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Editorial

Tree planting: The Republic of India is launching out on a tree planting week— 'Vanamahotsava' commencing from the 1st July 1950. The President of the Republic in issuing his appeal has correctly stressed its importance in relation to agricultural prosperity. Tree planting was a duty or 'Dharma' in ancient India with almost a religious sanctity attached to it. Similarly, destruction of green trees, especially of fruit trees amounted to committing sin. The evils that follow in the wake of denudation of forests have been forcibly thrust on our attention by the sever drought last year in South India, resulting in the drying up of all wells and even the river Cauvery. Failure of rainfall has been wide-spread and recurrent during the past five year period. We have also experienced unprecedented hot winds and dust-storms, carrying away fine soil from our fields. Attention has been drawn to the trees useful as fruits, fodder or green manure. But it is very necessary that trees should also be planted, without any utilitarian motive. These should be tall-growing spreading trees that would act was wind-breaks, shade producers and form a canopy protecting the soil from the direct heat of the sun during summer. In these plants many birds that would be helpful in checking pests would find abode. Such plants should be found especially around villages, forming topes etc., and at selected spots to help break the force of gales and storms.

A greater stress, however, must be laid in plant preservation. The forests in the Western Ghats etc., abound in mighty trees, but it must be realised that they are the growth of centuries. For a good sized tree at least a decade must elapse. Exploitation must therefore be strictly controlled. In and around human habitations destruction of trees is apt to be more severe. Rearing of goats by

people who have no other means of getting green material, leads them to destroy the avenue trees. Scarcity of fuel has led to people stripping off the bark from living trees leading to their ultimate drying up. Such acts must be made punishable offences. Unless measures are instituted to prevent wanton destruction of avenue and other public trees, much valuable work will go to waste. Finally, we earnestly hope that this noble effort on which so much money is to be spent continues beyond the first enthusiasm and that the preservation of the trees that are planted in this Vanamahotsava week would also be kept on an equally sacred level and be considered as one of the primary duties of every citizen of India.

A Standard Process for Cooking Rice for Experimental Purposes *

By

E. J. VERGHESE, B. A., M. Sc.,

(Agricultural Research Institute, Coimbatore)

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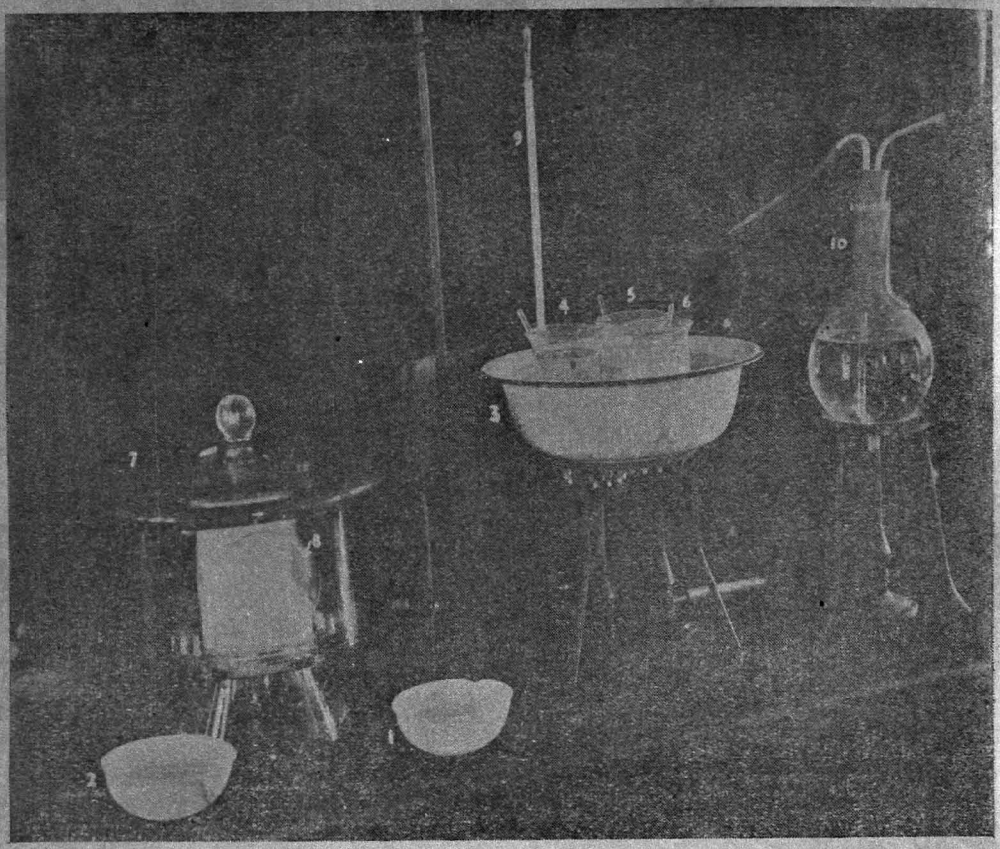
Volume expansion on cooking has generally been accepted as a factor of quality in rice. Reported values for this factor are however often vitiated by the lack of any standard technique for its determination. Kondo (1928) and Kondo and Okamura (1930, 1933, 1935, 1937, 1938) boiled rice in a kettle and determined volume by water displacement. Srinivasan and Mudaliar (1938) cooked rice in a boiling tube 1½" x 8·0", heated in a water bath, and measured the volume of the raw and cooked rice in a specially improvised dilatometer. Verghese (1948) during the course of an investigation on Quality in Rice, found it necessary to cook for estimating the expansion in volume and to collect the "Kanjee"—the rice water—for the determination of its density, vicosity, reducing power, starch content etc., under standard and comparable conditions and the techinque for cooking rice detailed in this paper was consequently devised.

The Standard Cooking Process

A. Chloride Bath: This consists of a circular enamelled basin 12 inches in diameter and 8 inches deep. Enough calcium chloride solution is added to the basin so that the solution stands at a depth of 1½ inches from the rim of the basin. The concentration of the solution is such that it boils at 105°C. The bath is maintained at this temperature (105 ±1°C.) by maintaining a constant level of solution, adding boiling water as and when the calcium chloride solution gets concentrated. The enamelled basin contained 3,700 cc. of a stock solution of calcium chloride containing approximately 27% $CaCl_2$ by weight. The boiling point was reached in 20–30 minutes and after two estimations 400 cc. of boiling water had to be added to maintain the temperature. In the basin is placed a circular perforated porcelain plate with legs 1½ inches high. Thus the vessel for cooking the rice stands on this porcelain plate about 2 inches from the bottom of the basin and not directly in contact with it. Heating is done by two rosehead burners protected from air draft. When once the burners, the porcelain disc, the size of flame etc., are chosen and adjusted, determinations of cooking are done under identical conditions. Even the position of the cooking vessel on the porcelain plate is of some importance. Though the temperature of the bath is uniform throughout, attention to these minor details will produce better results, for in the words of Shaffer and Somogyi (1933) these details affect "the intensity of the heat and the effective duration of the heating period".

* Extract from the M. Sc. Thesis, University of Madras, 1948.



Explanation to plate:

1 and 2. Soaking and Washing, 3. The calcium chloride bath heated by two good rosehead burners and protected from air draft by metal screens. 4, 5 and 6. Rice under different stages of cooking. 7. Desiccator containing water. 8. Beaker with the cooked and washed rice spread on one side, kept for draining. 9. Thermometer recording temperature of the bath. 10. Boiling water for rinsing the grains and for diluting the calcium chloride solution.

B. The Cooking vessel: A 250 cc. beaker is selected for this. A stout glass rod is placed in the beaker so that the spout is effectively closed and thus the escape of any grain or "Kanjee" during cooking is prevented. 200 cc. distilled water are taken in the beaker which is then closed with a suitable cover glass and kept on the porcelain plate in the bath. The porcelain plate can accomodate four beakers so that four samples may be handled at the same time. Complete cooking and determination of volume could be done at the rate of three samples per hour.

C. The Cooking process: (i) *Sampling:* From a representative sample of the available rice all broken grains, glumes, extraneous matter, bad or otherwise damaged or defective grains etc., are removed by hand picking. The material is again sampled and 20·0 gms. of whole grains are weighed into a 150–200 cc. porcelain basin.

(ii) ***Washing and soaking:*** To the whole rice grains in the porcelain basin about 100 cc. of distilled water are added and the grains well rubbed with fingers so as to separate and remove adhering dirt, bran or other extraneous material present. The water is then drained away and washing repeated with fresh distilled water three more times. The grains are then soaked by allowing to remain in distilled water for 10 minutes, the water being changed three times during the interval. At the end of 10 minutes the water is completely drained off.

(iii) ***Rinsing with boiling water:*** When the distilled water in the beaker (vide B above) is boiling the soaked grains are rapidly rinsed two or three times with boiling water. This serves to raise the cooking water quickly to boiling after addition of the grains to the beaker.

(iv) ***Cooking:*** The rinsed grains are then transferred carefully to the boiling water in the beaker. Boiling commences within a minute. Cooking is allowed to proceed for 14 minutes when it is considered complete. For arriving at this standard cooking period G.E.B. 24 considered to be one of the best varieties of rice in South India, was taken as the standard variety. The time taken for the complete cooking of this variety of rice is 14 minutes. It is true that all varieties of rice do not completely cook within the time specified. But, if the cooking is continued till complete cooking takes place in all cases, then the expansion in volume would be a function of the time of cooking and inherent varietal differences. The author found it more accurate to cook all the varieties for the same period of time under specified conditions. Volume expansion on cooking would thus be a direct test of quality of the different varieties. Extension of time of cooking beyond 14 minutes also resulted in most cases in the breaking up of the grain. The time of cooking is therefore kept constant in all the estimations.

(v) ***Washing of cooked rice:*** At the end of 14 minutes' cooking, the beaker is removed from the bath and the calcium chloride adhering to the outside completely washed away. The contents of the beaker are then transferred to a 900 cc. beaker containing about 600 cc. of distilled water. This prevents all further heating of the rice grains by the hot "Kanjee". Further the "Kanjee" sticking on to the cooked rice is thereby removed. This is particularly important in bad quality rices, especially new rices which often cook to a pasty mass and yield a thick gruel. The combined effect of these two sources of error is sometimes appreciable. The rice grains rapidly settle to the bottom of the 900 cc. beaker. The supernatant liquid is drained off. The grains are washed two times more with 600 cc. distilled water. The grains are then spread on one side of the beaker.

(vi) ***Draining:*** Thereafter the beaker is kept inclined for a couple of minutes. Most of the water is thus drained away. Further drainage is effected by keeping the beaker inclined in an atmosphere saturated with

water vapour so that during the time taken for complete draining of the water, the cooked rice grains do not lose the imbibed water by evaporation and shrink and thus lose in volume. This draining is done by keeping the beaker inclined in a desiccator containing water on the surface of which is placed a suitable porcelain basin. The water draining from the rice is discharged into this basin. Draining like this has also the advantage that cooked rice can be kept for longer periods of time after cooking and before it is convenient to determine volume.

D. Determination of Volume: The volume of the rice before and after cooking is measured in a volumenometer (Vergese 1949). The above process of cooking is adopted when the volume of the cooked rice is to be determined. If, however, the "Kanjee" — rice water — is required for experimental purposes, the following alteration in the technique is made at stage C (v) above.

After 14 minutes' cooking in the chloride bath the beaker containing the cooked rice is removed from the bath and the calcium chloride adhering to the outside completely washed off. The "Kanjee" is then transferred through a funnel to a 200 cc. volumetric flask. When all the "Kanjee" is thus poured off, the cooked grains in the beaker are washed four times with small quantities of water and the washings transferred to the funnel. Finally the grains are also transferred. Washing of the grains on the funnel is continued till about 200 cc. of the extract are obtained. The flask is then removed, cooled in running water and the contents made up to volume and well mixed. The flask is then left undisturbed for about half an hour by which time most of the suspended matter – fragments of cooked rice-settle down to the bottom. From the supernatant liquid a clear extract can be obtained by centrifuging. The author found it convenient to use an "Ecco" centrifuge – radius of arm 14·0 cms., length of centrifuging tubes 11·0 cms. and capacity 100 cc. 15 minutes' centrifuging at 3,000 revolutions per minute is usually sufficient to give a clear extract.

