Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXII] MAY 1934 [No. 5.

CONTENTS

Editorial.

Rural Reconstruction. It is a well known fact that the bulk of the population in India live in the country. Only a minor part of it lives in town. Under the influence of commercial and industrial development the urban population has received a slight impetus. Municipal administration, under the eye of the intelligentia of the land, is tending more and more to conform to popular needs and standards. The bulk of the rural area is even to-day not in the lime light and to us agriculturists familiar with its conditions, the fact will be evident that there has been a steady decline and a gradual decadence in this rural territory. To all thinking minds the problem of rural reconstruction has become one of major magnitude. The term reconstruction connotes a disintegration and decay in an older order of things. The popular saying that God made the country and man made the town is broadly true and when the country-side is decadent and its reconstruction is in the programme, there is something of the divine in the endeavour. Inter-twined with this concept of reconstruction is the sister idea of construction *de novo* which has also to be taken into account.

The Problem. The ills of the villager are manifold. He has a long spell of unemployment and its resultant idleness. Idleness

tempteth the devil. Litigation thus becomes his 'second greatest industry'. The rivalries and factions in the village are chronic. A small community knows its units too well to be healthily detached. His indebtedness is chronic. This is mostly traceable to (current or inherited) expenditure on marriages or funeral ceremonies, which his vanity and sentiment wring out of him. What he needs is an awakening of the mind to the realities of the situation and a desire for a higher standard of personal living. Until this is felt by him and supplies the necessary motive power, any improvement will merely be an excresence and not organic in growth. The function therefore of all schemes of rural reconstruction should primarily be to tap these main-springs of sound progress. Till then they can only be curative or palliative but not preventive.

Gosaba. Endeavours at this rural reconstruction have been manifold. One type which is practically a rural construction has its origin mainly in the unemployment of educated classes and an easy way of solving it by thinking of restoring them to the bosom of the all-nursing mother earth. Of this type is the colossal scheme of Sir Daniel Hamilton of Gosaba fame who dreams of rural Bengal and its re-habilitation in terms of 6000 first class work-men trained in a short course of agriculture to serve as organisers for the settlement of the 50 million people in rural Bengal. The wide sweep of this scheme and the prospect of roping in educated unemployed youth appeal to the imagination of the intelligentia, the more so as the scheme provides a healthy alternative to destructive activities. Of a feebler type and still embryonic is the Mannargudi scheme of Rao Saheb Kanakasabhai Pillai. Schemes like this require sustained endeavour of a type unattainable except through warm support at the hands of Government in the initial stages. The set-back which may overtake any serious activity of this type will set back the clock of progress in this direction. It is therefore up to government to watch and take stock of endeavours of self-help of this type and give each of them the heart push that is looked for, to take it to fruition. Each success will lead to fresh endeavours and nowhere else is it true to say that to succeed is the best way to success.

Gurgaon. Pre-eminent in attempts at rural reconstruction are the labours of Mr. Brayne, I. C. S. His endeavours are well known and the gradual sliding down in the standard set and maintained through his personal enthusiasm as an official, are becoming evident. His is an instance of a one-man-endeavour and that of an official. Similar isolated instances can be quoted from all over India. The defect arises from the want of starting the construction from the foundation, but super-imposing it from above.

Y. M. C. A. The Young Men's Christian Association is a world-wide organization that has stood the test of time. It has turned its

attention to this rural uplift. Marthandam and Ramanathapuram are examples. As long as the zeal and the missionary spirit of service permeate these attempts so long will success be ensured. The supreme need on the part of the Y. M. C. A. in this activity is to realize that it is part of the nation and a link thereof. So long as noble souls of the type of the late Mr. K. T. Paul are available to guide this endeavour, a wholesome agency will function in this fruitful field.

Rural Development Commissioners. The appointment of these Commissioners in the Provinces is the first step of a government responsive to the realization of the rural situation. A co-ordinated endeavour on the part of development departments is called for. The needs of the villager are manifold and though the catering to his convenience has been patchy, no concerted endeavour has so far been made towards his abiding betterment. A bureaucratic institution has its place in work of this type only in so far as it serves as a steady and wholesome nucleus round which the manifold forces of reconstruction could gather. Beyond that, as a wholesale agency in this huge endeavour, it has its limitations. Its function is to serve, stimulate and sustain.

The Depressed Classes. One aspect of this rural reconstruction is the amelioration of the depressed classes and the appointment of Labour Commissioners. Such uplift though in the long run is likely to be of immense service to the body politic, may at the beginning prove a source of unsettlement in the rural social life. Nothing iniquitous has been set right without the initial pangs incidental to the process and the occasional rumblings that we hear in the rural parts between landed interests and labour is no more than the repercussions of this uplift.

Co-operation. As a remedy for existing ills and as a constructive force in this rural uplift, the co-operative movement would easily come to the minds of all people interested in this subject. After plenty of experiments and much generous sympathy shown to the movement it is sad to find in the recent Assembly debate a realization on the part of government that the co-operative movement has not been the glorious success it was expected or assumed to be. Co-operation by its very connotation is an inner urge and can never be made to order. An outside agency and that an official one has an alien-ness and artificiality that will not betoken the inner volition so very necessary for success. Nothing short of chronic adversity or a supreme perception on the part of a mass that a conjoint endeavour will alone save a situation, can ensure the success of co-operation. It therefore looks as if the official movement at co-operation is not likely to function soundly at this rural reconstruction unless its programme is radically altered. Inasmuch as this movement lies mostly in and among village folk the official co-operator should if he be an

agriculturist, serve as an efficient agency in this work of rural amelioration. Such an official could then have a true assaying of the problems that confront the villager and might in that measure suggest a realignment of co-operative endeavour. It therefore looks as if one of the first steps that should be taken is the absorption in ever increasing numbers of agricultural graduates to man the department and strengthen the movement.

Agricultural Service. The Indian villager is a resourceful individual. He has a sense of humour and his intelligence is whetted by vicissitudes. He is wary of new experiments, but is appreciative of advance. He resents the superior air of inexperienced husbandry, but is the first to adopt measures born of cultured experience. What he needs is an atmosphere round him permeated with enlightened agriculture so that the rural air is, so to say, agronomic-minded. This is ensured not by set agencies whose one pointed effort is to sell a plough, a good manure or superior seed. There is an element of commerce in this exchange which militates against an all-round advance. A more comprehensive service is indicated. The villager is accustomed to look upon all Government servants with respect. To him they are centres of culture. He would exchange places with them if he could. Every Government servant that comes in contact with him has thus the opportunity to serve as a vehicle of enlightened agriculture and contented rural life. What is therefore desirable is that such officers as far as may be, should be agriculturists by training and outlook. To us, it appears. that there are golden opportunities for an all-round rural uplift if the village school-master round whom gather the children of the cultivators, is a young man steeped in modern agricultural knowledge. So also the inspecting agency in schools. The Revenue Inspector, tax gatherer that he mostly is, could well be an agriculturist, and be a source of great comfort and encouragement instead of the unwelcome visitant that he is. The Sub-Registrar round whose office gather the village folk would have opportunities, should he be an agriculturist, of taking to these people on rural indebtedness and the consolidation of their holdings. What is indicated as a necessity in any serious endeavour at achieving tangible success in rural advancement is a wholesale permeation of the officialdom in touch with rural India, with enlightened agriculture. We therefore urge with all the earnestness at our command that there shall not be one unemployed agriculturist trained at such great cost to the state, as long as there are avenues open in any line and in any department of the state. For, man for man, educated individual to educated individual, an agricultural graduate has a training so humane and so comprehensive that in him the state will find a servant of a type that in addition to discharging the narrow duties incidental to his particular office, has an outlook that embraces the whole of the country-side and its folk. An endeavour towards the uplift of the

rural population is worth the high purpose of a whole host of public servants and none among them will equal an agricultural graduate in initial equipment. To us, therefore, it looks as if there is a tragic element in the enforced idleness of this class of men, when each of them could be made a centre of dynamic strength. A comprehensive plan of absorbing all agricultural graduates with a view to permeating the service to make it as it were rural minded, strikes us as the only solution to this unemployment of educated youth and their utilisation in agencies for schemes of rural reconstruction. We have not written this in any opportunist mood born of current distress, but with the high purpose of tackling this fundamental problem right at its bottom. We hope that our appeal will fall on responsive ears.

