as a simple recessive to the R_2^{as} and R_2^{rs} alleles in the inter-racial crosses studied now.

(ii) *Inheritance of Corolla colour:* The CST. 3 Green stem/Ghost type possesses Yellow corolla and the inheritance of the same in crosses with Yellow corolla (Burma C 19); Pale yellow corolla (Cernuum); White corolla (NR5); Red on Yellow corolla (Sanguineum 119) and Red on White corolla (Sanguineum major) types is summarised in table 3.

Cross 1: CST. 3 x Burma C. 19 (*indicum* x *burmanicum*)
Yellow x Yellow.

In this cross between two Yellow corolla types, the F_1 was Yellow and in the back crosses and F_2 , all the plants possessed Yellow corolla, thus confirming that both the parents carried the Y_a allele.

Cross 2: CST. 3 x Cernuum (*indicum* x *cernuum*)
Yellow x Pale Yellow.

In the F_1 , yellow corolla colour was dominant over pale yellow and in the back cross with CST. 3, all the plants were yellow. In the other back cross viz., with the recessive Pale yellow parent, 1:1 segregation for the two phenotypes was obtained. The F_2 segregated in the ratio of 3:1 for yellow and pale yellow corolla types, respectively.

The cernuum parent is known to carry the Y_a^p allele and its behaviour as a simple recessive to Y_a carried by the CST. 3 parent is confirmed.

Cross 3: CST. 3 x N. R. 5 (*indicum* x *bengalense*)
Yellow x White.

In the F_1 , all plants possessed yellow corolla and in the back cross with CST. 3 all the plants were yellow. In the other back cross with the recessive white corolla parent, the segregation for yellow and white corolla plants gave a good fit to 1:1 expectation. In the F_2 , the proportion of plants in the two phenotypes conformed to a 3:1 segregation.

The N. R. 5 parent is known to carry the y_a allele and the behaviour of the same as a simple recessive to Y_a of the CST. 3 parent is confirmed.

TABLE III
Inheritance of Corolla Colour

S. No.	Nature of cross and generation	No. of plants with corolla				Monogenic segregation	
		Yellow	Pale Yellow	White	Total	X ²	Value of P. between
1.	CST. 3 x BC. 19 Back cross with CST. 3 Back cross with BC. 19 F ₂ Total of 6 families	F ₁ 33 93 102 360	.. .. .. ..	.. .. .. ..	33 93 102 360	.. .. .. ..	.. .. .. ..
2.	CST. 3 x Cernuum Back cross with CST. 3 Back cross with cernuum F ₂ Total of 4 families	F ₁ 32 110 56 304	 42 94	.. .. .. ..	32 110 98 398	 2.000 0.404	 0.10 — 0.20 0.50 — 0.70
3.	CST. 3 x N. R. 5 Back cross with CST. 3 Back cross with N. R. 5 F ₂ Total of 7 families	F ₁ 37 69 16 205	.. .. .. ..	.. .. 10 67	37 69 26 272	 1.384 0.020	 0.20 — 0.30 0.80 — 0.90
No. of plants with corolla							
		Red on yellow	Yellow	Red on white	White	Total	
4.	CST. 3 x Sanguineum major Back cross with CST. 3 Back cross with Sanguineum 119 F ₂ Total of 3 families	F ₁ 20 66 55 191	.. .. .. ..	.. .. .. ..	.. .. .. ..	20 116 55 259	 2.206 0.217
5.	CST. 3 x Sanguineum major Back cross with CST. 3 Back cross with Sanguineum major F ₂ Total of 3 families	8 79 31 176	.. .. .. ..	.. .. 21 56	 12	8 176 52 312	 1.840 1.924 4.536

Cross 4: CST. 3 x Sanguineum 119 (*indicum* x *bengalense*)
Yellow x Red on Yellow.

The corolla colour genotype of the Sanguineum 119 parent is Y_a, but due to the inter-action of the anthocyanin allele R₂^{rs}, the phenotypic expression is 'Red on Yellow'. In the F₁, the corolla colour was 'Red on Yellow' due to dominance of R₂^{rs} over R₂^{os} (CST. 3 parent). In the back cross with CST. 3, segregation was obtained in the ratio of 1:1 for Red on Yellow: Yellow corolla plants. In the other back cross viz., with Sanguineum 119, all the plants possessed 'Red on Yellow' corolla. The segregation in F₂ conformed to 3:1 expectations for 'Red on Yellow': Yellow corolla plants.

Although this cross represents one between two types both carrying Y_a, due to the differences in their anthocyanin genotypes viz., R₂^{rs} and R₂^{os}, phenotypic segregation for corolla colour was obtained and the same was identical with that of anthocyanin segregation. The intensity of anthocyanin expression on the yellow corolla background was also studied in the different R₂^{rs} segregants as per standard grades and these results are presented and discussed in a separate section.

Cross 5: CST. x Sanguineum major (*indicum* x *bengalense*)
Yellow x Red on White.

The Sanguineum major parent carries the recessive y_a allele for corolla colour and the phenotypic expression of this white corolla gene is 'Red on White' in the background of R₂^{rs}, the anthocyanin allele carried by Sanguineum major.

The F₁ was 'Red on Yellow' due to the Y_a allele inherited from the CST. 3 parent. In the backcross with this parent, segregation for the F₁ and parental phenotypes was obtained in the ratio of 1:1. In the backcross with the other parent viz., Sanguineum major, segregation for the F₁ and the parental phenotypes gave a good fit to 1:1 segregation. In the F₂, the phenotypic classes were 'Red on Yellow', Yellow, 'Red on White' and White corolla and the segregation conformed to expectations on a 9:3; 3:1 hypothesis.

Although this cross represents one between two alleles viz., Y_a and y_a, so far as corolla colour is concerned, four phenotypic classes have been obtained in the F₂ due to the interaction of the

R_2^{RS} anthocyanin allele on corolla colour expression. The grades of corolla colour segregation in this cross is dealt with in a subsequent section of this paper.

(iii) *Corolla Colour—Anthocyanin combined assortment*: The crosses involved in the present study include three anthocyanin genotypes in the R_2 series of multiple allelomorphs and three corolla colour genotypes in the Y_a series of alleles.

The data relating to corolla colour—anthocyanin combined assortment in the five crosses studied are presented below.

Cross 1: CST. 3 x Burma C. 19 (indicum x burmanicum)
Yellow corolla/Green stem—Ghost x Yellow corolla/Sun-red, spotted.

Since both the parents carry the Yellow corolla gene Y_a , there was a segregation only in respect of anthocyanin, the results of which have been presented earlier.

Cross 2: CST. 3 x Cernuum (indicum x cernuum)
Yellow corolla/Green stem—Ghost x Pale yellow corolla/Sun-red, spotted.

This represents a cross between $Y_a Y_a R_2^{OS} R_2^{OS}$ and $Y_a^P Y_a^P R_2^{AS} R_2^{AS}$. The F_1 was phenotypically $Y_a R_2^{AS}$ (Yellow corolla/Sun-red, spotted) and the results of segregation in F_2 and back crosses are presented in table 4(a).

Cross 2: CST. 2 x cernuum: Yellow corolla/Green stem, Ghost x Pale yellow corolla/pigmented-red spot.

It would be seen that the results of combined assortment accord well with expectations on the basis of independent dihybrid segregation for corolla colour and anthocyanin.