If determinations of viscosity, reducing power, starch content etc., of the extract are to be determined, special care should be taken to avoid the least possible contamination of the several apparatus used in the complete process. Contamination with calcium chloride from the chloride bath is the common experience. This can be completely avoided by keeping the beaker covered while cooking and washing off completely the calcium chloride adhering to the outside of the beaker after its removal from the bath. The chloride solution should also be kept boiling smoothly by the use of good rosehead burners.

The author has been using the standard process of cooking rice for the last eight years and has always obtained reliable results.

Summary: A standard process for cooking rice for experimental purposes is described. In this process 20·0 gms. of whole rice grains are carefully sampled out, thoroughly cleaned and washed and then soaked for 10 minutes in cold distilled water. The grains are then rapidly rinsed with boiling distilled water and transferred to a 250 cc. beaker containing 200 cc. of boiling distilled water. The beaker rests on a porcelain plate in a bath of calcium chloride maintained at 105° ± 1°C. The rice is cooked for 14 minutes, washed and drained free of water in an atmosphere saturated with water vapour and its volume determined in a volumenometer. The procedure for collecting the "Kanjee" — rice water — under standard conditions is also described.

Acknowledgment.

The author is greatly indebted to Mr. P. D. Karunakar, M. Sc. (Rutgers) A. R. I. C., Government Agricultural Chemist, Coimbatore, for his kind guidance in the prosecution of this study and for affording facilities for the same.

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Rooting of Cuttings

Part I — Influence of Growth-Regulating Substances

By

V. N. MADHAVA RAO, B. SC., (Ag),
Student, Diploma Course in Horticulture, Madras.

(Received 31—3—1950.)

During recent years there has been a remarkable expansion of research in the field of plant regeneration by vegetative propagation, the importance of which in horticultural practices cannot be overemphasized. Of the various methods of vegetative propagation in common employment, that by cuttings is at once the cheapest and easiest. Because of a growing belief that all plants can be propagated by means of cuttings, given proper conditions, recent researches have been directed towards determining the optimum conditions conducive to this type of reproduction.

One of the fundamental problems of the propagator is why certain woody-plants can be easily propagated vegetatively while others cannot be so propagated or only with great difficulty. Recent physiological research has to some extent provided an answer to this problem, but a great many details still remain to be worked out. The horticulturist is faced with the question "How can the regenerative capacity of plant cuttings be improved by human intervention"? The efforts of a host of horticultural workers led to the discovery of the growth-regulating substances or plant hormones. The history of these investigations forms a fascinating chapter in botanical research and has been well told by Boysen Jensen (1936) and Went and Thimann (1937). The discovery of these substances was based on the assumption that the meristematic regions of active tissues are centres of production of hormones or growth-regulating substances, but it is now known that they can also be prepared synthetically in the laboratory. These substances are all extremely potent in promoting root-formation when applied to intact plants or plant parts.

Pearse (1939) has given an excellent summary of the work on this aspect. He observes that hormone treatment is effective in the case of cuttings from species which are moderately difficult to root; accelerating rooting in a majority of cases and in causing the production of more roots per cutting. These findings represent a considerable advantage to the practical propagator, in enabling him to clear his propagating beds more quickly and in handling a larger number of cuttings than is otherwise possible. With cuttings which are normally very difficult to root, however, hormone treatment has seldom succeeded in improving root formation to any practical extent. He therefore concludes that in the treatment of cuttings with synthetic root-forming substances, it should be regarded more as a supplement, than as a replacement of the methods normally used by the propagator.

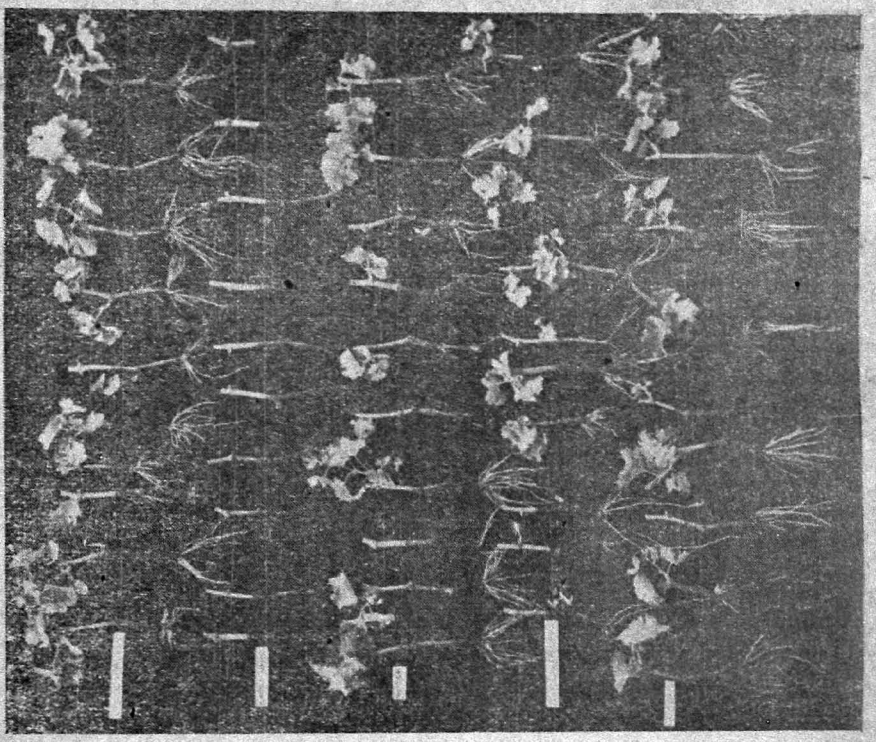

PLATE I

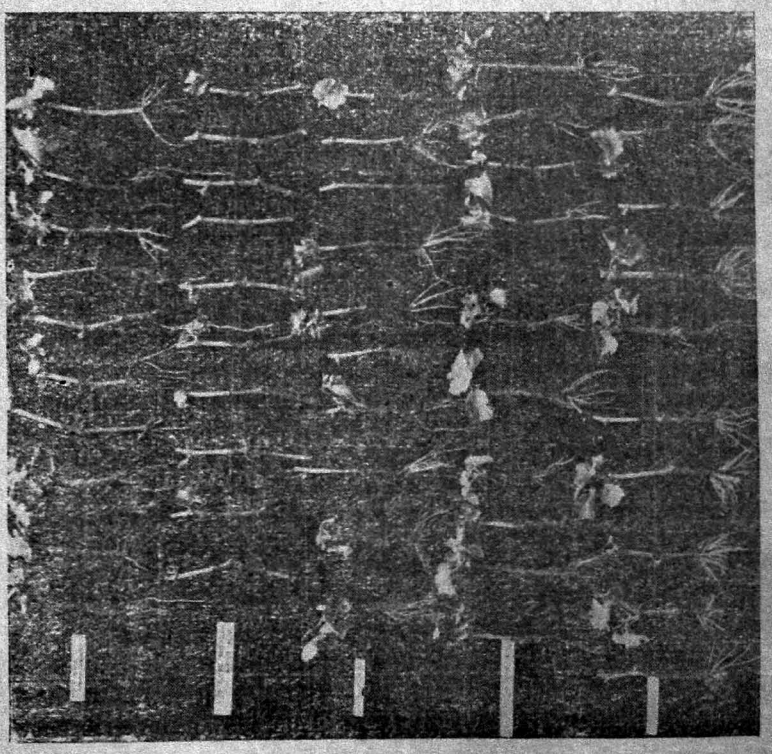

PLATE II

The remarkable expansion of research in this field has resulted in the introduction of innumerable proprietary products in the market, such as 'Seradix', 'Hortomone', 'Hormodin', etc., some of which claim to possess 'growth inducing' properties. With a view to compare the efficacy of these products along with similar chemicals as indolyl-acetic acid, indolylbutyric acid, and phenoxy compounds, small-scale trials were initiated by the author at the College Orchards, Agricultural College, Coimbatore, in May—June 1949, The limitations of time and facilities did not permit a study on a more comprehensive scale and the results of these investigations are therefore subject to confirmation by more extended studies.

Material and Methods: The following substances were tested. 1. 2 : 4 — Dichloro phenoxy acetic acid. 2. β-Indolyl acetic acid. 3. β-Indolyl butyric acid. 4. Hortomone A. 5. Seradix A. 6. Seradix B (3). 7. Potassium permanganate, 8. Cattle urine undiluted. 9. Cattle urine (10%) 10. Water. Stem cuttings of grapevine (*Vitis vinifera*), 'Pachadrakshai' variety, each about a centimeter in diameter were used. These were cut into convenient lengths of six to seven inches with only the lamina of the basal leaves removed. Due attention was paid to the selection of uniform material and subsequent treatments.

Treatments: *2 : 4 Dichloro phenoxy acetic acid, β-indolyl-acetic acid and β—indolyl-butyric acid:* These substances were obtained in the form of crystals and dissolved in a few drops of 95% ethyl alcohol* and diluted to the required degree. A common dose of 100 mg. of the substance per litre of water was tried at the first instance.

Hortomone A and Seradix A:— These are two of the proprietary products recently released in the market. The strengths recommended by the firms were adopted.

Seradix B (3):— This is another proprietary product in the form of a powder.

Potassium permanganate:— A solution of 0·02% potassium permanganate was also included as one of the treatments.

Cattle urine undiluted and cattle urineen 10%:— (i) Fresh bullock urine (from the Central Farm, Agricultural College) (ii) same diluted in water ten times.

Water:— Immersion of cuttings in water served as the control.

* The use of alcohol is because of the difficulty in dissolving these substances in water. Pearse (1939) who conducted control tests showed that the small amounts of alcohol present are without effect on the plant material.

Nature of pre-treatment of cuttings:— Ten cuttings were used for each treatment. The cuttings intended for the treatment by the 'Solution method' were immersed in the respective solutions with about $\frac{3}{4}$" of the basal portion immersed for a period of 24 hours, at the end of which, they were rinsed in water and planted in beds (29—5—49).

While the cuttings treated by the solution method were all removed on one day, the batch of ten cuttings treated with Seradix (B), powder, had to be removed from the parent a day later, as it was necessary that the powder had to be applied soon after removal of the cuttings, followed immediately by planting.

Rooting medium:— Raised beds of 4' x 2½' of clean river sand, provided the rooting medium.

Results.

At the end of 60 days, the cuttings were removed from the beds for examination after washing without loss of any roots. The rooting response under each treatment is represented in plates I & II. The number of roots produced by each cutting and the total weight of roots obtained in each treatment, are presented in the appended table.

It is seen from the table and the plates, that of the ten treatments, the following are the most promising in respect of the number of roots prodaced :— 1. Hortomone A, 2. Seradix B (3). 3. Cattle urine 10%, 4. Seradix A and 5. β-indolyl butyric acid.

Considering the weight of roots, the order is as follows :— 1. Hortomone A, (2) Seradix A, (3) B-indolyl butyric acid, (4) Cattle urine 10% and (5) β-indolyl acetic acid.

It is seen from the above that (1) Hortomone 'A' leads the other treatments both by the number and weight at the concentrations used followed by Seradix 'A' and B (3).

(2) The performance of the indolyl compounds are inconsistent at this range of concentration. *

(3) 2 : 4— Dichloro phenoxy acetic acid at 100 mg. per litre and cattle urine (undiluted) are deffnitely lethal.

(4) urine (10%) is promising as a root growth promoting substance.

(5) Cuttings treated with the indolyl compounds and the proprietary products produced roots thicker and shorter, compared to those treated with permanganate, urine and water.

* Seadix 'A' and Seradix (3) are merely two different concentrations of β-indolyl butyric acid, containing 0·48% and 0·8% respectively. Hence it is not surprising that that the performance of the indolyl compounds are in consistent, as 100 gms per litre of the active substance are obviously too high and have proved to be toxic.

(6) Treatment with growth-substances in general produced a larger number of roots *.

With a view to test the efficacy of some of the substances on cuttings normally difficult to root, three substances, Seradix A, Seradix B, (3) and Hortomone 'A' were tried on stem cuttings of jack *(Artocarpus integrifolia)*.