Cattle Breeding. With reference to our note on Cattle Breeding in the December issue of the journal, we are glad to learn from the Director of Agriculture, that work on Ongoles was not given up, but that "the select breed of Chintaldevi was transferred to Guntur, to form a nucleus."

The Late Dewan Bahadur K. Rangachariar. It is with feelings of deep sorrow that we have to announce the death of Dewan Bahadur K. Rangachariar on the 10th of May at his village, Lakshmipuram, near Kuppam. He had been ailing for sometime but none suspected that the end was so near. It is sad to face the fact that only ten years have elapsed since he was a pensioner. Attuned to very active habits, these years were to him a period of continued work, until he broke down under its strain. Simple in habits, warm in his emotions and encyclopaedic in his equipment, his was a great soul. In his death, India has lost a Botanist of repute. To his many students and to us at the Agricultural College and Research Institute, it will be many years before the memory of his genial presence and incessant activity fades away. We offer to Mrs. Rangachariar and other members of the family our sincere and heart-felt condolences.

ENVIRONMENTAL AND GENETIC INFLUENCES ON THE SORGHUM CROP AT NANDYAL

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Introduction. The area under sorghum in the Nandyal tract is fairly extensive and comprises the whole of the Kurnool district, parts of Cuddapah, Anantapur and Nellore districts and portions of the Nizam's dominions. The whole of this area is under one variety—a compact-headed yellow type called '*Patcha jonna*'. Early trial of other types such as the famous white or *Tella jonna* of Bellary and some red sorghums were not found useful at the Nandyal Station. Further work was therefore more or less confined to the *Patcha jonna*

and covers a wide field of agricultural experiments on the varietal, manurial and cultural side. A few aspects of this work are presented in this paper as throwing light on some fundamental problems associated with agricultural improvements and the methods adopted to attain them.

Variability in yields. A fact of common interest in all agricultural work is the large variation in crop yields. Two aspects of this variation are of profound interest in agricultural studies namely the annual variation and the field variation. When improvements whether varietal or manurial are to spread over several thousands of acres, a wide range of soils and other conditions are to be encountered, and it is desirable that the extent of improvement likely to be effected is perceptible beyond the range of variation. In the sorghum crop, for example, seasonal as well as field variations are high On an average, for the past 25 years, over an area of 80 acres at Nandyal Farm, the effects of these causes can be quantitatively expressed thus:—

	Per acre. lbs.	Per cent of total variance.
Seasonal variation.	135	49%
Differential field variation.	150	51%

Expressed in terms of the average acre yield of unmanured land, which is 370 lbs. per acre, these are respectively an annual variation of 37% and a field variation of 41%. Of these two factors the percentage of variance attributable to seasonal factors in the several experiments is as follows:—

	Percentage of variance.	Period.
Comparative trials	79%	15 years.
Manurial trials.	57%	8 years.

These figures are very high indeed and their extent has to be borne in mind as factors over which we have no control but with the working of which we are indirectly connected.

Variation due to agronomic factors. The next step in our enquiry will be to determine how far the variations induced by the several channels of agricultural improvements compare with these annual variations. For this purpose the data of the several agricultural experiments were analysed by the methods of variance of Fisher. The experiments were conducted from 1912 onwards and except for the restriction that the random arrangement of plots has not been followed, have been conducted over a large number of years with a fair number of repetitions to ensure statistical accuracy. Subject to the original designs, each of the manurial, cultural and varietal trials was conducted separately so that the effects of these are not strictly comparable. But by comparing each of these factors with the annual variations and the experimental error, over several years, the effects of the several factors can be expressed approximately on a common basis as follows :—

	Standard deviation in pounds per acre.	Period.
Seasonal variation	174	15 years.
Varietal „	118	„ „
Manurial „ (artificials)	176	3 „
„ „ (Cattle manure)	122	8 „
Block „ „	105	15 „
Experimental error	45	15 „

From the figures given, it will be seen that the variability due to 'artificial manuring' is the largest of the agronomic influences, followed by 'cattle manure' and 'varieties'. In general, it can be said that the larger the variability of a factor the greater the measure of improvement that can be effected. To understand more fully the influence of each, it will be necessary to know the actual increases obtained.

The extent of the different agricultural improvements on sorghum. From results of the several agronomic experiments the following table gives the increases in pounds per acre due to the several factors:—

Table I. Increases in pounds per acre due to the several agronomic factors.

Nature of factor.	Nature of control.	Value of control		Increase over control		Percentage increase		Remarks.
		Grain	Straw	Grain	Straw	Grain %	Straw %	
Manures.								
Cattle manure, super 1 cwt. & am. sulphate 2 cwt.	No manure.	370	1440	315	800	85	56	New Series.
Artificials only.	do.	do.	do.	250	700	68	49	(The immediate effect of manures applied to Sorghum appearing in alternate years in the rotation).
Cattle manure only (5 cartloads).	do.	do.	do.	97	230	26	16	
Cattle manure (continuous 8 years)	do.	433	1000	390	536	90	54	Old Series (single plots)
Poudrette (continuous 4 years).	do.	450	1510	406	920	90	61	do.
Varieties.								
N 23/10	T_6	557	1953	88	272	16	14	New Series
T_1	Local	410	1800	40	- 220	10	- 12	Old Series
T_6	do.	410	1800	20	- 100	5	- 6	do.
Spacings.								
28" Drill	10½"	464	1681	- 27	- 337	- 6	- 20	Old Series
16" do.	do.	do.	do.	- 40	- 200	- 9	- 12	do.
24" do.	do.	390	1502	39	- 443	10	- 29	New Series
20" do.	do.	do.	do.	- 15	- 418	4	- 28	
16" do.	do.	do.	do.	52	- 182	13	- 12	
24" do. Thinned to ½ as control.	24" Drill	429	1060	4	- 175	1	17	
20" do. Thinned to ½ as control.	do.	375	1084	66	- 68	17	6	
16" do. Thinned to ½ as control.	do.	442	1320	- 37	- 284	- 8	22	
10½" do. Thinned to ½ as control.	do.	390	1502	23	- 330	- 6	4	

(a) *Manures.* From the figures given in Table 1, it will be seen that artificial manuring gives by far the largest increase on the crop. The effect of the cattle manure is variable. In the first series of experiments (1913—24) it gave so high an increase as 400 lbs. per acre applied continuously over eight years in doses of 10 cart-loads per acre. This includes the accumulated residual effects. Recent trials have however not been so encouraging, the immediate increase being as small as 80 to 100 lbs per acre when applied alone or over artificials. Part of the difference is due to the smaller dose (5 cartloads), but it should be mentioned that there are residual effects. Although the extent of increase due to artificials is fairly high, their application is unfortunately not an economic proposition even when two years' residual effects on the succeeding cotton and *jonna* are considered. In the case of cattle manure, the profits depend more or less on cost, but considering the limited quantity of cattle manure available and the great demand for it in paddy lands, the area that can be covered is necessarily restricted. The results would also indicate that unless when applied in doses of 10 cartloads and more per acre the effect will not be appreciable. We are therefore left to conclude that although manuring is a marked channel of increasing sorghum yields, economic considerations prevent its utilisation to the full extent. Among other sources of manure that have been experimented with on the farm, mention may be made of the preparation of composts and poudrette [1]. Our present experience is that these can be made but the profits depend on the way in which the labour cost is calculated. One fact may be mentioned in this connection, and that is the high conserving value of poudrette. Results at the Nandyal Agricultural Station show that in four years of application of poudrette, the land has increased in fertility at the rate of 332 lbs per acre, per year, while, with cattle manure the increase has been only 78 lbs per acre for the same period. This would indicate the large possibilities of poudrette.