Cross 3: CST. 3 x N. R. 5. (Indicum x bengalense)
Yellow corolla/Green stem-Ghost x White corolla Sun-red, spotted.

This is a cross between $Y_a Y_a R_2^{OS} R_2^{OS}$ and $Y_a Y_s R_2^{AS} R_2^{AS}$. The F_1 was phenotypically $Y_a R_2^{AS}$ (yellow corolla/Sun-red, spotted) and the combined segregation in back crosses and F_2 summarised in table 4(b) would show that there is independent assortment of the corolla colour and anthocyanin genes.

Cross 3: CST. 3 x N. R. 5 Yellow corolla/Green stem-Ghost x White corolla/pigmented red spot.

TABLE IV (a)
Cross 2: CST. 3 x Cernuum: Yellow corolla/Green stem Ghost x Pale-yellow corolla/Pigmented-Red spot

Generation	No. of plants				Total	χ^2	P. value between
	Yellow Red spot	Pale-Yellow Red spot	Yellow Ghost	Pale-yellow Ghost			
F_1	32	..	..	..	32	..	..
Back cross with CST. 3	58	..	52	..	110	0.328	0.50 — 0.70
Back cross with Cernuum	56	42	..	..	98	2.000	0.10 — 0.20
F_2 Total of 4 families	227	72	77	22	398	0.543	0.90 — 0.95

TABLE IV (b)
Cross 3: CST 3 x N. R. 5: Yellow corolla/Green stem-Ghost x White corolla/Pigmented Red spot

Generation	No. of plants				Total	χ^2	P. value between
	Yellow Red spot	White Red spot	Yellow Ghost	White Ghost			
F_1	37	..	..	..	37	..	..
Back cross with CST. 3	35	..	34	..	69	0.014	0.80 — 0.99
Back cross with N. R. 5	16	10	..	..	26	1.384	0.20 — 0.30
F_2 Total of 7 families	148	51	57	16	272	0.928	0.80 — 0.90

Cross 4: CST. 3 Sanguineum 119 (*indicum* x *bengalense*)
Yellow corolla/Green stem - Ghost x Red on
Yellow/Full red-spotted.

This cross represents $Y_a Y_a R_2^{os} R_2^{os}$ x $Y_a Y_a R_2^{rs} R_2^{rs}$.

The parents differ only in their anthocyanin genotype and the segregation for this character has been presented earlier. In respect of corolla colour, both the parents carry the Yellow corolla gene Y_a , but the phenotypic expression of the same is greatly modified by the anthocyanin background and the grades of corolla colour in segregating populations vary in the heterozygous and homozygous phases of both the genes. These results are discussed in the subsequent section of this paper.

Cross 5: CST. 3 x Sanguineum major (*indicum* x *bengalense*)
Yellow corolla/Green stem-Ghost x Red on White
Full red-spotted.

This is a cross between $Y_a Y_a R_2^{os} R_2^{os}$ and $Y_a Y_a R_2^{rs} R_2^{os}$. The F_1 was phenotypically Red on Yellow/Full red spotted ($Y_a Y_a R_2^{rs} R_2^{os}$) and in the F_2 , independent dihybrid assortment was obtained in the ratio of 9:3:3:1 for the four phenotypes, Red on Yellow/Full red-spotted; Red on White/Full red-spotted; Yellow corolla/Green stem-Ghost and White corolla/Green stem-Ghost. The last-mentioned phenotype was confirmed to be so in further breeding tests, since Ghost spot will not be visible against White corolla background, but merely appear as spotless.

The combined assortment in F_2 and back crosses is summarised in table 4(c).

The corolla colour grading in respect of the Y_a gene in its homozygous and heterozygous phases in the R_2^{rs} background is discussed in the next section.

(iv) *Interaction of genotypes*: The inheritance of anthocyanin and corolla colour in the crosses involving the two Sanguineum parents which carry the highest member of the anthocyanin allelomorph series viz. R_2^{rs} presents interesting data for study of the interaction of genotypes and the same is dealt with in this section. The phenotypic expression of the corolla colour genes $Y_a Y_a$ (Yellow) and $Y_a Y_a$ (White) in their homozygous and heterozygous states is modified by the anthocyanin genotype.

TABLE IV (c)
Cross 5: CST. 3 x Sanguineum Major: Yellow corolla/Green stem-Ghost x Red on White/Deep Red-spotted

Generation	Red on Yellow spot	No. of plants			Total	χ^2	P. value between
		Red on White spot	Yellow Ghost	White Ghost			
F_1	8	..	..	..	8	..	..
Back cross with CST. 3	79	..	97	..	176	1.840	0.10 — 0.20
Back cross with Sanguineum major	31	21	..	..	52	1.924	0.10 — 0.20
F_2 Total of 3 families	176	56	68	12	312	4.536	0.20 — 0.30

All *arboreums* homozygous for both R_2^{RS} and Y_a grade consistently at 10-11 (Silow and Yu 1942) and this is found to be the feature in the case of the Sanguineum 119 parent utilised in the present study. This phenotype may be designated as 'Red on Yellow' corolla.

The CST. 3 x Sanguineum 119 F_1 heterozygous for both R_2^{RS} and Y_a graded at 7-8 and in the F_2 , segregation was obtained in the ratio of 1:2:1 for parental: F_1 grades of 'Red on Yellow'; Yellow corolla respectively.

In the backcross with R_2^{os} , all the $R_2^{RS} R_2^{os}$ segregants graded at 7-8 as expected, while in the backcross with R_2^{RS} , a 1:1 segregation was obtained for parental and F_1 grades of 'Red on Yellow' corolla, which gave a good fit to the genotypic expectations. The relevant data are furnished in table 5.

Cross 4: CST. 3 x Sanguineum 119 (*indicum* x *bengalense*)
 $R_2^{os} R_2^{os} Y_a Y_a$ x $R_2^{RS} R_2^{RS} Y_a Y_a$

The sanguineum 119 parent is homozygous for both R_2^{RS} and Y_a ; the F_1 is heterozygous for R_2^{RS} ; in the back cross with CST. 3 ($R_2^{os} R_2^{os} Y_a Y_a$), the phenotypically R_2^{RS} segregants are all heterozygous for this gene (i. e.) like the F_1 ; in the back cross with Sanguineum 119 ($R_2^{RS} R_2^{RS} Y_a Y_a$), the phenotypically R_2^{RS} segregants are in the homozygous and heterozygous phases in the proportion of 1:1; in the F_2 , the R_2^{RS} segregants occur in the ratio of 2:1 in the heterozygous and homozygous phases respectively.

The data on petal pattern grades furnished in the table above accord well with these expectations.

The Sanguineum major parent carries the R_2^{RS} and Y_a alleles in their homozygous phase and the phenotypic expression of corolla colour in this parent may be designated as 'Red on White'. This parent graded at 1 and the F_1 CST. 3 x Sanguineum major which has a genetic constitution of $R_2^{RS} R_2^{os} Y_a Y_a$ was found to possess grade 7 corolla colour.

The data pertaining to this cross are as follows.

Cross 5: CST. 3 x Sanguineum major (*indicum* x *bengalense*)
 $R_2^{os} R_2^{os} Y_a Y_a$ x $R_2^{RS} R_2^{RS} y_a y_a$

The frequency arrays of petal pattern distribution of the R_2^{RS} components in the different generations, as graded with Hutchinson's petal colour grades are furnished in table 6.