Stem cuttings, about a year old were obtained from a bearing tree at the College Orchard, Coimbatore, Batches of ten cuttings were treated with these substances. Examination of the cuttings on the 75th day failed to reveal any sign of root formation, although traces of the powder used were visible even on that date. There was not even an indication of any callus formation. This proved true with a similar batch of cuttings of *(Achras sapota)* tried during the same period.

Discussion.

The superior performance of some of the substances as revealed in these trials may, to some extent, serve as a guide to the practical propagator but it cannot at the same time be said with any certainty that those which have failed to produce any spectacular results are unsuitable. Cattle urine (undiluted) and 2 : 4 Dichloro phenoxy acetic acid, however, have proved to be definitely harmful at the concentrations. Phenoxy compounds have not been very popular as growth-promoting substances, but on the other hand constitute the principal ingredients of growth inhibiting substances. It was however included as one of the substances to test the extent of its activity as compared to other substances like urine.

The abundant root production obtained in cuttings treated with the proprietary products as compared to the less promising results of the other substances, emphasises the need for a series of trials to arrive at a definite recommendation for a particular species. On the basis of these trials it may not be unnatural to presume that the aforesaid firms should have based their recommendations on such trials.

The use of these substances in propagation is as yet a new technique and it is therefore premature to say which species respond better and which do not. The selection of the most suitable material, the age of the wood, the health of the parent plant, the care of the cuttings while in the rooting medium, and the precautions to minimise losses from diseases all remain as essential considerations for the best results.

* A separate trial was under way (the details of which appear in another part of this series) where grape vine formed the material for an investigation on 'depth of planting cuttings'. These cuttings were planted without any pre-treatment. Rooting in these was found to be very little compared to the trial mentioned above.

From the data presented in this paper, one is inclined to agree with Pearse (1939) that with species which are easy to root without treatment, optimal treatment rarely fails to result in increased root formation, and that the shortening of the time required for root formation is a distinct gain in time with the added possibility of handling many more cuttings, during the season. Although a separate trial to observe the 'quickness' in rooting in particular could not be taken up, it was incidentally observed from comparison with a similar batch of untreated grapevine cuttings used for a different trial, that the rooting was definitely meager compared to the luxuriant production of roots in treated cuttings.

The fact that roots in untreated cuttings were long, fibrous and thin and those of the treated were shorter and thicker may raise the issue whether this feature of the thickness is desirable at all from the point of view of planting a vineyard. Considering the production of such a large mass of roots in a short time and the fact that the life of the cutting in a nursery bed is only a temporary phase and that the same condition of the roots need not persist in a well-manured orchard site, it can safely be said that the propagator need never feel concerned about the shortness or thickness of the roots in the nursery bed, especially as the cuttings are grown in an ill-nourished bed of sand.

With subjects difficult to root, however a response is not always easy to obtain and the use of hormones will not replace the careful attention to details necessary without their use.

For a proper utilisation of the growth hormones for rooting of cuttings a comprehensive study will be essential in order to determine the more optimal concentrations, the type of hormone, the method of application and its effect on different types of plants under the different phases of their development. This knowledge becomes all the more important because of the growing tendency to an indiscriminate use of hormones caused by spectacular results achieved with some plants. Intense work in this direction may be as important to the horticulturist as variety testing because of the large number of proprietary preparations released in the market.

Before undertaking such trials with these substances, other methods without the aid of any accessories, have also to be planned simultaneously. Certain findings of a fundamental nature may be lost sight of while attempts are being made to solve problems of a more complicated nature. An excellent illustration of this is provided by S. R. Varma, Director of Agriculture, Patiala, who in an article entitled "Glimpses of Fruit Culture in Ancient India", presents the 50th Chapter of "Vrikshayurveda" compiled or composed by Brahma Sangitacharya in 1449 Bikrami, on the importance of fruit culture. Dealing with methods of propagation, it is mentioned therein that jack is propagated

both by root cuttings and by root or stem grafting.* Although stem grafting of jack is fairly well-known now, propagation by root cuttings and root grafting have not been very promising or popular and it seems therefore worthwhile pursuing this aspect to be able to popularise this and such other methods of propagation.

Acknowledgements. The author's grateful thanks are due to Sri. S. N. Chandrasekara Iyer, M. A., Government Lecturing and systematic Botanist, Coimbatore, under whose guidance the work was carried out and to Sri. U. Narasinga Rao, B. SC., Ag., Fruit Specialist, Madras for his valuable advice and help in the preparation of this paper.

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TABLE I.

Showing the number and weight of roots.

Cutting No.	Number of roots									
	Cattle urine 10%	Cattle urine	B-indol water	B-indol acetic acid	Seradix H	Potassium permanganate	2 : 4-D	Seradix B. (3)	B-indol butyric acid	Hortomone A
1	31	...	28	13	15	10	...	52	6	47
2	25	...	13	6	17	8	...	37	29	32
3	21	...	29	13	34	8	...	68	30	63
4	42	...	5	24	29	9	...	47	22	30
5	33	...	30	11	35	22	2	11	22	39
6	29	...	8	14	26	9	...	36	28	43
7	31	...	26	16	13	13	5	18	29	43
8	30	...	11	21	39	25	...	13	17	41
9	25	...	20	19	28	15	...	26	16	38
10	25	...	26	18	20	17	7	2	24	81
Total	... 300	...	196	155	256	136	14	310	223	457
Total weight in gms.	2·15	...	1·30	1·70	2·24	1·38	0·02	1·60	2·10	2·93

Note :— As the roots were very tender and brittle and in some cases too few, weights of individual cuttings could not be recorded.

* The jack fruit, the Asok, the Kadali, the Jamun, the monkey fruit, the pomegranate the grape, Palivat and Muktaka are propagated by root cuttings or by root or stem grafting. Whichever method is adopted the cutting or grafting, a protective liquefied coat of dung must be applied.

Vernalisation as a Method of Improving yields in Rice

By

T. R. NARAYANAN, B. sc., (Ag.), M. A. (Cantab.),
Plant Physiologist,

and

S. GOPALAKRISHNAN, B. sc.,
Assistant in Plant Physiology.
(Agricultural Research Institute, Coimbatore)

(Received 16—6—1950)

Introduction: The term vernalisation is now taken to include all the various adjustments of environmental factors to which seeds and seedlings may be subjected, with a view to hasten flowering and shorten the life cycle of plants. A shortened life-cycle, especially in the case of annual crops, has the advantage of avoiding the hazards of drought, seasonal pests and diseases. There is also the possibility, with such shortened durations, of growing varieties that would normally be incapable of growing in a particular locality. To the plant breeder, reduction of duration by vernalisation can be helpful in speeding up his breeding programme by raising a larger number of generations within a specific period.

There are a number of possible pre-treatment processes of seeds and young seedlings that are capable of shortening duration in annual crops, but for large-scale adoption under Indian agricultural conditions, the methods should obviously be such as not to need elaborate equipment. A further limitation is that the method should not shorten the life cycle at the expense of yield but should if possible be such as to improve the yield as well as hasten maturity. This paper describes certain studies made on the effects of vernalizing rice with the aim of shortening duration and improving yields as well.

Previous Work and Literature: Since the available literature on vernalisation in all its aspects has recently been summarised by Whyte (1946), Murneek and Whyte (1948) and others, it is not necessary to review it here. Certain preliminary attempts at vernalisation that were made at Coimbatore between the years 1933 to 1935 were reported as not very successful, possibly on account of too rigid an adherence to the method of "high temperature vernalisation" advocated for tropical crops by Lysenko. Vernalisation, as an agronomic measure was thought to be of little importance for Indian Agriculture, due largely to the lack of any systematic study of Indian crops under local tropical conditions, on the lines carried out for other crops in Western countries. Parthasarathy (1940) vernalized sterilized seeds of rice in darkness or continuous light at 10 to 20°C. for three weeks. Those vernalized in darkness flowered 4 to 5 days earlier than the control. In 1944, Kar found that the usual pre-sowing cold treatment followed by a post-sowing photostage of short days was able to induce a very marked earliness of 24 days in wheat and 43 days for oats. Thus a more systematic search for the right combinations of temperature, light and moisture conditions required for effective vernalisation of our main food crops is clearly necessary.

It may be desirable at this stage to explain the terms "long day" and "short-day" treatments. Plants are influenced in the course of their growth and development by many environmental factors. One of the major external factors is the length of day or the period for which plants are exposed to the action of light. This is technically known as the "photo-period". The vast majority of plants react to these photo-periods and particularly so in respect of the formation of flowers and development of fruits and seeds. Based upon the nature of their response to different photo-periods, plants are classified as "long day" and "short day" plants. "Long day" plants are those species, varieties or strains in which the flowering period is accelerated by a relatively long daily exposure to light, usually more than 12 to 14 hours (Garner and Allard, 1920). "Short-day" plants are those in which flowering is hastened by a relatively short daily exposure to light usually less than 12 hours, or by photoperiods of minimum intensity or by dark periods. There is also a third group of indeterminate plants where the flowering period is not influenced either way by the length of daily exposure to light.

One definite fact that has emerged from recent studies in India on vernalisation, is that low temperature vernalisation is not favourable for rice, (Kar and Adhikary, 1945). High temperature vernalisation on the other hand is found to hasten maturity in Rice (Parija, 1943). In Bengal, summer varieties of rice flower when the seasonal day length is above 12 hours, while winter varieties come to flower with day lengths of less than 12 hours. The influence of different day length periods on the earliness of ear emergence in rice has been studied by a number of workers, notably, Alam (1940), Sircar (1942, 1944), Kar and Adhikary (1945), Saran (1945) and Sen Gupta and Sen (1945). Kar and Adikary found that winter varieties of rice which do not respond to high temperature vernalisation, flowered earlier when subjected to short-day treatment, thus proving that short-days are essential for flowering in winter rice. In the case of summer varieties, short day treatment delays flowering, while long days hasten it (Sircar and Ghosh 1947). Perhaps the most remarkable instance of accelerated flowering in rice is that reported by Sircar and Parija (1945) in a winter variety called "*Rupsail*" where the normal flowering duration of 133 days was reduced to 47 days as a result of short-day treatment. The nature of vernalisation response is also varied, thus in another winter variety "*Bhasamanik*", earlier flowering along with increased grain yield has been noted by Sircar (1946), this increase being associated with an increase in the number of earhead bearing tillers.

Further work on wheat, rye and other cereals have led to the conclusion (Whyte and Oljhovikov, 1939) that the dark period requirement of so-called short-day plants is inherent only during a definite period of the plant's development. It is claimed that in such cases the plants should be described as short-day—long-day plants. In the case of rice, however, this conclusion does not seem to be warranted, because in the variety *Bhasamanik*, the acceleration of ear emergence was maximum and the grain yield also was increased, when the seedlings were exposed to short-days all through without any succession of short and long days (Mukherjee 1946).

The limitations attendent on hastening flowering are indicated by Pal (1948), who found after vernalisation studies carried out on nearly 150 strains of Indian wheat, that although a degree of earliness sufficient to be of agricultural importance could be induced in certain varieties by the use of vernalised seed, the number of tillers, the chief feature positively correlated with yield, was smaller in vernalised plants.

Material and methods: About 65 experiments were carried out in field and pot cultures, in the course of 1946 to 1949, in studying the

response of seven paddy varieties belonging to three duration groups, short, medium and long durations, to different photoperiodic treatments. The general method was to soak a known weight of seed for 24 hours, until incipient germination started, taking care to keep the moisture absorbed below the critical level needed for the embryo to separate the glumes and emerge outside. These soaked seeds were then subjected to the action of light or darkness as the case may be, for different periods, at the end of which they were sown in glazed pots of 10 inches diameter and height, holding 15 kilogrammes of soil, puddled to three inches from the surface. Seeds of the same variety soaked for 24 hours prior to sowing at the same time as vernalised seed served as the control for comparison. Parallel trials were carried out under field conditions also, during the seasons 1947, 1948 and 1949, to see how far the observations from pot cultures were corroborated by the field trials.

In view of the obvious practical difficulties inherent in high temperature vernalisation and also at low temperatures, the treatments were confined to photoperiodic modifications at ordinary laboratory temperatures, ranging from 27 to 29°C. Seeds receiving short day treatment were kept in total darkness all the 24 hours, for the duration of one or more weeks as the vernalisation treatment lasted. For providing long-day conditions, the soaked seeds were kept at a distance of 12 inches below three 60 watt electric bulbs from sunset till dawn and then under ordinary light for the rest of the day. This treatment also was continued for two periods, of one week and two weeks respectively.