(b) *Varietal improvement.* Although this represents the easiest channel of crop improvement the magnitude of increase due to this cause is small, being within 100 lbs. per acre as can be seen from table 1. Considering that these figures refer to the highest increase from 17 years of comparative trials, with as many as 37 strains, they can be taken to be sufficiently indicative. Unfortunately, the fullest use cannot be taken of these increases, as the high-yielders have generally poor quality of grain. Popular opinion among ryots, however, seems definitely to favour a bold type of grain even at the sacrifice of yield. For instance, a bold-grained type such as T. 6 has been popular with the ryots for the past 15 years although with a small-grained strain, N. 23/10, we are not able to advance very much inspite of it being definitely higher in yield. Recent trials at the Nandyal station show

1. Manure prepared from nightsoil.

that considerable genetic variations exist in the size of the grain and that much improvement can be effected by choice of a suitable type. The quality of the straw is also another factor of varietal improvement. In Nandyal, two types of sorghum exist, one with sweet stalk and dull midrib and another with pithy stalk and white midrib. The two combinations were found inseparable for a long time but we have recently isolated the two types, of which the one with a white midrib and a sweet stalk has economic possibilities. Another channel of improvement on the genetic side is the percentage of grain to earhead, a character which is not affected significantly by such environmental influences as manuring. Although the magnitude of the varietal improvement is relatively moderate, it is still of importance on account of the above three characters.

(c) *Spacing experiments.*—An examination of Table I will show that under conditions of Nandyal the acre yields of grain are not significantly affected by different spacings. Closer spacings give more straw yields and are therefore preferable.

Environmental and genetic variations on the characters of the plant. From the point of view of the scientific investigator, it is not sufficient to know the quantity of the improvement; it is also useful to know the channels through which the variation is caused so that improvement can be effected through all sources. The sorghum crop especially, is very sensitive to environmental influences and the characters on which these effect are most marked, are also those in which varietal differences exist. The relative importance of these two factors can be understood by the following data from 22 varieties giving the influence of a border position in a plot on the several characters.

Table II. Analysis of variance. Border effect.

Variance due to freedom		Mean sqaure variance in character		
		Weight of head (grms.)	Length of head (c.m.)	Number of grains per head.
Varieties	21	495	113	364490
Border effect	1	27805	129	1188990
Differential response	21	212	36	180505
Random	88	87	67	50417

It will be seen that the effects due to varieties as well as the border position are very significant, the differences being very pronounced for weight of head and number of grains per head. In the case of weight of grain, it was found that there was a significant and progressive decrease in the character from the top of the head towards the bottom, as shown below :

Table III. Mean weight of 1000 grains along the earhead from top to bottom (grms.)

Average of	1st quarter (Bottom)	2nd quarter	3rd quarter	4th quarter (Top)
Centre heads	28·3	28·9	29·1	29·6
Border „	30·9	31·1	31·2	31·3

The analysis of variance for this character is as follows:

	Freedom.	Mean square.
Varieties.	21	87·8
Position along head.	3	146·1
Interaction of variety & position.	63	3·2
Border effect.	1	8525·4
Interaction of border and variety.	21	20·0
Random	418	6·8

The figures give very clear evidence, as to how large an influence is exerted on the earhead characters of the sorghum crop by such a purely environmental variation as border effect, ascompared to the varietal factor.

The weight of the earhead. As a next step in the enquiry, the influence of the different environmental and genetic factors on the weight of the earhead was investigated from the several agronomic experiments, this character being very important for yield. The results are as below:—

Table IV. Influence of th different agronomic factors on the weight of earheads and the number of earheads per plot.

Nature of factor.	Nature of control.	Weight of earheads (gms).		Number of earheads perplot of 2 cents.	
		Increase over control.	Value of control.	Increase over control.	Value of control.
Border influence.	Centre heads	28·9	17·5	...	...
Varieties.					
(Maximum effect).	Local	4 7	12·8	—45	478
				20	478
Manuring.					
Artificial & cattle manure.	No manure	8·4	15 3	21	465
Cattle mauring.	„	2·6	15·3	—33	465
Artificials.	„	3·5	15·3	78	465
Spacing.					
24″ drill.	10½ drill	6·9	9·1	—169	498
20″ „	„	4·7	9·1	—174	498
16″ „	„	1·6	9·1	— 43	496
Thinned to half as control. 24	24″	5·9	16·0	— 80	329
20″	20″	5·9	13·8	— 51	324
16″	16″	2·9	10·7	—122	455
10½″	10½″	2·7	9·1	— 94	498

Leaving out of consideration the border influence which is very high due to the limited sphere of its action and taking as the basis of comparison the maximum values as representing the possible increase due to each factor, it is seen that the influences of manuring and spacing on the earhead weight are to higher than that of the varieties. As these figures are obtained from large samples made from bulk fields, the result can be of wide application. For purposes of yield studies, however, the earhead weight is not the sole factor influencing the result. Recent studies have shown that this character is profoundly affected by changes in population. In the spacing experiments, for example, every increase of spacing whether between lines by use of drill or within lines by thinning, produced a pronounced and statistically significant increase in the size of the earhead, as given below, although the acre yield is not affected.

Table V. Spacing experiments—Analysis of variance.

Variance due to.	Freedom	Mean variance in the characters.			
		Yield of grain.	Yield of straw.	Average wt. of grain per earhead.	Number of earheads per plot.
Drill spacings.	3	230·6	63·4	·0581	36819
Thinnings (wide & narrow).	1	181·6	97·5	·0700	47633
Interactions.	3	137·7	7·2	·0047	2313
Blocks.	2	3355·2	122·7	·0039	17096
Random.	14	298·6	10·7	·0078	3810
Significance of spacing effects.		Not significant.	Significant.	Significant.	Significant.

This high response of earhead weight to population seen above, makes any improvement in earhead weight alone of practically no value. What is wanted is an increase of population as well as earhead weight. From an examination of Table IV, it will be seen that the plots manured with artificials alone or combined with cattle manure, satisfy both these conditions. We are not in a position to state why cattle manure gives a lower number of earheads per plot than the artificials, although in both cases the same seed rate and conditions of sowing were employed. If mere increase of the yield is the problem on hand, the application of artificials and the use of a moderate seed rate appears to be the best method from the farm data for both grain and straw. As already mentioned, considerations of cost do not justify the use of artificials at present.

Rainfall, 'trend' and date of sowing influences. We have already mentioned that the influences of the several agronomic factors are superimposed on the already existing variations of soil and season. At the Nandyal Agricultural Station no work has been done yet on the nature of the soil influences and the effect of tilth on yields, but as

mentioned in a previous section the nature of the influence is sufficiently high (S. D. 150 lbs per acre) to warrant intensive study. In regard to the seasonal variation, it will be interesting to know the nature of influences at work. Part of these changes is due to a cyclic influence or 'slow trend' which takes place independently of the weather. The nature of this influence is given in Fig. (1) from which it will be seen that the yield of sorghum exhibits a tendency to high and low yields once in seven years. The magnitude of this influence is however moderate being less than 15 % of the total variance. With regard to weather elements, we have data of rainfall and yields for the past 25 years, from which we find that the nature of the rainfall influence on the jonna crop is limited, the average effect due to every inch of additional rainfall in pounds per acre at different periods of the year being as in Fig. II (Fisher's method of multiple regression by polynomials. Phil. Tran B. 213, 1925). The percentage effect of rainfall on yield is however small and the effect is not statistically significant ($R = 0{\cdot}4$ $P > {\cdot}05$) We can therefore conclude that the existing variations in the amount or distribution of rainfall at Nandyal does not materially affect yields. In a similar manner, the date of sowing, and changes due to variations in rainfall—incidence, which ranged from the middle of September to the middle of October, had no significant effect on yield ($r = 0{\cdot}289 \pm {\cdot}121$). It was also found that the effect due to soil deterioration was practically nil (less than 1%). That the soils have been maintaining their fertility may be due to the better tilth on farm lands and to the effect of improved varieties. It is seen, however, that no significant increase in fertility on cropping power has occurred during the past twenty five years, probably because the quantity of manure applied (3 or 4 cartloads per acre once in four years) is hardly enough to add to fertility. An examination of all of the above factors shows that more than 60% of the seasonal variation is due to causes other than those above mentioned. Although this variation is high, the analysis of the several agronomic experiments show that the effects of manuring, varieties etc. take place independently of the annual variation, and are statistically significant in most cases. The extent to which they contribute to the acre yield have already been discussed in a previous section.