TABLE V
Frequency array of petal pattern distribution

S. No.	Material	Hutchinson's R_2^{RS} grades				Total plants	χ^2	Value of P. between
		7	8	9	10			
1.	Sanguineum 119	..	..	..	13	13	..	..
2.	CST. 3 x Sanguineum 119 F_1	20	..	..	..	20	..	..
3.	Back Cross with CST. 3	116	..	..	..	116	..	..
4.	Back cross with Sanguineum 119	34	..	..	25	59	1.370	0.2 — 0.3
5.	F_2 Total of 3 families	131	..	..	77	208	1.273	0.2 — 0.3

TABLE VI
Frequency arrays of petal pattern distribution

S. No.	Material	Hutchinson's R_2^{RS} grades				Total plants	χ^2	Value of P. between
		7	8	9	10			
1.	CST. 3 x Sanguineum major F_1	8	..	..	..	8	..	..
2.	Back cross with CST. 3	20	47	14	..	81	..	..
3.	Back cross with Sang. major	10	10	1	4	25	..	..
4.	F_2 Total of 3 families	34	57	10	31	133	0.184	0.5 — 0.7

Only the R_2^{rs} segregants are dealt with, since only in this genotypic background, the expression of the Y_a gene is modified.

The F_1 which is heterozygous for both R_2^{rs} and R_2^{os} graded at 7. The genotypes in the backcross with CST. 3 are 1) $R_2^{rs} R_2^{os} Y_a Y_a$ and 2) $R_2^{rs} R_2^{os} Y_a y_a$ and this population has graded 7 to 9 with no indication of any segregation. In the back cross with Sanguineum major, the genotypes are $R_2^{rs} R_2^{rs} Y_a Y_a$ and $R_2^{rs} R_2^{rs} y_a y_a$.

A large enough population in this back cross would possibly yield a 1:1 segregation for grades 7 and 8: grades 9, 10 and 11.

In the F_2 , the genotypes of the phenotype 'Red on Yellow' i. e. R_2^{rs} component are:

	Frequency
(1) homozygous for R_2^{rs} and homozygous for Y_a	1
(2) homozygous for R_2^{rs} and heterozygous for Y_a	2
}	
3	
(3) heterozygous for R_2^{rs} and homozygous for Y_a	2
(4) heterozygous for both R_2^{rs} and Y_a	4
}	
6	

Items 1 and 2 may be expected to grade 9-11, while items 3 and 4 will cover grades 7 and 8.

From the frequency distribution of this phenotype in the F_2 population, a close fit to 1:2 segregation is obtained in respect of the above classes.

The interaction of the R_2^{rs} allele with the corolla colour genotypes may be summed up as follows:

- (1) Homozygous R_2^{rs} with homozygous Y_a grades 10 and above.
- (2) Homozygous R_2^{rs} with heterozygous Y_a grades not below 9.
- (3) Heterozygous R_2^{rs} with homozygous or heterozygous Y_a grades 7 and 8.

(4) The influence of heterozygous Y_a on the expression of R_2^{rs} in corolla colour, is only slight and does not shift the grade below one, to that obtained in the homozygous phase.

Summary: The inheritance of the Cocanadas Green stem Ghost spot type, spotted in Peninsular Indian *G. arboreum* race *indicum*, in five inter-racial crosses with Sun-red spotted and Full red Spotted; yellow corolla, Pale yellow and White corolla genotypes is reported.

In anthocyanin inheritance, the Green stem Ghost which carries the R_2^{os} allele confirmed its behaviour as a simple recessive to the R_2^{as} (Sun-red Spotted) and R_2^{rs} (Full red spotted) alleles of the anthocyanin multiple allelomorph series.

In respect of corolla colour, the Pale Yellow corolla (Y_a^p) of *Cernuum* and White corolla (y_a) of N. R. 5 behaved as simple recessive to Yellow corolla (Y_a) of the Green stem Ghost parent. In the cross with Sanguineum 119 carrying Yellow corolla gene Y_a , phenotypic segregation for corolla colour was however obtained due to differences in their anthocyanin genotypes and the same was identical with that of anthocyanin segregation. In the cross with Sanguineum major carrying the White corolla gene Y_a , four phenotypic classes were obtained in the F_2 , due to the interaction of the R_2^{rs} anthocyanin allele on corolla colour expression and the segregation accorded well with the expectations.

Anthocyanin and corolla colour genes assorted independently in all the crosses studied.

The interaction of the R_2^{rs} anthocyanin genotype on the expression of corolla colour was studied with reference to colour plates of Hutchinson (1932) in the two crosses involving Y_a and y_a alleles and the results have been discussed.

It was shown that while heterozygosity of the R_2^{rs} allele brought down the grade of petal pattern, the influence of heterozygous Y_a on the expression of R_2^{rs} in corolla colour, was only slight and did not shift the grade below one, to that obtained in the homozygous phase.

Acknowledgements: The author's grateful thanks are due to Sri. R. Balasubramanyan, B. A., B. sc. (Ag.) for helpful guidance and valuable suggestions in carrying out the investigations.

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Science for the Farmer — II

Grass for Fertility

by

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During the last few years there has been in this country a spate of talk about scientific farming and carrying science to the farmer. The sum and substance of all this talk that is being made seems to me to be nothing but a lavish use of ammonium sulphate and insecticides. My ten years' study of agriculture has, however, given me a totally different idea of scientific farming. I am attempting to express here the essence of what I have learnt, in the hope that if I am wrong, some expert will put me right.

I have gathered that the type of soil fertility which results in high productivity depends firstly, upon a certain physical condition of the soil. The physical properties of the soil which determine productivity are known collectively as "soil structure" by which is meant the state of aggregation of the soil particles on which depend the principal air and water regimes of the soil. In a structureless soil the separate particles tend to pack into the smallest possible space, producing a minimum of porosity, aeration, permeability, and water-holding capacity, which are qualities indispensable to the healthy growth of cultivated crops. We are told that experience has shown that the degree of granulation of a soil is a rough measure of its state of fertility, and that the higher the state of granulation of any given soil the more productive it will be, as measured by crop yields.

Considerable research has been made on this so-called "granular structure", (commonly also spoken of as "crumb" structure) in which the granules or crumbs are formed when separate particles of sand, silt, clay etc. are cemented together by means of the organic and inorganic colloids in the soil. Innumerable experiments have been made to study the effect on crop yields of varying degrees of granulation in the same soil with other factors like manuring kept constant. I quote only one instance. Striking results were observed in an investigation of the relation of onion yields to degree of soil granulation. The yields of onions increased from 157 bushels per acre to 487 bushels, more than threefold, as soil in granules larger than 0.5 m.m. increased from about 21 to 37 percent. This high yield was obtained in a rotation in which the onion crop followed two years of grass. In an earlier experiment

on similar soil the onion yield increased from 72 bushels to 524 bushel with an increase in granulation from 21 to 37.9 per cent. Another effect of improved soil structure of immense importance to us is that a granular soil offers considerable resistance to erosion even when bare of vegetation.

Humid climates exert a disintegrating effect on soil structure and granulation is less highly developed than in more arid climates and destruction of soil structure is very rapid under heavy rainfall. Both these factors, inimical to the formation and maintenance of soil structure are present on our West Coast. Add to this the fact that red laterite soil is the least fertile type of soil even to begin with and we can appreciate the importance to the West Coast farmer of systems which will develop and maintain a high degree of granulation.