At the end of the treatment periods, seeds were sown in glazed pots at 60 seeds per pot with two seeds in each of 30 holes, in each pot. Germination counts were taken one week after the sowing date and seedlings were subsequently thinned out at random in two stages so as to retain ten plants per pot at the adult stage. Periodical height measurements and tiller counts were also taken and at flowering time, the date of full emergence of the main tiller in all plants was recorded individually to determine the mean flowering duration of the variety under each treatment. At harvest time, the plants were cut at ground level, separated into earheads and straw and individual weights recorded, once at harvest time as fresh weight and again after two weeks drying in the sun as dry weight. The data were analysed for assessing the statistical significance or otherwise of the differences, between various treatments and varieties.

Results: The effects of pre-treatments at various stages from germination to harvest are set out below:

(a) *Germination:* In certain preliminary tests made early in 1946, it was found that germination of paddy seeds was adversely

affected when the soaked grains were kept for one or more weeks at low temperatures of 0° C. and 5° C. in darkness. These treatments were therefore omitted, and subsequent treatments were confined to ordinary temperatures. Under such conditions vernalised seeds were not appreciably poorer in germination than untreated seed: the percentage being 94·6% of the control seed viability. It was observed, however, that vernalised seeds were slightly later, by one day on the average, than control seeds in emerging from the soil.

(b) *Growth:* Plants from vernalised seed are in general somewhat shorter than those from untreated seed, during the early stages of growth, but later on, they make up the deficiency and at the adult stage they are often taller than the controls. This should be clear from the following table.

TABLE 1.

Effect of vernalisation on plant height at different stages of growth
(Expressed as percentages of control plant heights = 100)

Stage of growth	Short duration varieties (100 days and less)	Medium duration varieties (150 days)	Long duration varieties (200 days and more)
30 days after sowing	72·8%	91·1%	92·6%
30–60 days after sowing	105·0%	97·4%	99·7%
60–90 ,, ,,	111·8%	106·4%	101·8%
90–120 ,, ,,	...	107·6%	105·1%

N.B.— The figures are mean values of about 90 sets of measurements made on nine varieties (three in each duration group) in the 1946–47 season.

The table shows that vernalised plants are shorter than controls to begin with, in all the three duration groups, but subsequently outstrip the controls in plant height. Thus in the short duration varieties vernalised plants are shorter in the beginning by more than 25%, but this disparity narrows down by the second month and when flowering sets in, during the third month and the plants attain their adult height, the vernalised plants are nearly 12 per cent. taller. In the medium group also, a similar trend is noticeable, but the initial disparity in height is less, being only about 10 per cent. The difference gets levelled up in the course of the next two months of growth and vernalised plants are slightly taller than controls when they are 60—90 days old. After 90 days the plants begin to flower and attain their full adult height, which is about 8 per cent. taller than in controls. A very similar trend is noticeable in the long duration group as well, though the initial and final differences are narrower here than in the other two groups.

The effects observed on other plant characters, like tillering, ear emergence, grain and straw yields are presented in Appendix I. For the sake of brevity these results, which were gathered from a number of pot and field experiments during four years, from 1946 to 1949, are not given in full, but only as the mean of four years' results, expressed as a percentage of control in each case.

Effect on Plant height [Appendix I (a)]: When considered over a number of seasons, it may be said that plant height is not increased to any marked degree by the treatments that have been tried so far. The maximum increase is only 10·7% in G.E.B. 24, under 7 days light treatment. On the otherhand it may also be noted that neither is there any marked reduction in final plant height, except, in the case of 3 weeks treatment in the dark of A.K.P. 8, where the height was depressed by nearly 18 per cent. It will be noted from Appendix I (a) that on the whole, plant height is more often improved than depressed.

The variation in varietal response to vernalisation treatments is also well shown in this table; for instance, amongst the short duration varieties themselves, Adt. 3 is apparently improved in height under all the four treatments, while P.T.B. 10 is depressed by the same four treatments. G.E.B. 24 is improved in height by three out of the four treatments, and the long duration varieties A.K.P. 5, A.K.P. 8 and M.T.U. 7 all appear to be somewhat improved by vernalisation.

Effect on Tillering [Appendix I (b)]: It will be noted that in tillering too, there are marked differences between varieties in response to vernalisation. In some varieties and particularly in P.T.B. 10, tillering is apparently reduced by vernalisation, but in the other varieties, such as G.E.B. 24 for instance, tillering is distinctly improved by such treatments The table 2 given below would also serve to illustrate this point.

TABLE 2.

Effect of vernalisation upon tillering in paddy varieties.

Varieties	1946			1947			1948		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
Adt. 3	1·67	1·66	100·6%	1·67	1·66	100·6%	2·64	2·23	118·4%
P.T.B. 10	1·20	1·55	77·4%	1·20	1·55	77·4%	2·23	2·75	81·2%
Co. 21	1·63	1·63	100·0%	1·63	1·64	99·4%	3·79	4·20	90·2%
G.E.B. 24	1·89	1·50	126·0%	...	...	...	3·16	2·15	146·9%
A.K.P. 5	2·04	1·35	151·1%	...	...	...	1·64	1·84	89·2%
A.K.P. 8	...	...	...	2·55	2·12	120 3%	2·78	2·25	123·5%
M.T.U. 7	1·60	1·59	100·6%	3·29	2·86	115·0%	3·14	3·34	94·0%

* (a) Vernalised; (b) Control; (c) % on control = 100.

Effect on earhead emergence: The maximum earliness that was induced in earhead emergence by means of photoperiodic treatments was 23 days in the variety A.K.P. 8, after vernalisation in the dark for 22 days. It was found that in this feature too, certain varieties were more responsive than others. Thus in Adt. 3, G.E.B. 24 and in A.K.P. 5, the maximum earliness was obtained after long-day treatments for 14 days (see Appendix I (c) reproduced below as Table 3), while other varieties like A.K.P. 8 showed the maximum response after short-day treatment. It was also noted that where flowering was very much hastened as in the case of A.K.P. 8, after three weeks of short-day treatment, other attributes such as tillering and grain yield were also very much less than in untreated controls.

TABLE 3.

Effect of vernalisation of earhead emergence in Rice

(Summary of results of 1946 to 1949–expressed as mean percentages on control = 100.)

Varieties	Vernalisation treatments					Remarks.
	D. 22.	D. 14.	D. 7.	L. 7.	L. 14.	
Adt. 3		98·1	105·2	94·5	94·5	Except in A.K.P. 8, under dark day treatment for 22 days, where flowering was hastened by nearly 20%, flowering response is not improved by more than 7% by any of the treatments in this series of experiments.
P.T.B. 10		98·9	100·0	96·9	96·4	
Co. 21		97·1	96·6	97·2	97·0	
G.E.B. 24		97·2	96·9	96·8	93·9	
A.K.P. 5		98·3	99·9	98·8	95·4	
A.K.P. 8	80·9	97·8	99·1	98·9	98·4	
M.T.U. 7		101·0	97·9	97·6	98·7	

Effect on grain yields: In this feature too, varietal differences are very marked in response to vernalisation treatments [Appendix I (d)]. Three varieties, namely, G.E.B. 24, A.K.P. 5 and A.K.P. 8 appear to be very responsive and have given increased yields under all the different treatments that were tried during 1946 to 1949, while other varieties like P.T.B. 10 and M.T.U. 7, show more often a reduction in yield than an increase. It may also be observed from the table, that in general short-duration varieties such as Adt. 3, P.T.B. 10 and Co. 21 were somewhat less responsive to vernalisation than medium and long-duration varieties like G,E.B. 24 and A.K.P. 8. The variety P.T.B. 10 in particular shows hardly any improvement in either tillering or in grain yield under any of the treatments. In the case of Adt. 3, however, pretreatment under light for 14 days, seems to have induced a definite improvement in yield, as an increase of 10·5 to 61·2% was recorded in all the four seasons it was grown.

Effect on straw yields [Appendix I (e)]: A very similar trend as in grain is also noticeable in the straw yield responses of different varieties to vernalisation treatments; only the effects are somewhat less pronounced than in grain yields. Here too, the varieties G.E.B. 24 and A.K.P. 8, show consistent increases over controls. The chief difference between the effects on grain and straw is seen in the variety A.K.P. 5, where the grain yield is higher while the straw yield is lower, than controls. The other varieties do not seem to be very responsive to vernalisation in respect of straw yields.

Discussion: In the light of the results obtained so far, the possibility of utilising photoperiodic treatments as a means of primarily improving grain yields in cereal crops deserves to be explored more fully. They seem to indicate that this might be a more fruitful line of investigation than attempts to induce extra earliness in ripening. The results also indicate that even in the same crop, a good deal of varietal differences exist. It is therefore necessary to determine beforehand, which variety would respond favourably to what set of treatments, and then subject those varieties to such optimum combination of photoperiodic and other environmental factors as would help to maximise production.

The increase in grain yields noted in varieties like G.E.B. 24 and A.K.P. 8 after vernalisation is in line with the observation of Sircar (1944) that vernalisation response varies according to the nature of the variety. As mentioned before, he found that in a winter variety *Bhasamanik*, earliness with increased grain yield was obtained after vernalisation, this increase in grain yield being associated with an increase in the number of grain-bearing tillers.

In the case of cotton too, it has recently been reported (I.C.C. Ann. Rept., 1948), that vernalised seed gives significantly higher yields than untreated bulk seed, in three out of the four seasons of the trial. In this case it is of interest to note that the pre-treatment failed to achieve its immediate object of shortening the duration, but brought about some other genotypic change of a permanent nature in the strain X. 4463.

From the practical standpoint it is advisable to prefer a short-day treatment, in cases where a variety is improved in yield both by long-day and short-day treatments, since no electric equipment is needed for short-day treatments. For example, in the strain G.E.B. 24, dark day treatment for 14 days gave an average increase of 30% over control in grain yield, while from long-day treatments there was an increase of 27·3 and 33·0%. In such cases it is preferable to test the variety under large scale trials after two weeks of pre-treatment in darkness. The same is the case in the variety A.K.P. 8, where the highest average increase in grain yield of 37·9% was obtained after dark day treatment for 14 days.

Summary: Seven paddy varieties of three duration groups, short, medium and long, were studied under four types of vernalisation treatments in pot and field cultures during 1946 to 1949 and the effects observed in respect of growth flowering and yield are presented and discussed.

The possibilities of utilising this method of seed pre-treatment as a means of improving yields in rice are indicated.

The varieties, G.E.B. 24 and A.K.P. 8, were found to show consistent increases in grain yield, after vernalisation treatments, and to a lesser degree in the straw yield also. It is suggested that such responsive varieties could be tried on a large scale in different rice growing centres.

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APPENDIX I.

Effects of Vernalisation on Paddy Varieties

(Summary of results of 1949 expressed as mean precentages on control = 100.)