Effect of size of the earhead and quality of grain on the succeeding crops.—As channels of increasing yields, mention may be made of the effect of grading grain which is being employed in Bombay ; and in our own Province the studies of the cropping power of seed in relation to manurial practice have been undertaken by Viswanath and Suryanarayana. In Nandyal we have got only one year's trial of grading the seeds and the results are not consistent or statistically significant. With regard to the other aspect, we have been experimenting on the effect of sowing grain obtained from different sizes of earheads in our row yields. We have found that in all the

Fig II. AVERAGE EFFECT IN POUNDS PER ACRE OF EVERY INCH OF ADDITIONAL RAINFALL ON THE SORGHUM CROP AT NANDYAL

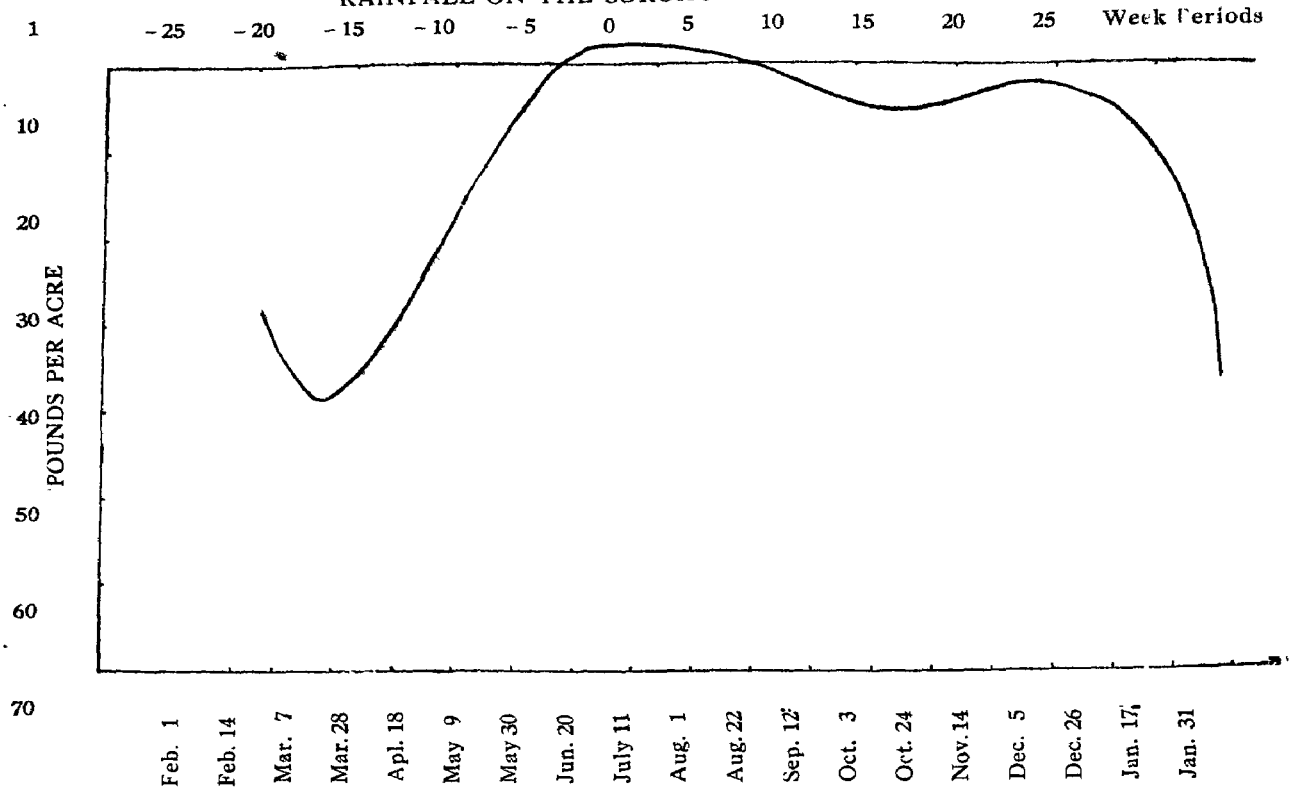
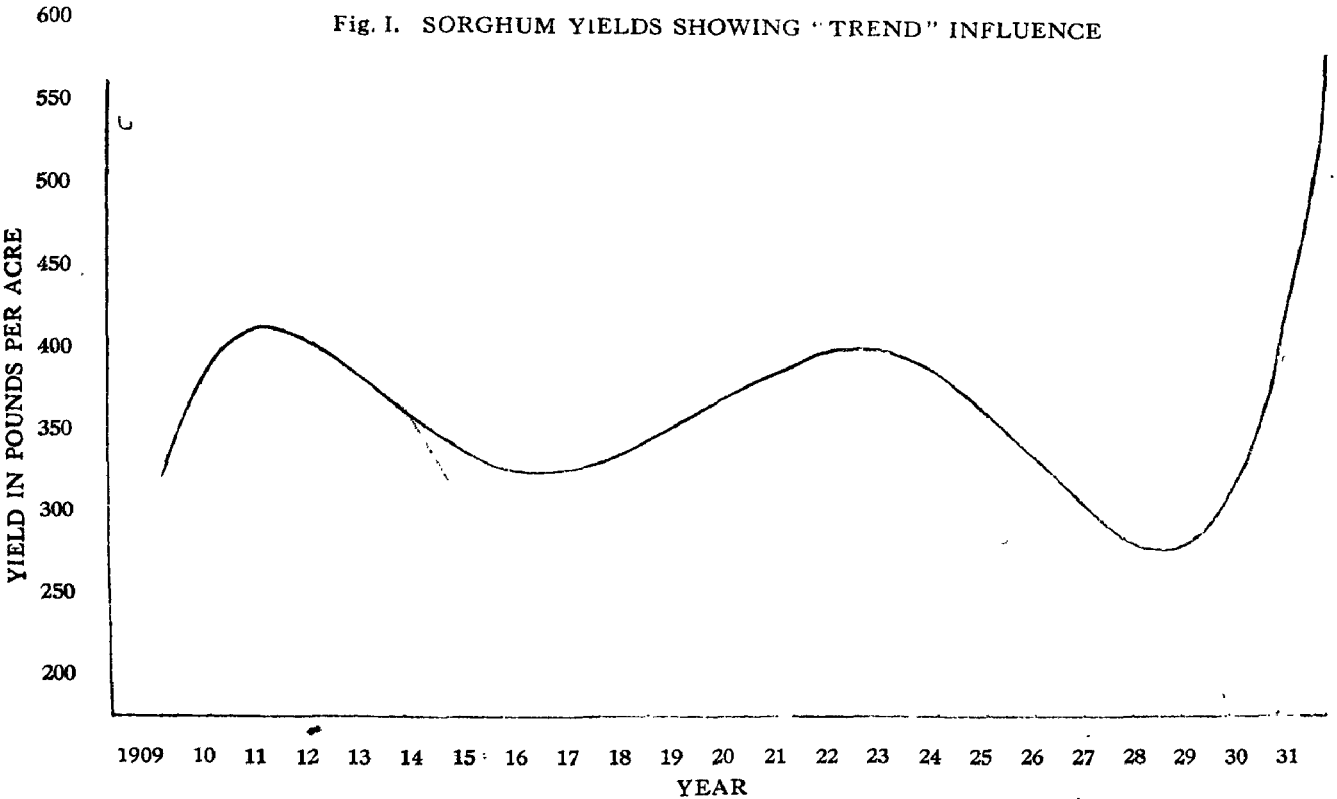