What I read about soil structure so impressed me that I felt forced to take stock of my own farming. Logical thinking is indispensable to scientific method. I found myself facing two facts:—

1. The extremely low fertility of my sandy soil which was in most parts of the farm below even what may be called the threshold level, below which even weeds do not grow.

2. It is notoriously difficult to bring pure sand without even a trace of silt or clay into a state of aggregation of the sand grains. If, I said to myself, I am to make my farming venture pay, I must first restore "structure" to my structureless soil. What is the most efficient and most economical method of bringing about aggregation into granules? The advice most commonly thrust on one is to add silt or clay. This is from my experience, the most expensive and at the same time the most inefficient method. It means merely heavy capital expenditure which will not yield an adequate return even in the first year of application; and in this deep sand no trace of the silt or clay will be visible after a couple of years of cultivation. In any case even this ephemeral effect of added silt will be only on the top three or four inch layer of sand. The temporary beneficial effect on crop yields produced by heavy additions of silt or clay to sands is due more to the manurial content of the additions than to physical qualities; for silts and clays can be devoid of structure, and structureless silts and clays are worse than sands from the point of view of plant growth, which depends on root penetration and spread.

We must first learn how these aggregates, granules, or crumbs are formed out of discrete particles of soil, for every type of soil—silts, clays or loam—will be structureless unless the necessary causal factors are present in the soil.

The two causal factors are—(1) root action
—(2) the cementing substances
which are formed when organic matter is reduced to humus by the action of soil bacteria and fungi.

Though both are necessary for aggregate formation, root-systems play an active part and are therefore the more important; for investigations have shown that farmyard manure, composts or green manure, fail to have the desired effect on soil structure. The root systems of plants by themselves will have the desired effect upon the soil because they are also the source of much humus to cement the soil particles into aggregates. Organic manures accelerate the processes by serving as a source of ample food for bacteria and consequent rapid conversion to humus. The addition of farmyard manure and ripe compost will also provide ample supplies of microbes to soils like sands with low microbial populations. If that is all there is to restoring soil structure, are we not growing crops which have root systems and manuring them, even if inadequately, with organic manures? Why then should any special measures be necessary to form soil aggregates? Unfortunately, it seems that (to make the farmers task more difficult) Nature has decreed that granulation can be effected only by a special type of root system which is denied to our normal cultivated crops. One can understand the uselessness of the paddy crop as a builder of soil structure, for in many respects it is an abnormal crop revelling in puddled, swampy conditions which destroy all structure, but even the dryland, cereal crops like sorghum apparently have not the type of roots which can form aggregates. Moreover, to get good yields from our crops we have to do so many cultivations, hoeings, weedings, and irrigations; all operations which tend to destroy structure, that after a few successive cultivated crops, there is very little left of the aggregates that might have existed at the start.

The most efficient natural producer of granular soil structure is grass and this is one more reason why livestock are said to be inseparable from good farming. Soil granulation in all climates, we are assured, becomes greater under perennial grasses than under any other kind of vegetation. Several explanations of the action of a

grass crop in granulating the soil have been given, but, for us farmers, the essential fact is that under all circumstances it does have this granulating effect which, from the point of view of maintaining on increasing soil fertility, is one important reason for introducing perennial grasses in the crop rotation. Some other observations derived from scientific research which are of practical importance to farmers are:—

(1) Even grasses vary considerably in their granulating ability because of differences in their root-system and habits of growth. For instance, among tropical grasses, which alone are of any use to us in this part of our country, the most outstanding in granulating ability is said to be elephant grass, whereas a stoloniferous grass with stolons buried deep in the soil like *Panicum repens* is practically useless. *Panicum repens*, in spite of its palatability, drought resistance, and its ability to survive and grow in the most unpromising soil, is an obnoxious pest on arable land.

(2) The most active part of a grass crop in aggregate formation is the root system which is not only the source of much of the humus, which cements the soil particles in aggregates but also has a purely mechanical action which assists the formation of aggregates of the right size while preventing the soil from coalescing into clods.

(3) In the tropics, Uganda was the first colonial territory to adopt the grass—resting period for the restoration of soil structure as the corner-stone of its agricultural policy. The Uganda investigations have shown (a) farmyard manures and composts fail to have the desired effect on soil structure. (b) the root systems of legumes are not so valuable in crumb formation as are those of grasses.

(4) Legumes add fertility by the nitrogen-fixing activities of nodule bacteria but their root systems produce only a cloddy structure throughout the root-inhabiting layer which, though it assists aeration and permeability, particularly in the deeper layers, has not the effect on the following cereal crops in the rotation, which the well-developed medium to fine structure in the top 18 inches to 2 feet of soil produced by grasses has on increasing yields of crops which follow grass in the rotation.

(5) The optimal air-water regimes throughout the entire soil to a depth of several feet is therefore effected by a mixture of legumes and grass. Numerous investigations have indicated the superiority, from the structure point of view, of a mixture of grasses and legumes over either component separately.

For this as well as other reasons, in all those countries which grow grass as a crop for fertility restoration and livestock maintenance “grass” has come to mean the sward produced by sowing a seeds mixture of grasses, legumes, and possibly other plants.

In Europe, grass is an essential crop invariably grown in the rotation though farmyard manure is so plentiful that the minimum basic dose used is 10 to 15 tons an acre. Though we have in this country hundreds of millions of cattle, farmyard manure is conspicuous by its absence on the average farm and yet nobody ever thinks of growing grass for restoring fertility or even just for feeding our animals.

Only one who keeps all these facts in mind will realise the full import of what one expert said:—

“Grass is the most important natural product that the country can possess. Grass restores natural fertility to the soil more quickly and more effectively than any other form of vegetation. Grass maintains the fertility of the soil longer than any other crop. Grass creates structure in soil more effectively than any other plant growth, and thereby renders it less liable to erosion than is the case under any other form of plant cover. The neglect of grass cover spells declining soil fertility and a crumbling agriculture; then poverty, ill-health, disease, hunger, starvation and national disaster follow”.

We have always neglected grass and ruined our communal grazing grounds. Soil fertility has already declined and erosion has begun to be a serious problem. Our agriculture has been crumbling and we have poverty, ill-health, disease, hunger and starvation. Remains only national disaster to follow. Our community projects and our expanding extension services can save us from the inevitable national disaster only if they show a proper appreciation of the value of grass and the animal factor in the restoration of lost fertility and prevention of erosion.

The need is for a re-orientation of food and fodder production policies and the re-arrangement of ideas about farming generally.

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Sesbania aegyptiaca, Poir — A Perennial Greenleaf Manure Plant

Sesbania aegyptiaca Poir, is a native of tropical Africa, Asia and North Australia. It is cultivated throughout the tropics and found wild in tropical Africa. It is found throughout India from the Himalayas at an altitude of 4000 feet in the North-West to Ceylon and Siam. In Madras it is found both wild and cultivated in almost all the plain districts. Brandis (1907) mentions that on the banks of the Kistna and Warma rivers in the Deccan, which are submerged during the annual floods, it is grown from seed as an annual, attaining 15 to 20 feet in height.