Effects. / Varieties.	Vernalisation Treatments					Remarks.
	D. 22.	D. 14.	D. 7.	L. 7.	L. 14.	
(a) Effect on plant Height						
A.D.T. 3		103·7	105·5	102·9	101·1	(1) It may be concluded that on the whole. plant height is not improved very markedly as a result of vernalisation treatments although it is improved more often than reduced.
P.T.B. 10		98·5	94·7	89·6	92·7	
Co. 21		93·3	97·8	100·7	94·2	
G.E.B. 24		106.3	110·7	106·4	95·7	
A.K.P. 5		101·3	100 8	100·2	100·5	(2) In A.K.P. 8 – vernalisation for D.22 reduced plant height by nearly 20%
A.K.P. 8	32·4	101·7	101·4	104·6	101·4	
M.T.U. 7		100·8	102·1	102·9	102·2	
(b) Effect on Tillering						
A.D.T. 3		113·5	101·2	95·6	94·5	(1) Two varieties, G.E.B. 24 and A.K.P. 8 show a definite improvement in tillering. It is not so marked in A.K.P. 5, except under L. 14 treatment.
P.T.B. 10		99·1	101·4	68·2	78·2	
Co. 21		106·2	105·1	89·8	100·0	
G.E.B. 24		108·5	116·8	107·3	125·1	(2) The 3 short duration varieties, A. D. T. 3, P. T. B. 10, Co. 21 and M.T.U. 7 do not show any improvement in tillering.
A.K.P. 5		91·4	94'1	110·3	130·3	
A.K.P. 8	85·5	105·5	105·5	112·5	137·4	(3) In the variety P.T.B. 10, tillering is depressed by vernalisation.
M.T.U. 7		94·1	79·2	76·1	90·8	
(c) Effect of flowering earliness						
A.D.T. 3		98·1	105·2	94·5	94·5	Except in A.K.P. 8, under 22 days of dark day treatment, where the flowering was hastened by nearly 20%, flowering response was not improved by more than 7% in any variety – by any of the vernalisation treatments tried in this series of experiments.
P.T.B. 10		98·9	100·0	96·9	96·4	
Co. 21		97·1	96·6	97·2	97·0	
G.E.B. 24		97·2	96·9	96·8	93·9	
A.K.P. 5		98·3	99·9	98·8	95·4	
A.K.P. 8	80·9	97·8	99·1	98·9	08·4	
M.T.U. 7		101·0	97·9	97·6	98·7	

APPENDIX 1. — *contd.*

Effects. / Varieties.	Vernalisation Treatments					Remarks.
	D. 22.	D. 14.	D. 7.	L. 7.	L. 14.	
(d) Effect on Grain Yield						
A.D.T. 3		95·5	80·8	80·6	122·1	(1) G.E.B. 24, A.K.B. 8 and A.K.P. 5 are definitely responsive to vernalisation treatments in grain yield, the increase ranging from 12 to 38%.
P.T.B. 10		88·5	101·3	86·2	91·2	
Co. 21		103·8	97·3	110·2	104·5	
G.B.B. 24		130·2	119·8	127·3	133·0	(2) The three short duration varieties A.D.T. 3, P.T.B. 10 and Co. 21 are not so responsive, except A.D.T. 3 under L. 14 treatment.
A.K.P. 5		113·9	119·5	118·5	118·9	
A.K.P. 8	79·0	137·9	124·5	125·6	114·5	
M.T.U. 7		107·5	97·2	99 3	93·6	(3) M.T.U. 7 also does not show any definite improvement in grain yield as a result of vernalisation.
(e) Effect on Straw Yield						
A.D T. 3		101·4	95·6	104·8	96·3	(1) General trend is similar to grain yield responses though less marked. Here too, G.E.B. 24 and A.K.P. 8 show a consistant increase over controls under different vernalisation treatments.
P.T.B. 10		95·3	113·3	81·3	107·2	
Co. 21		102·9	106·7	111·7	101·1	
G.E.B. 24		107·3	110·9	110·7	108·2	
A.K.P. 5		95·4	92·4	97·3	101·3	(2) In A.K.P. 5, the straw yield tends to be reduced by vernalisation - though the grain yield is increased.
A.K.P. 8		133·7	119·7	116·1	103·3	
M.T.U. 7		94·8	94·2	98·3	90·9	(3) M.T.U. 7 and the short duration types A.D.T. 3, P.T.B. 10 and Co. 21. are not responsive.

Note :— D. 22 = Seeds vernalised in total darkness for 22 days ;
D. 14 = ,, ,, ,, ,, ,, 14 ,,
D· 7 = ,, ,, ,, ,, ,, 7 ,,
L. 7 = ,, Vernalised in continuous illumination for 7 days ;
L. 14 = ,, ,, ,, ,, ,, ,, 14 ,,

Meteorology and Agriculture

By

C. BALASUBRAMANIYAN, B. A., B. SC., Ag.,
Agricultural Meteorologist

and

M. B. V. NARASINGA RAO, B. A., B. SC., Ag.,
Paddy Specialist, Coimbatore

(Recived 4—5—1950)

Introduction: Agriculture is being revolutionised by modern science. Weather Science has its own important part to play in the development of scientific agriculture. Scientists have evolved faithful and highly reliable instruments to record the minutest changes occurring in the weather conditions, both above and below the soil and also in different strata of the atmosphere. Exhaustive weather data, collected in a net work of meteorological observatories, enable the meteorologists to prepare weather maps and predict weather conditions a day or two in advance. Recently. the meteorologists have directed their research to the influence of the weather conditions on the crops under cultivation. Dr. L. A. Ramdas and his colleagues are the pioneers in this field fo far as India is concerned. The Central Government and the various Commodities Commities and the Madras Goverment are financing the 'All India Co-ordinated Crop Weather Scheme' and the experiments are in progress at six selected typical agricultural tracts in the Presidency.

Agricultural Meteorology in Rural Environments: Because of the irregular and erratic nature of monsoon development, the farmer is extremely interested in knowing whether precipitation will be normal and season favourable for his cultural operations. It is for this reason that he often consults Indian almanacs, which predict, in some detail, rainfall in the light of astronomical calculations based on the position of stars in relation to moon. Those who visit the agricultural tracts and talk to the farmers will not fail to observe two things. One is the hopes and fears regarding rainfall and the other is the importance, which older and experienced farmers attach to rains in a particular 'KARTHI'—(a term related to the twelve signs of the Zodiac and the twenty seven stars–as a means of predicting weather and rainfall). Every tiller of the soil is a weather prophet of some ability. In fact, in the early hours of the morning he daily scans the sky and notes the direction of wind and then pictures to himself what the weather for that day will be, so that he can plan his field operations to suit the weather conditions. If he were unaware of the influence of weather condititions on the crops he raises, he would certainly not do so. Inspite of his many ignorances he is fully conscious of the fact that weather is the factor, controlling his daily activities in the field. No farmer takes the risk of sowing if torrential rain is expected within a period of twenty four hours and thus waste his

seed material and labour. No farmer wants to irrigate his crop if the prospects of getting a rain in a day or two are really bright. Labour saving is his main criterion. No farmer will venture, particularly at the time of harvest, if weather conditions appear to be definitely uncertain and unsafe. He knows that he must have clear weather conditions at the time of harvest.

This awareness is perhaps the reason for a good number of proverbs among the rural population, embodying the influence of weather on the cultivated crops. As John Russel has said "A proverb is one man's wit and all men's wisdom." Long before the man studied the science of weather, there were people, who, from local observation, could often predict the weather. Many of these observations are now available in different languages as apt sayings, proverbs or little couplets. Though all of them might not hold a great deal of truth, yet they do certainly provide interest and advantage for examining scientifically some of them. A start has been made to render some weather service to farmers with the kind co-operotion of the All India Department with effect from 1—7—45. There are seven Regional Forecasting Centres in India. They are at Calcutta, Delhi, Lahore, Karachi, Bombay, Nagpur and Madras. At present, a regular feature of the rural broadcast programme is the issue of the Farmers' Bulletin in the regional languages. Further, certain leading dailies publish weather forecast. But as matters stand at present, the weather news do not reach the home of every farmer.

Suggestions for Improving Weather Service: (i) Co-operative organisations, as in America, can play an important part in the efficient dissemination of the weather news. No Government can maintain more than a few observatories of the first, second and third class types. Thousands of observatories of third class type can be run, as in England, by voluntary workers. Very valuable data can be collected by them and communicated to the Central Meteorological Office, which issues daily weather forecasts.

(ii) Agriculture is the mainstay of the Indian population and its success or failure depends mainly on weather. Hence, it becomes logically imperative that every educated man must be conversant with the fundamentals of weather science. For a man to become a village official it must be made compulsory that he should pass the preliminary examination in the study and interpretation of weather charts and underatanding the weather forecasts as announced in the papers and by the radios.

(iii) The Government can easily arrrange for more detailed regional weather bulletin broadcasts by the regional Radio Stations at Madras, Tiruchirappalli, Mysore, Trivandrum Kozhikod and Vijayawada. Each group of villages within a radius of one mile is to be provided with a radio set. The village Karnam or Munsiff must be made responsible for

further spreading the news announced by the radio. By suitable legislation, if necessary, wide publication must be achieved in actual practice. Every organisation, whether official or otherwise, should help the State to this end. Press also has got its important role to play in this national weather service.

(iv) The Government can financially help the voluntary orgnisations involved in weather study. These organisations have to be continuously vigilant in their observations, since then only they can be successful, as changes occur so rapidly in the weather. The really valuable information can be merited and awarded a merit bonus. These organisations are not to ignore the phenological side of weather.

(v) On co-operative basis and with the support of the Government industrial workshops are to be started in suitable localities to manufacture the required essential thermometers, windvanes, anemometers, rain-gauges and screens. As it is, the initial cost of setting up an observatory is very high. It can be reduced considerably if these workshops function efficiently with suitable efficient staff.

Conclusion: The State and the Public should take co-ordinated measures to run weather service on a par with 'Postal Service'. In addition, the farmers should be posted with all details as to what the adverse weather conditions are for their particular locality with special reference to everyone one of the cultivated crops. This valuable information can be furnished to them, crop-war, by enabling them to have for reference, Crop Weather Calendars in regional languages. Steps in this direction have already been taken by the Director, Agricultural Meneorology, Poona, with the kind co-operation of the various Provincial Agricultural Departments.

Some Experiences with Gammexane (B. H. C.) and D. D. T.

II. *The Garlic and onion thrips — Thrips tabaci*

By

Sri S. RAMACHANDRAN, Govt. Entomologist

(Received 16—3—1950)

Garlic is one of the most important spice crops in this Province but its cultivation is restricted to certain parts of Coimbatore, Madura and Bellary districts, probably because of its being able to thrive only under the peculiar envionments prevalent in these tracts. At Bellary only one crop is raised from October to January while at Coimbatore there are two seasons, the first one from June to September and the second

from November to January. The duration is reported to vary from 2½ to 3½ months according to the local conditions. The maturity of the crop is indicated by the flowering of the plants and the formation of the small size-bulbs, but a certain amount of experience is necessary to decide the actual stage at which the bulbs are to be lifted. The yield varies from 1,500 to 7,000 lbs., but the average may be taken as somewhere about 4,000 lbs. In spite of the attractive prices the produce fetches, the ryots are only luke-warm about its expansion, more in a spirit of sheer helplessness against the minute insect — the thrips — which regularly infest the crop year after year, often causing its wholesale ruin, not to speak of one or two fungoid diseases which also levy their toll. D.D.T. and B.H.C. were tested against this insect recently and the following is a short account of the details of the pest and the lines of contorl.

The pest: Investigations on the life-history, habits and control of the thrips have been in progress from 1929 onwards and the available information on these aspects is summarised below. Two species of thrips *Heliothrips indicus* B. and *Thrips tabaci* L. are concerned in the damage. The former is generally the first to appear but is very soon swamped out by the latter, because of its higher prolificity. Discussing the details about *Thrips tabaci* — the major pest — stray adults are first found by about November but they multiply to large numbers within such an incredibly short period that the plants literally teem with their population by December, the mild sunny weather probably being favourable for their multiplication.

Life-history and habits: The female lays its eggs singly inside the leaf tissue, generally more towards the basal parts of the leaf and the egg spots are easily visible when the leaf is held against light. Tiny nymphs hatch out in about eight to nine days and seek the innermost recesses in the heart of the plant where they hide and feed on the plant sap. They attain the pre-pupal stage in the course of 4 to 6 days. The actual pupation takes place a couple of days later in the soil at a depth of 1 to 2 inches. The adult emerges in 3 to 4 days. The egg-laying capacity of a female ranges from 50 to 60. The adults first confine their feeding activities to the inner regions of the leaf-bases but with the rapid increase in population, numbers of them can be found resting on the exposed surfaces of the leaves as well. They are very active and sneak away inside at the least disturbance. The fresh hatchlings are white but turn yellow in colour within a day or two. In contrast to this species, the other *Heliothrips indicus* is somewhat sluggish and the individuals are generally found feeding near the basal portion of the leaves.

Predators and parasites: A chrysopid larva, a species of mite and one or two egg-parasites feed on the different stage of the pest, but this natural control is hardly felt in reducing the incidence of the pest.