Fig. I. SORGHUM YIELDS SHOWING "TREND" INFLUENCE



characters—weight, length and circumference of head—the correlations between parent and offspring were invariably negative as follows:

Table VI. Correlation of parent and offspring in sorghum characters

Strain No.	Weight of earhead.	Length of head	Circumference of head.	Height of plant.
25/102	—·701	—·530	—·610	—·203
26/15	—·324	—·272	—·133	—·338
26/116	—·644	—·365	—·418	—·421
28/3	—·854	—·282	—·577	—·212
29/68	—·728	—·755	—·276	—·743
Mean value of '*r*'.	—·650±0·059	—·441±·061	—·403±·060	—·383±·066

Although the correlations are significant in the large majority of cases, there is no relation between the weight of the head sown and the yield of the progeny row ($r = 0{\cdot}145 \pm {\cdot}104$) and only a slight one between the number of earheads per plot and the yield ($r = {\cdot}310 \pm {\cdot}093$). There is however significant correlation between the weight of the earheads sown and the number of plants in the row ($r = 0{\cdot}649 \pm {\cdot}062$). The inference is probable from this that the greater weight of earhead has produced a larger number of plants which persisted in spite of thinning and that these have responded to closer spacing by a smaller size of earhead as in the spacing experiments discussed in a previous section. The results indicate the importance of keeping the number of plants constant in such studies although the authors recognise the practical difficulties in handling sorghum. There is, however, nothing in these results at variance with Viswanath's findings as the seeds he used were obtained from manured land, and were therefore different.

Conclusions.—We have so far endeavoured to show the possible limits of different agricultural improvements on the sorghum crop, and the relative importance of genetic and environmental influences increasing its yield. Manurial improvements have been found to have relatively higher intensity than varietal forces but application of artificials is however, excluded by cost considerations. The value of poudrette as a manure appears very promising and our present efforts are concentrated on the making of this and other organic composts on a large scale. The sorghum crop is shown to be very sensitive to environmental influences and responds significantly to even small variations in spacing and very considerably to manuring or border effect. A wide variation in soil is indicated in the tract and the possibilities of more intensive tillage are still to be investigated. Methods of grading the seed towards increase of yield are under study. Although seasonal variation is very high in the crop, some of the environmental, influences such as manuring, compare favourably with such variations and the possibilities of maintaining a moderately high yield irrespective of the season by intensive methods, are indicated.

INSECT PESTS OF STORED AGRICULTURAL PRODUCTS & THEIR CONTROL

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Introduction. Every cultivator is aware of the fact that it is not alone the crop growing in the fields which suffers from insect attacks but that insects of different kinds also do harm to stored agricultural products. It is well-known that preservation of grains, pulses, etc., for seeds and other purposes is often a serious problem among farmers everywhere. Commodities like grains, pulses, oil seeds and various dry vegetable products are the chief materials which suffer from such damage and the injury so caused is often very substantial. Farm granaries, provision and grocery depots, drug stores and flour mills are the chief haunts of these insects. It must, however, be noted that the great majority of them are quite different in their food habits from those affecting growing crops, and their activities are almost exclusively confined to stored products. A very brief account of the more important store insects with some directions for their control is given below.

Important Store Pests. The important insects affecting stored products of different kinds are the representatives of only two insect groups, viz., the *Beetles* and the *Moths* and between these two, beetles are far more represented and of greater importance than the moths. Beetles are also comparatively more destructive because of the fact that both the larva and the adult beetle attack the stored product while among the moths it is only the larva or the caterpillar that does the damage. The following are the most important and well-known beetles.

Beetles. (1) *Rice Weevil* (i) This is a small dark brown creature, one-eighth of an inch in length with a cylindrical body and a prominent curved snout. It is a very well-known insect found every where; though it is specially bad on rice it is also found on other grains like wheat, maize, sorghum, and their products.

(2) *The red flour beetle* (ii) This is a small elongate flattish red beetle about one-sixth of an inch in length. It is an extremely common creature and is found to infest almost all stored products like grains, oil seeds, etc. ; it is a special pest of articles, like rice, wheat flour, pulse powder, biscuits, bran, etc. The elongate white larvae are found in infested material. This insect is also fond of museum specimens like dry insects, and insect collection boxes not properly disinfested often become subject to the infestation of this insect.

(i) *Calandra oryzae*, L. (ii) *Tribolium castaneum*, H.

(3) *The paddy borer beetle* (iii) A dark brown beetle measuring about one-sixth of an inch with a stout globular head. Though not so common as the two insects noted above, it occasionally becomes a serious pest of stored paddy; the adult beetles and their young ones bore through the husk of the grain, feed on the contents and turn it into chaff. It is also sometimes found in other grains with other beetles.

(4) *The drug store beetle* (iv) This is a minute brown beetle found boring into all kinds of dry stores like turmeric, ginger, coriander, etc., vegetable drugs of different kinds and practically all dry vegetable matter. It also attacks books and records boring minute round holes in them.

(5) *The tobacco borer beetle* (v) This is a well-known and widely distributed pest of dry tobacco in all forms such as cigarettes, cigars, etc. It is almost very similar in appearance to the drug store beetle and with its hairy whitish grub bores into dry tobacco. It is also known as the 'Cigar-borer' beetle.

(6) Pulse beetles (vi) These are small active roundish beetles about ¼" long; the body is abruptly rounded behind and the hind legs are stout at the base. These beetles are easily recognised and are closely associated with pulses of all kinds; their eggs are found laid as minute white scales on infested seeds and the grubs bore into them by cutting a neat hole. These are often serious and cause appreciable loss to cowpea, grams, lablab, etc.

Moths. As stated above these are very few compared to beetles and the important ones are (1) The Paddy moth (a) This is a very small shining insect found flying in numbers inside infested granaries and causing considerable damage to stored paddy: it is also found in maize and cholam stores. As stated above, it is the catterpillar of the moth that bores into the grain and turns it into chaff,

(2) *The Meal worm moths* (b) Two or three different species are found in S. India; the caterpillars of these infest flours, dry nuts, grains of different kinds and dried vegetable stuffs. They remain inside tubular galleries made up of the powdery matter, the loose grains, etc., being all webbed together in a connected mass, this infestation is very commonly noted on badly preserved wheat and other flours, rice, cholam, cashew-nut, groundnut, etc.

General life habits of store pests. Almost all the insects noted above are more or less similar in their life habits. They breed and multiply so rapidly that all the different stages are found on the same food material, and once infested the material is very badly damaged in a very short time. The pests get dispersed very easily from place to place with consignments of infested material conveyed by road, rail or waterway.

(iii) *Rhizopertha dominica*, F. (iv) *Sitodrepa panicea*, L (v) *Lasioderma serricorne*, F. (vi) *Bruchus* spp. (a) *Sitotroga cerealella*, O. (b) *Corcyra cephalonica*, H. and *Plodia interpunctella*, H are the two chief species.

Control measures. The effective measures for controlling insects affecting stored products and for preventing damage and loss are thorough cleanliness and proper treatment of the material before storage. In the way of preventive measures there are three fundamental points to be remembered.

(1) *Proper condition of the cellar, bin or vessel before storage.* Before a consignment is stored, the store house or any vessel in which it is going to be stored should be made thoroughly clean and free from any traces of loose grain, chaff, bran, etc; the corners and bottom of the vessels and any cracks in them which often retain bits of matter should be well cleaned. If this is not done the infection that would linger will spread and spoil the stored material,

(2) *The proper condition of the product to be stored.* The grain, pulse or other products should be thoroughly dried and made free from husk chaff or any extraneous matter which would carry the infection into the store room or vessel. No useful purpose is served in storing already infested seed in a cellar or bin, however clean the latter may be.

(3) *The proper condition of the material and the container after storage.* Once the material has been stored, the granaries, bins or vessels should be completely clo ed up and remain insect proof; otherwise they are liable to get infested sooner or later. Even the best lot of seeds, kept in very clean vessels, will get infested if kept exposed; baskets, open pots or jars or loose gunny bags do not keep seeds in good condition. If these three fundamental conditions are attended to properly it means that infection is prevented through all the three important channels, viz., the store room, the stored product and later exposure. In this way, a considerable degree of relief can be experienced from store pests.