Description: It is an unarmed, soft-wooded perennial shrub of short duration growing to a height of 6 to 10 feet, with terete, twiggy branches. Leaves 3 to 6 inches long with 10 to 20 pairs of glabrous, linear-oblong, pale-green leaflets. Flowers borne in lax, axillary racemes; calyx glabrous, membranous, with short teeth; corolla pale yellow, the standard usually purple or purple-spotted. Pod 6 to 9 inches long, slender, torulose with slightly thickened sutures.

Varieties: (Cooke 1909) in the Flora of Bombay Presidency describes two varieties. i. e.

Var *picta*, Prain — Standard mottled with purple on the outside and

Var *bicolor*, W & A — Standard maroon-coloured or dark purple (not mottled outside and the keel tipped with red.

According to Prain the typical *S. aegyptiaca* has uniformly yellow flowers and is a native of India. Both the above-named varieties are reported to be cultivated and more or less naturalised in Bombay.

Popular and local names: Its common English name is 'Common Sesban'. In Tamil it is known as *Chembai* or *Chitagathi*; in Malayalam as *Chemba* or *Kitaannu* or *Nellittali*.

Uses: It is used as a hedge plant and windbreak; also used as a shade tree and standard in betelvine gardens. The wood makes good charcoal for gunpowder.

Sampson (1936) and Watts (1893) mention that it is made into children's toys in Burma. In Assam the soft pithy stems of young plants are plaited into mats. It is said to be in common use in Bengal as a hedge plant. The bark yields a fibre which is made into ropes while the leaves and young branches are lopped off for fodder. A number of medicinal uses have been attributed to the leaves, bark and roots of this leguminous plant (Kirthikar and Basu: 1933)

Green Manure: It is not generally sown as a pure green manure crop in the fields, for ploughing *in situ*. The loppings can be used as

green manure, the plants being raised along the banks of rivers or tanks or even on field bunds and other suitable places. The plant stands lopping well and produces regrowths very quickly. The yield of green leaf is also very appreciable. As an observational trial, the seedlings of *Sesbania aegyptiaca* and *S. speciosa* of the same age, were planted side by side in the Botanical Garden, Coimbatore by the side of an irrigation channel on 4th February 1954. *Sesbania speciosa* plants dried up after 10 months and its regeneration capacity is also seen to be poor, compared to the other species. Regular loppings were taken from both the species and the data are given below.

Seedlings planted on 4th February 1954.

10 February 1954.

Date and No. of lopping	<i>S. aegyptiaca</i>					<i>S. speciosa</i>				
	No. of plants	Green leaf obtained		Average per plant		No. of plants	Leaf obtained		Average per plant	
		lb.	oz.	lb.	oz.		lb.	oz.	lb.	oz.
I 8-7-1954	7	2	12	0	6.3	5	6	4	1	4
II 30-8-1954	7	3	6½	0	7.8	8	14	4	1	12
III 6-11-1954	7	13	6	1	15	7	9	0	1	4
IV 24-1-1955	7	13	12	1	15½	Dried up on 20-12-1954				
Continued to grow luxuriantly.										

Well-grown plants yield fairly good quantities of green leaves. Thus *Sesbania aegyptiaca* is a perennial, green-leaf-yielding plant with capacity to regenerate quickly after being pruned. These can be planted in field bunds and other suitable places so that they may serve as a perennial source of green leaf for manurial purposes.

25-11-1955,
Agrl. College & Res. Institute,
Coimbatore.

D. MEENAKSHISUNDARAM,
D. DANIEL SUNDARARAJ.

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Abstracts

Potash Fertilizers: Potassium fertilizers are generally known as "Potash fertilizers" because in the fertilizer world they become associated with the potassium oxide compound called potash (K_2O) which is the conventional unit used in the Fertilizer and Feeding stuff Act for stating the amount of potassium in fertilizers. There are four principal potash fertilizers on the British Market. They are muriate of potash ($K_2O-60\%$ K_2O). Muriate of potash (50% K_2O) potash salt (40% K_2O) and sulphate of potash (48% K_2O). The lower grade salt, kainit is still used, but only to a small extent.

The present trend in the use of potash fertilizer in recent years has been the increasing preference for the concentrated type of salt—muriate of potash (60% K_2O). This helps to effect a saving in freight and handling charges. Another reason for this trend is that the highest grade is necessary for the manufacture of modern and more concentrated types of compound fertilizers which may contain up to 15% or even 20% potash (K_2O).

Question of Purity: The so-called impurities in the less concentrated forms contain something of value. The main impurities in potash salt (K_2O 40%) are rock or common salt (Sodium chloride) and magnesium salts. The rock salt has a recognised value for sugar beet, fodder beet, and mangolds, while magnesium salts are useful for horticultural crops like apples, gooseberries glass-house tomatoes etc. But these high-grade salts can however be used if the other salts present as impurities can be applied as special dressings without much upsetting the economy. So far as magnesium is concerned there is another potash fertilizer called sulphate of potash-magnesia or "Patent-Kali". It contains approximately 26-30% K_2O in the form of sulphate of potash and 25-35% sulphate of magnesium. The unit of potash in this fertilizer is dearer than in the normal potash fertilizers. It has also been argued that by the use of concentrated types of potash fertilizer certain trace or minor elements may be lost to the soil. Analyses have shown however, that such trace elements as boron, manganese, copper, zinc and molybdenum, even in the lower grade of potash fertilizers are present only in negligible amounts from less than 1 part per million to no more than 5 p.p.m. These quantities are valueless in view of the relatively small dressings used per acre of the potash fertilizers.

Muriate or Sulphate: So far as agricultural crops are concerned, no practical discrimination can be made between these fertilizers. In the case of potatoes, sulphate yields more starch and less water than muriate. The level of starch may be 1½ to 2% higher from sulphate. The difference is important where potatoes are grown for farina or alcohol but not in the case of edible purposes where no monetary credit is given for higher nutritive value. Where high dressings of potash are used, as in market gardening, the potash might be safely given as sulphate or as a mixture of sulphate and muriate. Similar preference should be given to sulphate of potash for tomato crops when grown intensively under glass.

Leaching: The potash in the conventional potash fertilizers is soluble in water, but when applied to the soil it is immediately absorbed into the colloidal particles of the soil when it is no longer water-soluble. However it is liberated slowly by the process of base exchange to become available to the crops.

Colour: The colour of the potash fertilizer should not be taken as an index to their potassium content. Minute quantities of iron oxide, clay or organic matter tend to give a yellowish or brownish colour to the finished product.

Even in the high grade muriate of potash, the one manufactured by ordinary solubility method has a more or less white appearance, while the same salt made by another process (flotation process) has a reddish colour.

(Abstract from "Potash fertilizers"
by Cowie, G. A. Agriculture, Vol. LXII, 236, 1955)
(A. M. K. and S. V.)

Gleanings

Green Manuring with Maize Better Tobacco Crop: Cigarette Tobacco can be green-manured with maize. This practice adds humus to the soil, without adding too much nitrogen. Maize should be sown in the beginning of the monsoon, using 16 to 20 pounds of seed per acre. The green crop should be applied whole or cut up and placed in furrows between the second week of August and the first week of September. Maize will decompose and get thoroughly mixed up with the soil by the end of October or beginning of November, when tobacco is transplanted. In trials, cigarette tobacco crop green-manured with maize produced fifty per cent as bright grades when the unmanured plots produced very dark green leaf, giving only 10 per cent as yellow leaf. [I. C. A. R.]