Host plants: *Heliothrips indicus* is reported to have a wide array of host plants such as coriander, Bishop's weed, fenugreek. brinjal, onions, ground-nut, agathi, cotton, beans, cabbage, cauli-flower etc. *Thrips tabaci*, on the other hand has a lesser range consisting of fenugreek, onions, and cotton. One of the factors which is perhaps most contributory to the pest having become chronic to certain areas, at any rate for the Siruguppa tract, is the fertile and almost perennial breeding ground, afforded by its alternate host—onions. This crop is grown practically throughout the year in successive batches with the result that the pest which is always prevalent there transfers its attention to gralic with all its virulence, whenever conditions are favourable. This trouble on this account was so bad during some years, that even a temporary cessation of the cultivation of onions was suggested as a preventive measure.

Control measures: Strenuous attempts were made as early as 1929 to control this insect. Tobacco extract in the strength of 1 lb. to 6 gallons of water with an extra dose of 1 lb. of soap, lime-sulphur at 1 in 15 and 1 in 20 with the addition of soapnut lather were tried. It, however, transpired from the trials that the treatments did more harm to the crop itself. The over-dose of soap was found to definitely retard plant growth and inhibit bulb formation while the lime-sulphur washes had even a scorching effect on the foliage. The results were so discouraging that the control plots were found to fare better than the treated ones. The possibilities of insecticides being limited, mechanical sweeping of the plants with a pasteboard smeared with castor oil was also tried. Even this attempt proved futile and the whole problem was, therefore, kept in cold storage for the time being, advocating mere tobacco spray or dust as a palliative in serious cases of attack. It was also found that in well cultivation plots with a liberal application of manure and frequent irrigations, the plants developed a better vigour and were, on that account, able to withstand the damage for a longer time.

Work done: The pest was serious at Puliampatti near Palladam, Coimbatore district, during December, 1948. The insecticides already mentioned not being of any practical use, B.H.C. 5% dust and D.D.T. 0·1% spray were tried, each over an area of 30 cents. Counts of the population taken before and 24 hours after the treatments showed a reduction of only about 35% in the case of the spray and much less in the dust. The trials however, gave an indication about the higher efficacy of the spray, as the fluid when discharged under high pressure is able to permeate into the inner recesses of the plant, where the insects usually lurk. A second set of experiments were conducted with sprays of B.H.C. (P. 520) 0·1% D.D.T. 0·1 and 0·2%. D.D.T. emulsion 0·16% and D.D.T. dust 2% and the percentages of reduction were 97, 68, 43, 89 and 58 respectively. The tentative results indicated that both D.D.T. and B.H.C. had a lethal

action against this species of thrips and that the effects of B.H.C. spray 0·1% were more convincing. D.D.T. emulsion also was promising but further work with this preparation was dropped out owing to non-availability of the necessary chemicals and the probable risk of foliage injury attendant with its inadvertant use. A few more trials conducted on exploratory basis gave more definite indications of the specific action of B.H.C. spray against these thrips.

Properly laid out field-scale experiments were again taken up during December, 1949, with B.H.C. and D.D.T. sprays each at 0·05% and 0·1% in 4·5 cent plots, randomised and replicated four times. Population counts of 5 plants, selected at random, were recorded for each replication before as well as 24 and 48 hours after treatment. At harvest, the yield of 4 beds (about 1/3 of a cent in extent) per replication, situated exactly in the middle of the experimental plots, was recorded. The data are furnished in statements I and II.

Conclusions: The respective percentages of reduction after 48 hours are 108, 100, 48 and 62% in the order of the 0.05% and 0.1% concentrations of B.H.C. and D.D.T. confirming the high lethal action of B.H.C.

The yield has been proportionate to the reduction in insect population, the B.H.C. 0.05% and 0.1% plots yielding 258 and 269% over the control. The calculated additional yield over the control in the case of the two concentrations is 2457 and 2625 lbs. respectively, the money value of which at Rs. 10/- per maund of 25 lbs. works out to Rs. 885/- and Rs. 1,050/-.

The higher yield is brought about by the better development of the bulbs in the treated plots. A thousand of them selected at random from the produce of the sprayed plots weighed 12 lbs. while a similar lot from the controls weighed only 3 lbs.

About 8 lbs. of the chemical in 100 gallons (0.05%) may be required to spray an acre and the cost of the same works out to Rs. 16/-. A second treatment may be necessary after about a fortnight in case there is a recrudescence of the pest. Though the figures definitely prove the higher efficacy of B.H.C. spray at 0.1%, it is considered that a 0.05% strength is enough for the purpose, povided the spray is applied carefully and thoroughly.

Considering the practical ruin of the crop by the pest year after year, a net profit of nearly Rs. 1,000/- per acre in either case is in no way inconsiderable. These results were further tested on a field scale and confirmed beyond doubt and the use of the chemical is becoming exceedingly popular in the Palladam area.

Trials against thrips on onions: D.D.T. and B.H.C. dusts at 5%, D.D.T. spray 1% and B.H.C. 0.5% were also tried against the same species of thrips on onions and the mortality ranged from 85 to 100%. Contrary to the previous findings, both the chemicals appear to have a unifom effect on this species crop which may probably be due to the looser arrangement of the leaves facilitating better penetration of the chemicals.

Acknowledgments: The material for the earlier part of the paper was from records, mostly consisting of the works of Sri M.S. Kylasam, then Assistant in Entomology. The recent trials were conducted by Messrs. S. Kanakaraj Devid and Assistants K. R. Nagaraja Rao and S. Venugopal.

STATEMENT I.

Results of trails at Puliyampatti—Palladam Taluk

Against the Garlic Thrips (Thrip Tabaci).

(Population only)

Date of sowing: 15th October 1949. Lay out: Randomised plots replicated four times.
Date of treatment: 15th December 1949.
Date of harvest: 28th January 1950. Area of each plot: 135' x 15'.
Area harvested in each plot: 1/3 cent.

Treatment	Population on 5 plants-average of four replications				
	Before treatment	24 hours after treatment	48 hours after treatment	Reduction in population after 48 hrs.	20 days after treatment
B.H.C. 0·05%	166	8	Nil	100%	28
B.H.C. 0·1%	188	Nil	Nil	100%	16
D.D.T. 0·05%	176	117	91	48%	64
D.D.T. 0·1%	176	103	65	62%	51
Control.	194	161	149	23%	362

STATEMENT II. (Yield Data)

Treatment	Yield in Lb. & Oz.				Yield in lb. mean of 4 replications.	Acre yield in lb.	Percentage over control	Approximate money value @ Rs. 10/- per maund of 25 lb.
	I Rep.	II Rep.	III Rep.	IV Rep.				Rs.
B.H.C. 0·05%	18–2	14–0	10–10	10–12	13–6	4013	257·9	1605
B.H.C. 0·1%	14–0	15–0	15–0	11–12	13–15	4181	268·7	1670
D.D.T. 0·05%	10–2	13–10	8–8	9–0	10–5	3094	198·9	1240
D.D.T. 0·1%	14–0	9–0	10–12	6–0	9–15	2981	191·6	1190
Control	4–13	5–0	6–0	4–14	5–3	1556	100.0	620

Extracts

Placement of Nitrogenous Manure for Rice. Rice is mainly a swamp crop and ordinary methods of fertilizer use break down. Nitrate of soda is relatively ineffective Sulphate of ammonia often acts well but sometimes not. These puzzling complexities were resolved from a quite unexpected quarter Professor Persall in studying marsh conditions in Cumberland found measurable differences in oxidation-reduction potential in the water logged soils; oxidation took place at the soil water surface but reduction lower down. Directly they heard of this the Japanese experts saw its bearing on the rice problem. Sulphate of ammonia put on the surface of the mud in the usual fashion at or before transplanting, was quickly oxidised to nitrate which washed down below and was reduced to gaseous nitrogen. But if the sulphate of ammonia was pushed down through the oxidation zone into the region of reduction it lay safely till the plant roots took it up. If nitrates, e. g. ammonium or sodium nitrate, are added during the period of rapid growth they can be absorbed quickly before they reach the reducing layer; therefore they may be used as later top dressings. The study of these oxidation and reduction zones showed also how cyanamide and other fertilizers should be applied. It gives for the first time a scientific basis to the manuring of the rice crop; another example of the far reaching results that may come from a purely academic enquiry well carried out. [World Population and World Food Supplies. The Advancement of Science, Vol. VI, No. 23, October 1949, pp 177-78]

D. M. R.

Tapioca—A Substitute for Rice—Demonstration in West Bengal. A demonstration of the various preparations of Tapioca (the root of which resembles ordinary potato) was given by the Agriculture Department, West Bengal Government, at the Writer's Buildings recently. Different edible preparations made out of the Tapioca tubers were served to a number of invited guests including Ministers of West Bengal Government and Pressmen at the time of the demonstration. The preparations which were served included (1) Simple boiled tuber with chutney (2) Tapioca preparation with coconut and fish, (3) Tapioca 'Singara' (4) Tapioca fried chips. (5) Tapioca preparation with par boiled dried chips and (7) Tapioca sweets. Dr. P. J. Gregory, Special Officer Crop Research, West Bengal Government who explained the edible preparation said that experimental cultivation of the crop in cultivators fields in compact blocks of 2 to 3 acres each was undertaken during the current season in suitable districts like Midnapore, Bankura and Murshidabad by the Agricultural Directorate. The planting material was obtained from Travancore for this trial on the basis of suitable types selected as a result of earlier experimental trial in district farms. Dr. Gregory said that the cultivators were eager to extend the cultivation with the cuttings of this year produce. Explaining the food value of Tapioca Mr. Gregory said that Tapioca was more or less similar to ordinary potato with the values of carbohydrate, fat, mineral matter, calcium, phosphorus, iron and calorific value a little more than that of potato. The fact that this food in one form or other had gone into the daily diet of about 60 lakhs of rice eating people of Travancore for the last 75 to 100 years without any bad effects on the health of the people might be sufficient testimony of the usefulness of this as an article of food. If it was bad, people of Travancore would have abandoned its cunsunption long ago. Dr. Gregory said that when a great famine threatened Travancore in 1942, almost simultaneously with the great famine that visited Bengal, this crop which served as a substitute for rice saved thousands of people from starvation. [Planters Journal & Agriculturist. Vol. XLII, No. 5, May 1950.]

Crop and Trade Reports.

Statistics—Crop—Cholam (Jowar)—1949—1950—Second Forecast Report—Madras State. The area sown with Cholam (Jowar or *Sorghum Vulgare*) in the Madras State up to the end of December 1949 is estimated at 3,861,800 acres. When compared with the estimate of 3,815,800 acres for the corresponding period of the previous year for the State (including the merged states), the present estimate reveals an increase of 1·2 per cent. The increase in acreage is due mainly to adequate rains at the sowing period of the crop. 1,656,100 acres have been reported as sown under the crop since the first forecast report was issued. The crop has been or is being harvested in the districts of Kurnool, Bellary, Anantapur, Cuddapah, South Arcot, Salem and Ramnad. The yield per acre is expected to be normal only in the Kurnool district and below the normal in the other districts of the State, due partly to heavy rains in the Circars districts and partly to the continued failure of the north east monsoon rains in the Carnatic, the Central and Southern districts of the State. The reduction in yields is expected to be marked in West Godavari, Krishna, Chingleput, South Arcot, Chittoor, North Arcot, Salem, Coimbatore, Tiruchirapalli, Ramnad and Tirunelveli. The crop is also reported to have been affected to some extent by attacks of insect pests in parts of the Anantapur district. The condition of the crop in the Deccan districts is better than in the previous year.

The seasonal factor for the State as a whole works out to 80 per cent of the average. On this basis, the total yield works out to 874,900 tons of unhusked grain (or 743,900 tons in terms of cleaned grain) as against the estimate of 882,500 tons of unhusked grain (or 750,100 tons in terms of cleaned grain), for the corresponding period of the previous year, representing a decrease or 0·9 per cent The average whole sale price of cholam per imperial maund of 82 2/7 lbs, (equivalent to 3,200 tolas) as reported from important market centres on 3—2—1950, was Rs. 8—1—0 at Guntur, Rs. 9—3—0 at Nandyal, Rs. 9—10—0 at Coimbatore, Rs. 9—15—0 at Guntakal, Rs. 10/- at Adoni (yellow cholam) and Rs. 10—14—0 at Cuddapah.