It is, however, found that in some cases stored products, even after bestowing such attention as described above become infested with beetles or moths when examined after sometime. This is due to the fact that the products before storage frequently contain the minute eggs or larvae of some of these insects which might have escaped our notice and withstood the ordinary mechanical methods of drying, cleaning, etc., and multiplied in storage. To guard against such a contingency, valuable lots of grains, pulses, etc., may be given some special treatment which would destroy all traces of insects lurking in them before storage. One of the best known methods in this direction is what is known as " Fumigation " by an insecticide.

Fumigation. This is the process of subjecting insect infested material to the fumes of a poisonous gas which would destroy all traces of insect life in the material to be stored. It has been found that stored products remain perfectly free from insect attacks if they are fumigated and preserved in clean insect-proof containers. It must be remembered, however, that fumigation does not make stored products immune to further attack if they are not properly preserved

after the process. The fumigant commonly used at present for such purposes is a liquid called carbon-bi-sulphide. The process is as follows:—The material to be fumigated is put into any vessel or container which can be tightly closed after the operation. A measured quantity of the chemical is poured on some cotton wool kept over the grain or other material inside the box and the same immediately closed. The box is left closed for 24 hours for the insecticide to act and then it is opened and the fumigated stuff freely aired and stored in insect-proof containers. The usual dose is one ounce of the liquid to every fifteen cubic feet of area enclosed and the period is generally 24 hours. During this period the carbon-bi-sulphide inside the box evaporates and the heavy gas penetrates the seeds and destroys all insect life. In carrying on fumigation with carbon-bi-sulphide which is an evil-smelling inflammable liquid some precautions have to be taken and only trained hands should do the work. The chief precautions are—Do not bring any lights near carbon-bi-sulphide or the fumigation chamber during the process. Do not take a bottle of carbon-bi-sulphide near a fire or naked light nor allow it to get exposed to the sunlight or become heated. Store the chemical in a properly stoppered bottle and under lock and key. Fumigation with carbon-bi-sulphide should be done in a place where no one can get access during the process. The gas is also poisonous to human beings and as such one should leave the bin or room immediately after pouring the liquid and closing the room. If the dose and the time limit are properly adhered to, the fumigated material will not suffer in any way—either for seed purposes or for consumption. There are also other fumigants now tried in western countries. These include hydrocyanic acid gas, sulphur fumes and ethylene dichloride; it is claimed that ethylene chloride has properties which make it not only a very effective fumigant but also a safe substance to deal with.

There are various other methods such as the use of hot air and metallic mercury, storage in underground cellars, etc., to defeat granary pests; the employment of hydrated lime in preserving seeds, of beans, peas and other pulses from beetle attack; covering seeds, etc., with a layer of sand to prevent beetle breeding; spraying the seeds and give a protective film of oil or emulsion to keep away moths and beetles; use of naphthalene in the preservation of seed grains, etc. We also meet with various other local methods of storage and different kinds of vessels, bins, granaries, etc., devised and used for the purpose in different tracts; but very few of them are known to be very effective or reliable in keeping away store pests. For all general needs, however, the instructions given above regarding the preliminary treatment and proper storage of the products will be found quite sufficient. As stated above, a great deal depends upon general cleanliness and the carrying out of the preventive measures suggested above.

ABSTRACTS

Population Pressure and the Migration Problem in Asia. By Dr. Radha Kamal Mukerjee, M. A., Ph. D, *Indian Journal of Economics*, July and October 1933.

India, South-east Asia and China contain nearly half the people of the entire earth. Asia west of the Indus and immense Siberia are relatively empty. In Siberia the population is one person per square mile. It is said that this country has about half a million square miles of good cultivable black soil. A great portion of this area has been occupied by Russians and therefore not available for people migrating from other parts of Asia. Russians have developed this country, constructed roads, railways and canals. Russian expansion in the east and south-east has been prevented by countries already densely populated, like China and India.

Colonisation of Manchuria. Manchuria, containing one of the richest soils of the world, is largely peopled by the Chinese who freely migrated into the country. In the year 1927 over a million Chinese colonised in Manchuria. The number of Japanese residents at present number just over 2 lakhs. There is now no more room in Manchuria for further emigrants and many Chinese migrate during busy seasons and return to their native land. Out of the total Japanese population only about two thousand are agriculturists, as they find it hard to compete with their more hardy Chinese brethren, not only in general cultivation but also in developing new countries. The Chinese more easily adapt themselves to new conditions. The semi-tropical agriculture of the Japanese is not suited to Manchuria with its long severe winters. The standard of living of the Japanese is much higher and they lack those habits of thrift noted in the Chinese settlers from the most congested parts of China. The seasonal migration of the Chinese seems to have been long established and more or less given them a preferential right to settle permanently. The laws of land tenure in Manchuria do not permit acquisition of ownership or the practical right to lease land for settlement or for any other purpose. The civil and military administration of the Japanese has been greatly responsible for peaceful conditions prevailing in Manchuria, till recently. However, "Manchuria as an outlet for Japan's surplus population or as a foothold of Russia's political expansion has not materialised."

China's population pressure. It is greatest in plains adjoining the rivers. In the wheat and millet growing regions the extent of economic holding is about 4·7 acres and in the rice-growing areas, it is about 1·7, to support a family of 5 persons in reasonable comfort. But it has been investigated that in these regions 33 per cent of the holdings are less than one acre in extent and 55 per cent more than one and-a-half acres in extent. The average size of the families who have about one and a half acres is 5·7. According to Professor Dittiner, "There is no evidence that the population of China is increasing at all, and there is every evidence that the standard of living has struck bottom; that a Malthusian balance has been at last attained." Human power is ridiculously cheap in China. Even women are yoked to the plough. Farmers in the United States use ten times as much power as the Chinese farmer has at his disposal. But the latter takes extreme care to utilise all organic waste for manure purposes. It is this that keeps up the fertility of land in crowded China, though the fragmentation of holdings and size of plots are much worse than in India. "China is sustaining nearly four times as large a population as that of the United States on about one-half as large a crop area."

The Problem in Japan. Taking the countries as a whole Japan has a greater density of population than China. The ratio of crop land to population is lower

in Japan than in any other country. The available cultivable area is utilised to the best extent. But only about 15 per cent of the total area is arable. The area under pasture is next to nothing and the cattle population is least in Japan. A great majority do not eat meat and its place has been taken by soybeans. In the Western Countries and Australia the consumption of meat is very great. All the available area in Japan is grown with rice and owing to intensive cultivation the average yield is as high as 2350 lb. per acre. There is very little new area to be brought under cultivation and therefore the expansion margin has reached saturation point. The surplus population of Japan has to find new industries for occupation or new lands for colonisation. This is the reason why Japan is keen on having some control in Manchuria, but the limit of Japanese colonisation seems to have reached in this country owing to overwhelming competition from the Chinese. Japan possesses Korea and important concessions in Shantung, Siberia and Formosa. Japan has to live essentially as an industrial country like England, but the chances for emigration to America, Canada and Australia have become poor. Only about 50000 Japanese now migrate to foreign countries annually. There are however a large number of labourers and others of Japanese origin, in Brazil, Argentine and Mexico. According to Japanese economists it is said that 'a progressive and virile nation is being bottled up in a small territory with inadequate food resources and raw materials.'

India's rural density. In portions of certain provinces, particularly in Eastern Bengal the density of population is much higher than that of China or Japan. Eastern Bengal has as much as 3000 persons per square mile. This tract is one of the intensely cultivated one, with paddy, jute etc. To the general population must be added the cattle population of India which is about 500 per square mile. Enough fodder and food must be produced to supply the needs of the cattle and human population. The pressure upon land is indeed very great in many provinces. In the U. P., Bihar and Bengal there are 2 to 2½ acres per worker in agriculture, but in Europe it is about 25 acres.