Seed Coconuts Best Stored in Sand: Seed coconuts are best stored in fine sand instead of being kept exposed to the atmosphere. Arrange the seed nuts with the stalk-ends up on the floor of a shed over a layer of about three inches of sand. Cover the nuts with sand and keep them in this position till required for planting. When a large number of seed nuts have to be stored, add more layers of sand and seed nuts over the first layer. When nuts are being taken out for planting, reject those which do not contain water or those that rattle on shaking. [I. C. A. R.]

A New Bhindi Variety—Good Quality Fruits: A variety of *Bhindi* (Lady's finger) that gives an acre yield of 200 to 250 maunds of fruits has been evolved at the Indian Agricultural Research Institute, New Delhi. The variety is called *Pusa Mukhmali*. The fruits are six to eight inches long, straight, smooth and of an attractive green colour. The variety can be grown both as a summer crop as well as a rainy season crop. When sown for the summer crop, it fruits in about 50 days, while as a monsoon crop it takes ten more days to be available for harvest. In parts of Northern India which have a fairly cool winter, *Pusa Mukhmali* can be sown towards the end of February. The sowings can be continued till the middle of July. For the main summer crop, sowing should be completed by March. For the rainy season crop, it is better to sow it well in advance of the break of monsoon, and complete sowing by about the middle of June or even earlier. In the warmer southern and western parts of the country, the main sowings should be done, similarly excepting that sowings can begin earlier in January. [I. C. A. R.]

Weather Review — For December, 1955

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January	Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenam-bakkam)	5.1	— 0.4	52.0	South	Madurai	8.7	+ 6.7	45.3
	Tirur-kuppam*	5.2	— 0.3	50.5		Pamban	17.7	+ 9.8	45.6
	Vellore	4.1	+ 1.5	37.1		Koilkatti*	6.5	+ 4.8	27.0
	Gudiyatham*	2.6	— 0.1	35.5		Palayam-cottai	2.1	— 2.1	28.8
						Amba-samudram*	3.2	— 2.0	35.5
East Coast	Palur*	9.3	+ 2.5	54.5	West Coast	Trivandrum	4.5	+ 2.0	82.4
	Tindivanam*	4.7	+ 0.8	41.7		Fort Cochin	0.4	— 1.2	147.7
	Cuddalore	10.0	+ 2.5	52.7		Pattambi*	0.4	— 0.9	100.1
	Nagapattinam	9.4	— 1.6	54.2		Kozhikode	Nil	— 1.5	153.9
	Aduthurai*	11.3	+ 7.0	50.6		Taliparamba*	Nil	— 1.4	137.5
Central	Pattukottai*	15.9	+ 11.7	48.9		Wynaad*	0.4	— 0.5	77.6
	Salem	1.7	+ 0.7	37.4		Nileshwar*	Nil	— 1.0	177.5
	Coimbatore (A. M. O.)*	1.0	— 0.2	18.1		Pilicode*	Nil	— 1.0	151.4
	Coimbatore	1.2	+ 0.1	19.6		Mangalore	Nil	— 0.7	150.3
	Tiruchirappalli	8.5	+ 5.9	47.0		Kankanady*	Nil	— 0.5	151.3
					Hills	Kodaikanal	10.4	+ 5.2	83.9
						Coonoor*	6.8	+ 0.3	53.0
						Ootacamund*	2.7	+ 0.4	67.9
						Nanjanad*	1.2	— 0.5	60.4

Note:— * Meteorological Stations of the Madras Agric. Dept.

A deep depression in the South-West Bay intensified into a cyclonic storm by the evening of 30—11—1955. Moving in a westerly direction it crossed the coast on 1—12—'55 (morning) to the south of Nagapattinam and weakened into a depression about 50 miles of Tiruchirappalli. Under its influence widespread and locally heavy rain occurred in Tamilnad. It became weak the next day and moved as a low pressure wave into the South-East Arabian Sea across Travancore-Cochin on 2—12—'55. The weather was markedly unsettled in the South-East Arabian Sea, off the Malabar Coast. The effect of this depression resulted in fairly widespread rain in Tamilnad and Travancore-Cochin in the first four days of the month. In the subsequent five days localised showers were received in Tamilnad. Then on 10—12—1955 the weather became dry with a fall in night temperature and this sort of weather continued upto 19—12—1955 with no large change. On 20—12—1955 a feeble incursion of moisture took place over Tamilnad and it continued on the next day also. Anyway this incursion of moisture did not alter the weather, which remained practically dry throughout the remaining portion of the month. Only slight fluctuations in the night temperature were observed.

In the latter half of the month a number of Western disturbances were noticed with no appreciable change in weather conditions.

The districts of Madurai, Tiruchirappalli, Tanjore and Ramanathapuram were affected by the cyclone, which gained velocity after sunset on 30—11—1955. The worst affected areas were in Tanjore and Ramanapuram districts. To add to the cyclone ravages a tidal wave upto a height of 6 feet inundated Point Calimere, Agasthiampalli, Vedaranyam, Thopputhurai and other places. Considerable damage was done to men and cattle, besides the widespread loss to crops, cultivated as well as perennial.

In the first four days of the month heavy rains were received in the following places as indicated hereunder:

Nagapattinam 8.5"
Tiruchirappalli 6.0"
Cuddalore 8.5"
Tuticorin 11.5"
Madurai 8.0"

The noteworthy rainfalls and the zonal rainfall in inches are furnished below:—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rainfall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remark
1/12/55	Nagapattinam	5.4	North	4.3	+ 0.2	Just above normal
"	Tiruchirapalli	3.3	East Coast	10.1	+ 3.8	Above normal
2/12/55	Madurai	6.5	Central	3.1	+ 1.6	do.
"	Kodaikanal	2.0	South	7.6	+ 3.4	do.
"	Cuddalore	3.7	West Coast	0.6	— 0.7	Far below normal
"	Kallakurichi	2.8	Hills	5.3	+ 1.8	Above normal
3/12/55	Tuticorin	7.4				

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 7-1-1955.

C. B. M. & M. V. J.

Departmental Notifications

Gezatted Service — Postings and Transfers

Name and present post	Posted as
Anantaraman, S. E., Assistant Agricultural Engineer, River Pumping Scheme, Madras,	Assistant Agricultural Engineer, Office of the D. A., Madras
Kanakaraj David, S., P. P. O., Entomology, Coimbatore,	Lecturer in Entomology, Coimbatore
Kannian, K., Additional Superintendent, Central Farm, Coimbatore,	Assistant Cotton Specialist, Koilpatti
Muthuswami Iyer, S., Special D. A. O., Kozhikode,	Additional D. A. O., Tanjore
Leo Swamikkan, Assistant Agricultural Engineer, Ooty,	Assistant Agricultural Engineer, Coimbatore
Mohamad Ali, Assistant Agricultural Engineer, Madras,	Assistant Agricultural Engineer, Ootacamund
Nagaraja Rao, K. R., Assistant in Entomology, Coimbatore,	P. P. O., Entomology, Coimbatore

Name and present post	Posted as
Raman Menon, K., D. A. O., on leave,	Special D. A. O., Crop Sampling, Kozhikode
Subramaniam, A., Assistant in Millets, Coimbatore,	Assistant Millets Specialist, Coimbatore
Sriraman, K., Assistant Marketing Officer, Coimbatore,	Additional D. A. O., Trichy
Subramaniam, C. R., Assistant Agricultural Engineer, on leave,	Assistant Agricultural Engineer, River Pumping Scheme, Madras
Varisai Muhamad, S., Assistant in Oil Seeds, Coimbatore,	Additional Superintendent, C. F., Coimbatore
Subramania Sarma, A. H., Lecturer in Agricultural, Coimbatore,	Special Assistant Marketing Officer, Livestock, Hosur
Sriraman, K., Additional D. A. O., Trichy,	Special Assistant Marketing Officer, Livestock, Trichy