Statistics—Crop—Ragi—Third and final forecast report—Madras State—1949—1950. The area sown with ragi (*Eleusine Coracana*) in the Madras State during 1949—1950 is estimated at 1,598,100 acres. Compared with the final area of 1,609,484 acres in the previous year, this a decrease of 0·7 per cent. The estimated area during the five years ending 1947—1948 viz, 1,605,500 acres by 0·5 per cent. 310,700 acres have been reported as sown under the crop since the second forecast report was issued. Compared with the actual area in the previous year the present estimate reveals an increase in the districts of Visakhapatnam, West Godavari, Bellary, Anantapur, Cuddapah, Chingleput, Chitoor, Tanjore, Ramnad, Malabar, and the Nilgiris, and a decrease in the other districts of the State excepting the Krishna district, where the area is expected to be the same as in the previous year. The variations are marked in Anantapur (— 5,400 acres), Chittoor (— 12,400 acres), North Arcot (— 12,000 acres) and Coimbatore (— 8,900 acres) districts

The main crop has been harvested. The yield per acre is expected to be below the normal in all the districts of the State due partly to the damage caused by heavy rains and cyclone in October 1949 in the Circars districts, and partly to the failure of the north-east monsoon rains in the Carnatic, the Central and the Southern Districts. The reduction in yields is expected to be considerable in the districts of Chingleput, South Arcot, Coimbatore, Tiruchirapalli, Ramnad and Tirunelveli due to conditions of severe drought. The seasonal factor for the State as a whole is estimated at 75 per cent of the normal, as against 80 per cent in 1948—1949. On this basis the total yield works out to 613,400 tons of unhusked grain (or 552,100 tons in terms of cleaned grain).

This represents a decrease of 5·2 per cent as compared with the final estimate of 647,100 tons of unhusked grain (or 582,100 tons in terms of cleaned grain) for the previous year. The present estimated production is lower than the average production during the five years ending 1947—1948 viz., 675,100 tons of unhusked grain (or 607,400 tons of cleaned grain), by 9·1 per cent. The average wholesale price of ragi per Imperial Maund of 82 2/7 lb (equivalent to 3,200 tolas) as reported from important market centres on 18th March 1950, was Rs. 9—6—0 at Erode, Rs. 9—12—0 at Coimbatore and Rs. 10—9—0 at Chittoor. (Economic Adviser and Joint Secretary to Government of Madras).

Cotton Raw, in the Madras Presidency. All figures in bales of 392 lbs. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1950 to 26th May 1950 amounted to 136,986 bales of 322 lb. lint. The receipts in the corresponding period of the previous year were 135,926 bales 149,209 bales mainly of pressed cotton were received at spinning mills and 493 bales were exported by sea while 39,464 bales were imported by sea mainly from Karachi and Bombay. (Director of Agriculture, Madras).

OBITUARY

Sri T. Narayana Rao, M. A., (East Godavari) was born on 3—5—1906. He was working as Research Assistant in the Millet Section at Coimbatore and Guntur from 14—7—1928 to 22—3—1939. He underwent post graduate course in Plant breeding and Genetics at Pusa (Bihar) in the years 1936 to 1938. His services were lent to the Government of India and he was in charge of Tobacco Research at the Tobacco Research Station at Guntur as Superintendent from 23—3—1939. He was versatile in his disposition and obtained the Master's degree both in Botany and Economics. He has many scientific publications to his credit both on Millets and Tobacco. He took ill in the month of June 1950 and died of Typhoid at the General Hospital at Guntur on 11—6—1950, at the early age of 44 years. He was of an amiable disposition and leaves behind a wife, children and a very large circle of friends and relations to mourn his loss.

Weather Review — For May 1950

RAINFALL DATA

Division	Station	Total for the month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	4·5	+2·4	9·0
	Calinga-patnam	2·2	—0·4	5·6
	Vizagapatnam	2·3	+0·3	2·8
	Anakapalle*	1·4	—1·1	2·3
	Samalkot*	1·9	+0·4	4·5
	Kakinada	1·0	—0·5	2·7
	Maruteru	2·1	+0·8	4·6
	Masulipatnam	2·8	+1·5	4·7
	Guntur*	2·4	+0·1	4·0
	Agrl. College, Bapatla*	1·6	+0·7	3·3
	Veeravanam* (College Farm)	2·2	(xx)	4·4
Ceded Dists.	Kurnool	2·0	+0·9	2·3
	Nandyal*	0·6	—1·4	1·1
	Hagari*	1·5	—1·0	1·6
	Siruguppa*	0·5	-1·5(a)	0·7
	Bellary	0·9	—1·9	1·0
	Rentichintala	1·0	—1·5	2·4
	Cuddapah	2·1	+0·6	2·2
	Anantha-rajpet*	1·8	—1·1	2·2
Carnatic.	Nellore	1·4	+0·3	1·5
	Buchireddi-palem*	0·4	—2·4	0·5
	Madras (Meenam-bakkam)	2·3	+1·3	3·6
	Tirurkuppam*	2·2	-0·8 @	2·5
	Palur*	3·9	—0·2	4·4
	Tindivanam*	3·8	—0·1	4·6
	Cuddalore	3·8	+2·8	4·6
Central.	Vellore	1·0	—1·3	2·1
	Gudiyatham*	1·6	—2·0	1·9
	Salem	1·4	—3·2	3·6
	Coimbatore (A. C. R. I.)*	1·3	—0·7	3·8
	Coimbatore (C. B. S.)*	0·9	—1·2	4·0
Central—*Contd.*	Coimbatore	0·8	—1·7	3·4
	Tiruchirapalli	2·7	+0·1	6·1
South.	Negapatnam	4·2	+2·6	7·9
	Aduturai*	3·8	+1.2	6·4
	Pattukottai*	1·1	—0·8	8·1
	Mathurai	2·3	—0·4	7·5
	Pamban	0·4	—0·6	7·4
	Koilpatti*	2·4	—0·1	10·1
	Palayamcottai	2·3	+0·7	10·7
	Amba-samudram*	2·6	+0·4	11·7
West Coast.	Trivandrum	7·2	—1·6	16·7
	Fort Cochin	13·0	+1·3	24·5
	Kozhikode	13·6	+4·7	15·7
	Pattambi*	19·8	+11·3	25·8
	Taliparamba*	7·7	—0·2	9·1
	Nileshwar*	9·9	(£)	10·7
	Pilicode*	8·8	-3·8 @	8·8
	Mangalore	4·4	—3·3	4·6
	Kankanady*	5·2	—3·7	5·5
Mysore & Coorg.	Chitaldrug	2·5	—0·4	2·7
	Bangalore	3·9	—0·3	4·0
	Mysore	9·1	+3·5	9·9
	Mercara	1·7	—3·5	4·8
Hills.	Kodaikanal	5·6	—0·8	11·4
	Coonoor*	4·5	+0·2	14·0
	Ootacamund*	2·8	—3·3	5·0
	Nanjanad*	3·3	—2·3	7·8

Note:—

(1) * Meteorological Stations of the Madras Agricultural Department.

(2) @ Average of seven years data for Tirurkuppam and eight years data for Pilicode is given as normal.

(3) (xx) Readings are taken only from February, 1948.

(4) (£) Departure from normal for Nileshwar is 0·03 ''.

(5) Average of ten years data is taken as the normal.

(6) (a) Taluk office normal is 1·76" and Rainfall is 0·81".

Weather Review for May 1950.

Mainly dry weather prevailed over the region during the beginning of the month. Due to the strengthening of Westerlies and South-Westerlies over Travancore-Cochin and Tamilnad, there were showers at a number of places in the interior of Tamilnad on 2—5—50.

A western disturbance lay over Rajastan and adjoining parts on 3—5—50 and moved away on 5—5—50, but a more active one appeared on the same day over North Baluchistan and South Punjab and passed off on the very next day.

The South East Monsoon advanced into the lower Burma coast on 12—5—50 and became feeble on 16—5—50. A shallow pressure area appeared over the Andaman sea on 22—5—50. It moved westwards and concentrated into a shallow depression the next day. The shallow depression intensified further and, on the morning of 25—5—50 was centred at 150 miles South of Port Blair and moved towards North West. Under its influence fairly widespread light to moderate rain occurred in Tamilnad and Rayalaseema. The deep bay depression lay on the morning of 26—6—50 at 300 miles South East of Vishakapatnam and in association with it the South-West Monsoon temporarily advanced into Travancore and West Coast. Thunder and rain occurred in Malabar, South Canara and Rayalseema. Thereafter the Monsoon continued to be strong and active along the West Coast, till the end of the month causing widespread and locally heavy rains in Malabar and South Canara districts.

The Bay depression weakened on the 28th and became unimportant on 30—5—50, off the Circars Coast.

The day temperatures were above normal through most of the region from the beginning of the month upto 25—5—50. Thereafter due to the influence of the Bay depression the day temperatures fell below normal over the region.

The noteworthy falls for the month are furnished below :—

S. No.	Date.	Place.	Rainfall in inches.
1.	11—5—50	Mysore	2·1
2.	27—5—50	Ananthapur	2·1
3.	28—5—50	Alleppey	5·3
4.	,,	Cochin	5·1
5.	,,	Trivandrum	2·5
6.	29—5—50	Palghat	2·5
	,,	Kozhikode	6·6

Agricultural Meteorology Section,
Lawley Road Post, Coimbatore
Dated, 17—6—1950

M. B. V. N., C. B. M., & M. V. J.

Departmental Notifications.

GAZETTED SERVICE—APPOINTMENTS

Posting and Transfers

Sri S. N. Chandrasekhara Iyer, Government Lecturing and Systematic Botanist is appointed to act as Vice-Principal in addition to his duties.

Name of Officers	From	To
Sri Balasubramaniam, R.	Cotton Specialist, Coimbatore,	Cotton Expansion Officer, Coimbatore.
,, Balasubramaniam, C. S.	Lecturer in Entomology, Bapatla,	P. P. O. (Entomology) Bapatla.
,, Fazlulla Khan Sahib,	On leave,	Asst. Fruit Specialist, Madras.
Sri Krishna Reddy, T.	On leave,	D. A. O. Kurnool.
,, Kandaswami, M.	Asst. Mycologist, Anakapalle,	Asst. Mycologist, Ootacamund.
,, Kanakaraj David, S.	Asst. Entomologist, Coimbatore,	Gazetted Asst. Lecturer in Entomology, Bapatla.
,, Krishnamurthi, C.	Gazetted Asst. Lecturer in Entomology, Bapatla,	Lecturer in Entomology, Bapatla.
,, Muthaiah Nattar, A. M.	Sugarcane Inspector, Ammainackanur,	D. A. O, Coimbatore.
,, Mirsa Anser Baig.	D. A. O. Kurnool,	J. L. A. Bapatla.
,, Narasimham, M.	On leave,	Farm Supdt. Bapatla.
,, Obeidulla Sahib,	Asst. Marketing Officer, Cuddapah,	Regional Dy. D. A. Cuddapah.
,, Ramana Rai, K. S.	D. A. O. Vellore,	D. A. O. Mangalore.
,, Rangaswami, T. V.	Asst. Cotton Specialist, Coimbatore,	Asst. Cotton Expansion Officer, Coimbatore.
,, Ramachandran, C. K.	Asst. Cotton Specialist, Coimbatore,	Asst. Cotton Expansion Officer, Koilpatti.
,, Raghavan, A.	Asst. Cotton Specialist, Coimbatore,	Asst. Cotton Expansion Officer, Bellary.
,, Subramaniam, R. S.	Asst. Agrl. Engineer, Madras,	Lecturer in Engineering, Bapatla.
,, Sridharan, C. S.	Lecturer in Engineering, Bapatla,	Asst. Agrl. Engineer, Madras.
,, Syed Ibrahim,	Asst. in Paddy, Buchireddipalayam,	Seed Development Officer (Millet) Bellary.
,, Subramaniam, T. V.	Asst. Mycologist, Ootacamund,	Asst. Mycologist, Anakapalle.
,, Srinivasacharya, K.	D. A. O. Coimbatore,	D. A. O. Vellore.
,, Satagopan, V.	Lecturer in Agriculture, Coimbatore,	Dy. D. A. Coimbatore.
,, Thirumala Rao, V.	P. P. O. Entomology, Bapatla,	Govt. Entomologist, Coimbatore.

Subordinate Service.

Srimathi S. T. Machamma, B. A., is appointed as woman demonstrator Fruit Development Scheme Calicut Vice Srimathi P. S. Leelavathi granted leave.