Taking the total cultivated area of India it is found that there is about an acre per head, the area under food-grains being only half of this; whereas in the United States the area of cultivation land per head is about 12 acres. 36 per cent of all the cultivators in the United Provinces are living below the economic level and 52 per cent are just about or a little above this leval.

Emigration in and out of India. Owing to the pressure of population in the richer tracts there has been a steady stream of labourers migrating into undeveloped areas in Assam, Central Provinces and Burma. In many parts of India as in the Gangetic valley and the deltas, the percentage of cultivated to cultivable area has risen up to well over 90 per cent. In 1931 about 1½ million persons were found in Assam born outside the province. The normal annual food requirements of the Indian population including cattle always fall short of the annual production, by many million tons. A statement given of emigrants that sailed from Calcutta during the years 1901 to 1917 shows that the number has been greatest from districts of Northern India where the density of population is generally greatest. However the sparsely populated tracts of the Central Povinces have contributed some emigrants to Assam. The emigration to foreign colonies diminished considerably after 1917, when indentured emigration ceased and due to restrictions imposed by foreign countries on unrestricted colonisation. Such emigrant labour has to be absorbed within the country by growing industries for which there seems to be wide scope. It is the opinion of some that countries like India and China multiplying population at a rapid rate, should not have freedom to emigrate freely to other countries as they would lower the standard of living in those countries. It is now observed that the oriental countries

though increasing in population every decade, do not do so at such increasing rates. The rates are now falling. The following is an extract from the statement of decennial rate of increase, per cent during 1920—1930.

India	14·6	Canada	18·0
China	5·6	Australia	19·0
Japan	9·4	Brazil	35·4
Germany	7·8	Argentina	30·8
United States	16·1		

"The increase of urbanisation, the rise of the marriage age, the diminution of the size of the family and the programme of birth-control all testify to a new trend in population growth in Japan." The Northern races on account of free colonisation and exploitation of the resources and products of the tropical countries have been able to keep up the standard of living and comfort and also the industrial expansion. The European expansion in Asia, Africa and Australasia has been mainly responsible for the high standard of comfort of the 'enlightened humanity'. In Australia the number of European working class is very small compared to the large area of the country. In South Africa, on the other hand, there is competition with the natives and the Asiatics.

Standard of living. The standard of living is much lower in the tropical countries. The natives of the soil can work and thrive more successfully than the white settler. In free economic competition the natives or those emigrated from tropical countries have an advantage and therefore are more successful. "The average basal metabolism of the Indians, Chinese and the Japanese has been found to be 5 to 15 per cent. below the English and American standards." Such low basal metabolism of the Oriental has been due to physiological and climatic causes and it is part of the racial make-up. Among these three, the average metabolism is greatest in the case of the Japanese, next in the Chinese and least in the case of Indians. The following figures have been worked out in the United Provinces.

	Basal Metabolism.	
	Calories	Diet
British working Man	1,700	3,500
Indian Peasant	1,200	2,400

This would mean that the Indian can work in warm regions with a much smaller consumption of fats and carbo-hydrates unlike the European. The smaller average weight of the Oriental man is a corollary of this. Low standard of living of the Oriental is therefore an economic advantage. The vegetarian diet seems to be more suited to the warm and humid climate of the tropics, where competition between man and animal for food is keen.

Owing to the physiological difference and the colour of the skin, the brown or the dark man keeps up his health better and turns out better work. The coloured man has more sweat glands than the Europeans and therefore the former loses less heat in work. It is observed that tropical peoples show a decrease in the rate and volume of respiration.

The adjustment of population to resources in the world, i.e., migration and colonisation, is governed largely by the strong tendency for population when faced with a limited food supply in the homelands, to migrate to similar climatic regions where they meet with congenial conditions. "To such new regions they bring adaptive crops and animals, agricultural methods and practices." Racial bias or colour prejudice should not impede the solving of the problem of free colonisation and settlement in the future.

Political Interference with Economic Evolution. There should be full freedom for the people to develop economically and industrially, without any superimposition of political authority. Free competition in colonisation and immigration should be encouraged according to the resources of the tracts. "Nothing is more certain to disturb regional balance than the bolstering up of an artificial standard of living which takes from the region more than it gives, reducing the opportunities of future generations." Owing to their political supremacy the Northern Races have disturbed rather than helped the sound economic condition of the masses of the Oriental countries.

Some facts about Population. Statistics show that in India and Japan the birth rates are higher, Japan having highest average in the world. It has already been seen that the rates of increase of population are much less in India and Japan than in United States, Canada and Australia. Between 1910 and 1920 the population of Japan increased by 12 per cent. whereas the area under cultivation was increased by only 5 per cent. By 1930 the increase was about 15 per cent. The nation has therefore to depend more and more upon imported supplies and emigration. The following table shows the recent figures of birth and death rates and natural increase in countries of the Pacific region.

Country	Year.	Birth-rate.	Death-rate.	Rate of natural increase.
India	1929	35·47	25·95	9·5
Japan	1930	32·35	18·17	14·18
Australia	1930	19·8	8·5	11·3
Canada	1931	24·5	11·0	13·5
United States	1930	18·9	11·3	7·6

The pressure of population is greatest in India, Japan and China whereas in the other Pacific countries it is far less as they are sparsely populated. This accounts for the economic and political difficulties which arise constantly in the former countries. "The population and food problems of the Orientals cannot be solved without the fair sense and enlightened co-operation of all the nations bordering the Pacific." It is estimated that Australia could easily support a population 75 times the present number and South America 40 times.

S. V. D.

Agricultural Wealth from waste. Activated Composts by R. D. Anstead. [*Tropical Agriculture, Vol. XI, No. 3—1934.*]

Soil Humus. Soil humus plays an important role in crop growth. It helps favourably for all biochemical changes in the soil, enhances the usefulness of artificial manures and also enriches the vitamin contents of food crops. The application of organic manures to maintain the soil humus has become essential and the problem of obtaining an adequate quantity (especially where farm yard manure had become scarce) centred about the proper utilization of *town sewage* and *town refuse.* The town sewage is handled under "Activated Sludge Process" and the "dry sludge" obtained as a final product contains 64—70 per cent organic matter, 3·5 to 7 per cent nitrogen, and 2 to 4 per cent. phosphate. The town refuse can be converted into useful manure in a short time by mixing it with liquid activated sludge and turning it from time to time. The whole heap rots very rapidly and becomes fine humus. Besides, there are many waste products in farms such as weeds, crop residues and roughage from ditches and roadsides, and they can similarly be converted into a final product rich in humus, capable of slow oxidation to liberate nitrogen for crop growth.

Method of preparation. In actual practice a systematic and continuous process of manufacture of these activated composts, as they are called, can be devised. Such a process may be briefly outlined as follows:—

The waste material is made into a heap three feet wide at the base, two feet high, and six feet long, big material being chopped into pieces about two inches long. This heap is thoroughly mixed and moistened with an " activator ", which may be cow dung and urine, or night soil emulsion, or sewage sludge, or in the absence of all these, Adco, or a solution of sulphate of ammonia. Rapid fermentation and rise in temperature will result and after a week or so the latter will fall and the fermented material now itself constitutes the "starter" or "activator" for further heaps. A quarter of the heap is now removed to form the basis of a second heap, and the first heap is made up to its original size with fresh waste material and well mixed again, more "activator" solution being added. Fermentation will again take place with a rise in temperature. As this falls a quarter is again removed and added to the second heap. This procedure is repeated until the second heap is the same size as the first. The next operation is to form a third heap in the same way removing a quarter of the second heap as a basis, and at each operation transferring a quarter from heap to heap, fresh material being added to the first heap only.

The process can now be made a continuous one, fresh material being constantly added to the first heap and the finished product removed for use from the third heap. Should the waste material used prove very refractory, a series of four heaps may be necessary, but three is usually sufficient.

In course of time it will probably be found that the fermentation becomes more rapid owing to the development of large numbers of the micro organisms specially suited to the local conditions, and it may then be possible to take away half of each heap at a time and thus speed up the process.

The time required to get the three-heap-system going will vary with the character of the waste material used, the activator, and the local conditions of climate &c., but it should not exceed three months, and after this, compost can usually be withdrawn for use every three weeks or so.