Upper Subordinates

Name and present post	Posted as
Annaswami, N., P. A. P., Pattukottai,	P. P. A., Salem
Balachandran, M., Cotton Assistant, Aduthurai	Cotton Assistant, Coimbatore
Balagopalan, A., A. D., Manjeri,	A. D., Kannamangalam
Chami, A., A. D., Pollachi,	A. D., Hanur, Coimbatore Dt.
Govinda Kurup, K., Additional D. A. O., Trichy,	A. D., Manjeri
Muthuswami, P. N., Agricultural Instructor, Coimbatore,	A. D., Pollachi
Narayanan, C. K., A. D., Peravurni,	Pepper Development Assistant, Taliparamba
Padmanabha Nambiar, K. P., Fruit Assistant, Taliparamba,	Pilot Pepper Survey Scheme, Taliparamba
Ramanathan, R., T. M., C. F., Coimbatore,	Horticultural Assistant, Coimbatore
Radhakrishnan, M., A. D., Keeranur,	Pepper Development Assistant, Rajapuram
Ranganadha Prabhu, K., Pepper Development Assistant, Rajapuram,	A. D., Vegetables, Madras
Shivarama Pai, P. C., Assistant, I/C., A. R. S., Nilsswar,	Coconut Nursery Assistant, Nileshtar
Subramaniam, P. T., Pepper Development Assistant, Taliparamba,	Fruit Assistant, Taliparamba
Swaminathan, R., Millets Assistant, Coimbatore,	Millets Assistant, Koilpatty

Name and present post	Posted as
Sethuraman, M. S., P. P. A., Salem,	P. A. to D. A. O., Salem
Swamiappan, S., A. D., Kundadam,	A. D., Udumalpet
Srinivasalu, N., O. S., Assistant, Tindivanam,	O. S., Assistant, Coimbatore
Thomas, N. K., on leave,	P. A. to D. A. O., Tellichery
Varadarajan, K.,	Chemistry Assistant, Palur
Venkataramana Rao, V. G., A. D., Vegetables, Madras,	Marketing Assistant, Madras
Viswanathan, P. S., Cotton Assistant, Trichengode,	Chemistry Assistant, Coimbatore
Varadachari, T. E., A. D., Gingee,	Technical Assistant, under Regional (Food) Government of India
Ummerkutty, O. V., Coconut Nursery Assistant, Nileshtar,	Assistant, in-charge A. R. S., Nileshtar
Kulandaivelu Naicker, R., A. D., Kanchipuram,	A. D., Gingee
Ramachandra Rao, C., Kakinada,	Paddy Assistant, Palur
Venkatachayanulu, Innipeta,	Cotton Assistant, Koilpatty
Ramakottiah, P., Vijayawada,	Cotton Assistant, Trichengode
Mohaboob Sharif, Kandapalle,	Cotton Assistant, Palur
Prasad, D. V. V., Butlaipet,	Entomology Assistant, Coimbatore
Pai, R. A., Cochin,	Millet Assistant, Coimbatore
George David, Trivandrum,	Allotted to Malabar Dt.
Venkataswamy, B., A. D., Cuddalore,	P. A., to D. A. O., Vellore
Ananthachari, P. S., P. A., to D. A., Vellore,	P. P. A., (Myco.) Guindy
Bharathan, P., P. P. A., (Myco.) Guindy,	P. P. A., Cuddalore
Pinakapany, N., P. P. A., Cuddalore,	A. D., Cuddalore



Review of Market Conditions of Commercial Crops in the Areas of Market Committees for December, 1955.

I. Cotton: (In this section: Candy = 784 lb; Pothi = 280 lb.)

1. Cotton Stocks: 1-1: Tirupur: 1-1-1: Lint: At Tirupur the cotton market opened with a stock of 4,416 candies of Cambodia and 2771 edys. of Karunganni. During the month about 3,805 edys. of Cambodia and 1,461 edys. of Karunganni were estimated to be the arrivals. Despatches to other States and districts were to the tune of 4,927 edys. of Cambodia and 2,878 edys. of Karunganni. The chief movements were to Bombay, Orissa, Travancore-Cochin and to other districts in the State like Tirunelveli, Madurai, Salem, North Arcot and Madras. The closing balance during the month was 3,294 edys. of Cambodia and 1,354 edys. of Karunganni.

1-1-2: Kapas: The kapas market at Tirupur opened with a balance of 7,770 pothis of Cambodia and 1,003 pothis of Karunganni. Arrivals during the month amounted to 5,991, pothis of Cambodia and 178 pothis of Karunganni as against the arrivals of 11,965 pothis of Cambodia and 202 pothis of Karunganni during the previous month. Disposals in the month amounted to 8,642 pothis of Cambodia and 789 pothis of Karunganni. The market closed with a stock of 5,119 pothis of Cambodia and 392 pothis of Karunganni at the end of the month.

1-2: Koilpatti: 1-2-1: Lint: During the month the market opened with a stock of 38.3 edys. of Karunganni and 450 edys. of Uganda. Arrivals during the month amounted to 600 edys.

2-2-4: *South Arcot District*: The average price of cotton kapas marketed in this district ranged from Rs. 80-6-0 to 83-4-0 per pothi.

2-3: *Cotton seeds*: 2-3-1: *Koilpatti*: The price of Karunganni and Uganda seeds continued to be firm, mainly due to low stocks. Karunganni seeds opened at Rs. 37-39 per pothi of 280 lb. and remained more or less at this level throughout the month. Uganda seeds ruled firm at Rs. 35-37 per pothi.

2-3-2: *Ramanathapuram District*: The opening and closing prices of cotton seeds in all the markets of this district are extracted below:

Variety	(Prices per pothi)	
	Opening	Closing
Karunganni	Rs. 33-34	Rs. 34-34.8
Uganda	Rs. 30-33	Rs. 22-27
Cambodia	Rs. 27-28	Rs. 15-20

II. *Groundnut*: (In this section: candy = 531 lb. of kernels bag = 80 lb. of pods)

2-1: *Stocks*: 2-1-1: *South Arcot District*: All the markets of South Arcot district opened with a stock of 7,675 tons at the commencement of the month. Arrivals during the month amounted to 12,398 tons as against 3,777 tons during the previous month. Receipts from other States and districts accounted for 930 and 5,300 tons respectively. Consumption both by oil mills and country *chekkus* amounted to 7,378 tons and 172 tons respectively. Despatches to other districts and States amounted to 3,805 tons and 176 tons respectively. After deducting a quantity of 789 tons the month closed with a stock of 13,983 tons with the trade.

2-2: *Prices*: 2-2-1: *South Arcot District*: The average price of groundnut kernels marketed in the several markets of this district ranged from Rs. 95-6-0 to 102-8-0 per candy of 531 lb.

2-2-2: *Ramanathapuram District*: The opening and closing prices of groundnut pods and kernels that prevailed in the different markets of this district are extracted below:

Market Committees Chronicle

(Pods: Price per bag of 82 lb.)
(Kernels: Price per candy of 531 lb.)