Postings and Transfers.

Name of Officers	From	To
Sri Alagiriswamy, M.	On leave,	Special A. D., Sugarcane Scheme, Nilakottai.
,, Ananta Rao, K.	A. D. Tekkali,	A. A. D. Parvathipur.
,, Appalanarasimham, J.	A. D. Penukonda,	A. A. D. Palaconda.
,, Ananda, U.	A. D. Sugarcane Scheme Mangalore,	A. D. Mangalore.
,, Achutha Rama Raju, D.	P. A. to D. A. O., W. Godavari,	P. A. to D. A. O., E. Godavari.
,, Balu Rao, G.	Asst. in Paddy, Pattambi,	Asst. in Paddy, Coimbatore.
,, Balasubramaniam, A.	A. D., Rasipuram,	Asst. in Chemistry, Coimbatore.
,, Banji Rao, B.	A. A. D. Salem,	Millet Asst. Nandyal.
,, Balasubramaniam, P.	A. D. Pulivendla,	A. D., Dronachalam.
,, Bhagirathipadi,	J. L. A. Bapatla,	F. M. Bapatla.
,, Cheriacko, T. V.	On leave,	Asst. in Mycology, Calicut.
,, Gopalarathnam, G.	A. A. D. Cuddalore,	A. D. Pulivendla.
,, Gopalakrishnan, A.	A. D. Cholavaram,	A. D. K. D. peta (Agency).
,, Habibulla, K. S.	A. D. Pathapatnam,	Seethampatna—Agency.
,, Jagannathan,	A. D. Gumalakshmi-puram,	A. D. Tekkali.
,, Jagannatha Rao, P.	Soil Conservation Asst. Bellary,	A. A. D. Yellamanchilli.
,, Krishnamurthi, J.	A. D. Kulitalai,	Asst. in Cotton, Coimbatore.
,, Kelukutty Menon, M.	Pepper Asst. Mattanur,	Asst. in Paddy, Pattambi.
,, Kameswara Sarma, V.	A. A. D. Tiruvannamalai,	A. A. D. Chandragiri.
,, Krishna Naik, S.	P. A. to D. A. O. Mangalore,	A. D. Sugarcane Scheme, Mangalore.
,, Lakshmanan, S.	A. D. Nannilam,	F. M. A. R. S. Aduthurai.
,, Lingaiah, M. K.	Sims' Park, Coonoor,	A. D. Coonoor.
,, Lakshmana Bhalu, P.	A. D. Dronahalam,	Special A. D. Gummalakshmipuram.
,, Mukundan, T. K.	A. D. Manantody,	Seed Development Asst. Paddy, Palghat.
,, Muthuswamy, S.	A. D. Tirupattur,	Teaching Asst. in Agriculture, Coimbatore.
,, Narayana Reddy, N. L.	Seethampeta Agency,	A. D. Pathapatnam.
,, Narasimham, K. A.	A. D. Peta (Agency)	A. D. Chodavaram.
,, Prabhakara Reddy, G.	A. D. Anantapur,	A. D. Penukonda.

Name of Officers	From	To
Sri Ramachandran, T. K.	Fruit Inspector, Kodur,	Horticultural Instructor, Madras.
,, Ranganathachar, N.	F. M. A. R. S. Aduthurai,	Teaching Asst. in Agriculture, Coimbatore.
,, Ramana Rao, A.	A. A. D. Tanjore,	A. D. Adoni.
,, Ramachandra Rao, M.	A. A. D. Polur,	P. P. A. Anantapur.
,, Ranganathaswami, G.	Seed Development Asst. Cuddapah,	F. M. Bapatla.
,, Ramakrishnan Nambiar, C.	P. P. A. (Mycology) Calicut,	A. A. D. Ponnani.
,, Sundaram, V. P.	A. D. Cheyyar,	A. D. Namakal.
,, Sampath, V.	Fruit Asst. Coonoor,	F. M. Sims' Park, Coonoor.
,, Soundara Rajan, R.	Dairy Manager, Coimbatore.	Asst. in Chemistry, Coonoor.
,, Suryanarayana Sarma, D.	Seed Development Asst. Paddy, Kakinada,	A. D. Nuzvid.
,, Sreeramulu, C.	Millet Asst. Nandyal,	Asst. A. D. Kurnool.
,, Suryanarayana, N.	A. A. D. Mettupalayam,	A. D. Giddalore.
,, Suryanarayana, B. V.	A. A. D. Namakkal,	A. A. D. Cuddapah.
,, Suryanarayana-murthi, C. V.	A. A. D. Tiruchirapalli,	A. A. D. Prodathur.
,, Subba Rao, A.	Fruit Asst. Melon Scheme, Sidhout,	Nursery Asst. Kodur.
,, Subramaniam, J.	Nursery Asst. Kodur,	F. M. Bapatla.
,, Satyanarayana-murthi, K.	A. A. D. Conjeevaram,	Asst. in Paddy, Buchireddipalam.
,, Sanjeeva Shetty, K.	A. D. Mangalore,	P. A. to D. A. O., Mangalore.
,, Suryanarayana, J.	P. A. to D. A. O. E. Godavari,	P. A. to D. A. O., W. Godavari.
,, Venkata Raghava Raju, N.	A. D. Kalyandrug,	Seed Development Asst. Paddy, Kakinada.
,, Venkata Rao, G.	A. A. D. Tiruvellore,	F. M. Hagari.
,, Vencoba Rao, K.	A. A. D. Saidapet,	A. D. Hadagalli.
,, Vasudeva Rao, A.	On leave,	A. D. Sugarcane Scheme Madanapalli.

APPOINTMENTS.

Mr. Abdul Azeez, M.—A. A. D. Anantapur; Annappan, R.S.—Asst. in Cotton, Srivilliputhur; Appaiah, K. M.—Asst. in Fruits, Mettupalayam; Ananthanarayanan, K. K.—Asst. in Fruits, Mettupalayam; Abdul Khadar, A—Asst. in Cotton, Coimbatore; Adinarayanan, N. P.—Asst. in Cotton. Coimbatore; Abdul Rashid—Asst. in Millets, Coimbatore; Boominathan, H.—Asst. in Cotton, Coimbatore; Balasubramaniam, S.—Asst. in Cotton Coimbatore; Balasubramaniam, V.—A. A. D. Salem; Balasubramaniam, H.—Seed Dev. Asst. Vellore; Balasubramaniam, S.—A. D. Tiruchendur; Baskharan, A. R.—A. A. D. Tiruvellore; Baskhara Rao, C.—Seed Dev. Asst. Paddy Cuddalore;

Chandrasekharan, P.—Asst. in Millets, Coimbatore; Chandrasekharan, P. (Cannanore)—Asst. in Entomology, Coimbatore; Dorai Raj, V.—Asst. in Millet, Ariyalur; Doraiswamy, R.—A. A. D. Udamalpet; Govindan, V. R.—Asst. in Oil Seeds A. R. S. Tindivanam; Gopalan, S.—A. A. D. Kulitalai; Guruswami Raju, V.—A.D. Srivilliputhur; Ganapathy, N. K.—A.A.D.—Tirunelveli; George, J.E.—A.A.D. Polur; Gopalachari, N. C.—Asst. in Mycology, Coimbatore; Jagannadha Rao, G.—Asst. in Chemistry, Coimbatore; Jagannadhan, K.—Special A. D. Tirupur; Jayaseelan, D. S.—A. D. Tirupattur; Jaya Raman, R.—Asst. in Oil Seeds, Tindivanam; Kumaraswami, P.—A.A.D. Hospet; Krishnan, S.—A. A. D. Mathuranathakam; Kasiviswanathan, S.—A.A.D. Tirumangalam; Krishnamurthi, S.—A.A.D. Vellore; Krishnamurthi, R.—F. M. Central Farm, Coimbatore; Kunhan Raja—F. M. Wynad; Krishnamurthi. K. A.—Asst. in Cotton, Coimbatore; Lokanathan, N. S.—A.A.D. Tiruturaipundi; Malakondaya, M.—A. A. D. Kovur; Mohammad Waizullah—Cotton Asst. A.R.S. Nandyal; Mohammad Abdul Rahiman Baig—Seed Dev. Asst. Millets, Bellary; Mohammad Basha, D—A. D. Kalyandrug; Muthukrishnan, K. S.—P. P. A. Mycology; Mani, P. S.—A. A. D. Sankaran Koil; Marappan, P.V.—Special A. D. for Cotton, Palladam; Moosa Baramy, K. P.—F.M. Wynad; Narayanan, A.—Asst. in Chemistry Coimbatore; Narayanan, C.—Asst. in Pulses, Coimbatore; Narayana Kutty Nair, T.—A.A.D. Manjeri; Navaladi Kuppuswami—A.D. Cheyyar; Nataraja Rathnam, M.—A.A.D. Cuddalore; Parthasarathi, S.S.—A.A.D. Kumbakonam; Perumal, A.S.—A.D. Nannilam; Palaniandi, V.G.—A.A.D. Musiri; Purusothaman. P.S.—Special A. D. Cotton Scheme, Srivilliputhur; Pranatharthiharan, S.N.—A.D. Rasipuram; Parthasarathi, D.R.—Seed Dev. Asst. Millets Athur; Rangaswami, P.—Asst. in Botany, Coimbatore; Ranganathan, K.S.—Asst. in Millets, Coimbatore; Ramaswami, K. R.—Asst. in Paddy, Coimbatore; Rebello, N.S.P.—Asst. in Paddy, Coimbatore; Raghu Shetty—A.A.D. Udipi; Raghava Panicker, K—A.D. Mannantody; Radhakrishna Alwa, K.—F. M. Nanjanad; Rajagopalan, R.—Seed Dev. Asst. Millets, Coimbatore; Rama Subramaniam, S.—A.A.D Sattur; Ramanujam, C.—A.A.D. Devakottai; Ramanathan, N.—A.A.D. Tiruvarur; Raghavachari, S.—A.A.D. Tanjore; Ramakrishnan, S.—A.A.D. Saidapet; Sitharamaih,—A.A.D. Markapur; Syed Mahaboob Ali—F.M.A.R.S. Nandiyal; Sheik Abdul Kadeer—Inspector of Fruits products, Kodur; Seshadri, V.S.—A.A.D. Mannargudi; Swaminathan, K.—Asst. Paddy A.R.S. Aduthurai; Sivasankaran, S.—Asst. in Paddy, A. R. S. Aduthurai; Sargunam Davis Peter—A.A. Dindigul; Sivagnanam, L.—Asst. in Cotton, Koilpatti; Siva Ramakrishnan, K.—A.A.D. Tiruvannamalai; Subramaniam, N.—A. A. D. Mettupalayam; Shanmugam, C.—A.A.D. Ambasamudram; Sethumadhavan, K.—A. A. D. Ponnani: Subramaniam, P.T.—F.M. Taliparamba; Srimathi Kalyankutty, T.—Asst. in Paddy, Pattambi; Srimatni Chandramathi—Asst. in Cotton, Coimbatore; Srinivasamurthi, M.—Asst. in Cotton, Coimbatore; Syed Salimuddin Razvi—Asst. in Millets, Coimbatore; Thejomurthi, P.S.—Asst. in Entomology, Coimbatore; Thanikachalam, T.K.—.AA.D. Trichinopoly; Veeraraghavan, V.—A.A.D. Conjeevaram; Venkata Raman, S.—A. D. Mannargudi; Venkata Ramani, B.—A. D. Vilathikulam; Vijaya Raghavan, A.P.—A. A. D. Cannanore; Vaman Bhat—Asst. in Cotton, Mangalore; Venkata Raman, A.—Asst in Chemistry, Coimbatore; Venkata Raman, S. N.—F. M. College Dairy, Coimbatore; Williams, P.—Asst. in Fruits, Coonoor; Yeswantha Ail—F. M. Nileshwar; Yuvaraj, N.—A. A. D. Gudiyattam.

THE MADRAS AGRICULTURAL JOURNAL

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The pages of the Madras Agricultural Journal shall be open ordinarily only to the members of the Madras Agricultural Students' Union.

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ADDENDUM.

Vol. 37. No. 5. Page 207. Line 16 from top. After 'Schult' insert (identified by the Madras Herbarium, Agricultural College, Coimbatore.)