		Opening	Closing
Pods	...	Rs. 8-10.8	Rs. 9/8-11/8
Kernels	...	Rs. 90-106	Rs. 100-118

III. *Gingelly*: (In this section candy = 168 lb.)

3. *South Arcot District*: 3-1: *Stocks*: All the markets of South Arcot district put together opened with a stock of 650 bags at the beginning of the month. Total arrivals in the month accounted for 1,259 bags out of which 1,066 bags alone were received by Virudhachalam market besides 193 bags from outside the district. Consumption by *chekkus* amounted to 783 bags. Despatches made to other districts during the month accounted for 245 bags. The month closed with a stock of 881 bags.

3-2: *Prices*: The average price of gingelly ranged from Rs. 41-48 1/2 per bag in this district.

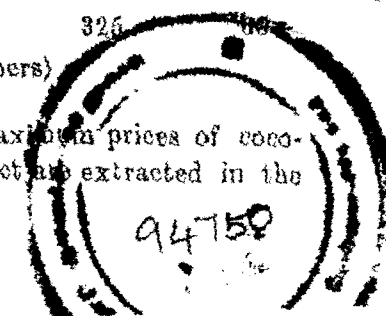
IV. *Coconut and its products*: (In this section: candy = 700 lb.)

4-1: *Coconut*: 4-1-1: *Stocks*: The particulars of stocks transacted in the districts of Malabar and South Kanara are extracted below:

Name of the Market	Opening balance	Arrivals	Disposals	Closing balance
<i>Malabar District</i> :				
1. Kozhikode	6,100	3,500	3,325	6,275
2. Badagara	515	1,626	1,837	304
3. Ponnani	550	775	553	775
4. Tellicherry and Dharmadam	673	1,152	1,112	713
<i>South Kanara District</i> :				
5. Mangalore	110	275	325	40

(Figures in thousand numbers)

4-1-2: *Prices*: (a) Minimum and maximum prices of coconuts in the different markets of Malabar district are extracted in the



		Maximum	Minimum
1. Kozhikode	...	Rs. 125	Rs. 70
2. Ponnani	...	Rs. 127	Rs. 120
3. Badagara	...	Rs. 145	Rs. 80
4. Tellicherry and Dharmadam	...	Rs. 115	Rs. 100

(Prices per thousand)

(b) The opening and closing prices of coconuts that prevailed in Mangalore market during the month are as follow :

		Opening	Closing
Raw	...	Rs. 150—170	Rs. 160—165
Dry	...	Rs. 165—215	Rs. 160—210

4-2: Copra: 4-2-1: The stock position of copra in Malabar and Mangalore markets is extracted below :

Name of the Market	Opening balance	Receipts	Disposals	Closing balance
<i>Malabar District (in candies):</i>				
1. Kozhikode	...	1,233	5,100	3,525
2. Badagara	...	736	1,910	2,014
<i>South Kanara District (in tons):</i>				
3. Mangalore	...	38	180	191

4-2-2: Prices: (a) The prices of copra in the different markets during the month are extracted below :

Variety	Price per candy in Rs.			
	Kozhikode		Badagara	
	Maximum	Minimum	Maximum	Minimum
Office	...	282	277	285
Edible	...	325	305	325
Madras	...	330	315	325
Rajpur	...	455	330	350
Gola	...	325	307	—

(b) The prices of copra in Mangalore market ranged at Rs. 270—305 per candy.

V. Arecanut: (In this section: Bag = 100 lb.)

5-1: Stocks: The stock particulars of arecanuts in the markets of Malabar and South Kanara district are extracted below :

Name of the Market	Opening balance	Receipts	Disposals	Closing balance
(in bags)				
Kozhikode	...	2,384	290	1,432
Ponnani	...	1,800	548	648
Palghat	...	340	120	130
Mangalore (cwts.)	...	3,180	22,300	21,300

5-2: Prices: (a) Prices of arecanut (*choor*) in Palghat market of Malabar district ranged at Rs. 156/- to 165 per bag.

(b) The price ranges of *supari* in Mangalore market as between the different varieties are extracted below :

Variety	Minimum	Maximum
Koka	...	90
Choll	...	175
Malabar supari	...	120
Mangalore supari	...	120

(Prices in Rs. per cwt.)

VI. Tobacco: (In this section: candy = 500 lb.)

6-1: Stocks: The tobacco market at Tirupur started with an opening balance of 7,625 edys. of chewing and 1,890 edys. of cheroot at the commencement of the month. Despatches during the month amounted to 2,437 edys. of chewing and 1,446 edys. of cheroot tobacco. The places despatches were mostly Travancore-Cochin State, Palghat, Ramnad, Pudukottai, Malabar, Tanjore, Tiruchirapalli, Chingleput, North Arcot, South Arcot, Pondicherry and Tirunelveli. The month closed with a stock of 6,282 edys. of chewing and 2,437 edys. of cheroot.

6-2: Prices: (a) Although there was a slight decline in the prices of superior chewing and cheroot tobacco varieties there was an upward trend in the case of all other sorts.

(b) The prices of different varieties of tobacco for different grades in Tirupur market are extracted in the following :

5-2: The enlistment of competitors for winter groundnut crop quality competition up to the end of December 1954, is as below:

Cuddalore O. T.	... 21
Panruti	... 20
Villupuram	... 8
Tirukoilur	... 6
Tindivanam	... 1
	— 56 —

Crop and Trade Reports

Sugarcane — Intermediate Condition Report — Period up to the end of November, 1955: The condition of the standing crop of sugarcane is reported to be generally fair in all the districts of the State. The yield per acre is expected to be below normal in the district of North Arcot. In Tiruchirapalli district the yield per acre is reported to be below normal due to damage caused by the cyclone in November, 1955. The yield per acre is expected to be normal in all the other districts of the State. The average wholesale price of jaggery per standard maund of 82 2/7 lb. or 8,200 tolas as reported from important market centres on 2-12-1955 was Rs. 13-15-0 in Mangalore, Rs. 10-0-0 in Erode, Rs. 9-6-0 in Tiruchirapalli, Rs. 8-4-0 in Cuddalore, Rs. 7-8-0 in Vellore, and Rs. 6-4-0 in Salem. Compared with the prices which prevailed in the corresponding period of last year, these prices reveal a decrease of 44.3 per cent in Cuddalore, 34.3 per cent in Vellore, 29.6 per cent in Salem, 27.5 per cent in Tiruchirapalli, 9.7 per cent in Mangalore and 4.8 per cent in Erode.



The Madras Agricultural Students' Union.

PATRONS.

1. Dewan Bahadur C. Arunachala Mudaliar, Zamindar of Chunampet, Chingleput District
2. Raja Sri Krishnachandra Gajapathi Narayana Dev, Maharaja of Parlakimidi, Ganjam District
3. Sri V. C. Palaniswami Gounder, M. L. A., Vellaikinar, Coimbatore
4. Sri C. P. Ramaswami Ayyar, Ootacamund
5. Dewan Bahadur C. S. Ratnasabapathi Mudaliar, Coimbatore
6. Sri R. Jeevandass, Varnasi, Parlakimidi
7. G. R. Hilson Esq., Norwich, England
8. Sri Ramachandra Ananga Bhima Dev, Kesari Gajapathi, Raja Saheb of Budokhemidi, Berhampore, Ganjam
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