Moisture is an important factor and in very dry climates water may possibly have to be added to the heaps before the process is complete. When this is necessary it is a good plan to use the " activator " solution for the purpose if it is available in quantity. No hard and fast rules can be laid down, however and the exact technique suitable to the local conditions must be discovered by experiment.

The area and volume of the heaps required will depend upon the quantity of the refuse to be dealt with. If larger heaps are required they may be lengthened, but they should not be materially increased in height or width. Packing of the material must be avoided and conditions kept aerobic or the wrong kind of fermentation will take place, with the development of bad smells and loss of nitrogen. For this reason heaps are superior to pits, as the latter usually become anaerobic and give trouble. In the majority of cases where difficulties have occurred with the process they have been due to packing of the heaps and the onset of an anaerobic fermentation.

Value of Activated Composts. The actual composition of activated composts produced in the way suggested naturally varies to some extent with the nature of the waste material used, but the nitrogen content is usually in the neighbourhood of one per cent. and they are comparable with good farmyard manure.

S. R. S.

The Development of Coffee production in the Empire. (*Bull Imp. Inst. Vol. XXXI. No. 4. 1933. Pp. 507—529*). An exhaustive account of the development and the present position of coffee industry in the Empire is given in this article. In the present century the production of coffee in the British Empire has risen from

12,000 tons to 50,000 tons per annum. In the same period the world's production has grown from roughly 1 to 2 million tons. Although the Empire's output has increased by over 300 per cent., its share in the world's production has only risen from 1·2 to 2·5 per cent.

A complete account of the history, development and varieties of coffee grown in the several countries of the Empire is also given in great detail. Briefly put, the present position of coffee in the Empire is that *Arabica* of a good "mild" type is being produced commercially in South India, Jamaica, Kenya, Uganda and Tanganyika; *Robusta* in Uganda, Tanganyika and Trinidad and on a smaller scale in several other countries; *Liberica* in British Guiana and British Malaya.

Coming nearer home, it is gratifying to note that India maintains its position as the largest producer of coffee in the British Empire, the area in 193.–32 being about 170,000 acres. Of this area 25 per cent is in Mysore, 24 per cent in Madras, 22 per cent in Coorg. and the remaining 2 per cent. in Cochin and Travancore. The annual production of coffee during the five years ended 1931–32 fluctuated between 13,000 and 18,000 tons. P. S. S.

Bacteria in Dairy products by L. A. Rogers. (*The newer knowledge of Bacteriology and imunology* by Jordan and False, pp. 395—402).

Fermented milks have become an important part of diet of many people in different parts of the world. The simplest fermented milk is produced by inoculating pasteurised milk with Steptococcus Lactis. The flavour and consistency of fermented milks vary according to the strains of St. Lactis responsible for the fermentation. The ropy milk known as "Taette milk" in Scandinavia, and the sour milks known as "matzoon" in Armenia, "Leben" in Egypt and "Yoghourt" in Bulgaria and Turkey are some of the different types of fermented milks produced by various strains of St. Lactis. Fermented milks specially soured by Lact. Bulgaricus, which has been styled as "Bacillus of long life" and Lact. Acidophilus are of great therapeutic value.

Some main dairy products of commercial interest are condensed milk, evaporated milk, milk powder, ice cream, butter and cheese.

Condensed milk, is milk preserved by the addition of cane sugar and subsequently by evaporation to a little less than half its original volume. The bacteria usually found as contaminants in condensed milk, are yeasts, and a few coccus, which will thrive when the sugar is low.

Evaporated milk is milk concentrated under vacuum to little less than half its original volume and preserved by heat sterilisation. Even this milk is subjected to spoilage due to spore-forming bacteria which survive the sterilisation, such as B. Coagulans, bacteria of the Butyric acid group and spore forming putrefactive type.

Milk powder is manufactured by two processes. (1) The drum process, where the milk is spread in a thin film on the surface of steam heated revolving drums either at atmospheric pressure or in vacuum and the dried film removed by Scrapers and powdered. (2) The spray process, according to which the milk is exposed to pasteurising temperature or at higher temperature to kill bacteria before drying. The bacterial numbers diminish in milk powder in storage. The change in its flavour and physical properties are evidently due to the oxidation and other chemical processes rather than to bacterial activities.

The ice cream is seldom free from bacteria and not unfrequently it is associated with pathogenic organisms like Typhoid, Scarlet fever and Diphtheria.

Butter is usually prepared from cream soured or ripened by inoculation with lactic acid bacteria to develop acidity and flavour. The natural flavour of butter

is partly due to the natural flavour of cream and partly to volatile compounds produced by bacteria. The aroma produced by a mixed culture of St. Lactis and Steptocoin is better than that caused by a pure culture of St. Lactis alone.

In the manufacture of cheese different types of micro organisms and enyzmes of milk especially the pepsin take part. The type of cheese produced and the biological sequence responsible for it are influenced by temperature, water required, the amount of salt, the method of incorporation, and the temperature of curing. The simplest cheese undergo no ripening and depend on the lactic fermentation only for their flavour. Hard cheeses such as Cheddar, Edam, Emental or Swiss and Parmesan are made from milk curdled with rennet. In this process, the insoluble casein is converted into soluble products due to the action of bacteria and enyzmes. The usual contaminants of cheese are bacteria of the colon-aerogenes of imp, putrificus bacelle producing disagreeable effect as pigment forming bacteria causing red spots in cheese and toula yeasty rendering the cheese better to taste.

T. R.

Gleanings.

The Role of Research. The election of Major Laguardia as mayor of New York City gives interest to his record in support of scientific research. As a member of the seventy-second Congress, speaking on December 28, 1932, in opposition to eliminate an item of approximately S. 39,000 from the agricultural appropriation bill, he said in part:

"Mr. Chairman: Science knows no politics. Are we in this frenzy of economy, brought about by those who control the wealth of this country, seeking to put a barrier on science and research for the paltry sum of S. 39,113 out of an appropriation of S. 100.000,000? Science will go on when existing political parties will long have been forgotten.

"I am sorry that the distinguished leader of the Republican Party in the House states that he is not versed in botany and publicly admits that he does not know anything of these terms or what it is all about; but, Mr. Chairman, it is indeed a sad day for the people of this country when we must close the doors of the laboratories doing research work for the people of the United States. The gentleman from New York says it is all foolish.

"Yes; it was foolish when Burbank was experimenting with wild cactus. It was foolish when the Wright boys went down to Kitty Hawk and had a contraption there that they were going to fly like birds. It was foolish when Robert Fulton tried to put a boiler into a sail boat and steam it up the Hudson. It was foolish when one of my ancestors thought the world was round and discovered this country that the gentleman from New York could become a Congressman. (Laughter.).....Do not seek to stop progress; do not seek to put the hand of politics on these scientific men who are doing a great work. As the gentleman from Texas points out, it is not the discharge of these particular employees that is at stake, it is all the work of investigation, of research, of experimentation that has been going on for years that will be stopped and lost."

The next day, when another item in the same bill was under consideration and the point was made that research in agriculture might well be curtailed because of current overproduction, Major LaGuardia said further:

"I want to say to my colleague, the gentleman from New York, that I believe he is confusing the purpose of experimentation and research work of this kind with the immediate question of production. Surely we can not delay scientific

research until the time comes when this country will need greater production. That indeed would be lack of vision. The very purpose of this kind of investigation and study is to have the information complete and ready when it is wanted, for it can not be developed overnight.....

"Momentary overproduction is not the important question. The important question is the continuing of study to correct the defects of nature. The most fascinating part of human activity is its constant combat with nature in fighting the elements and in correcting the defects of nature. This has engaged the attention of mankind from the earliest times of which we have record. Assuming, if you please, that we now have overproduction and production of more commodities than the people of the country have ability to purchase, that is no justification for closing the doors of these laboratories, closing the doors to scientific research and stopping it. We must continue it. The population is constantly increasing. Some day the legislative branch of government will keep abreast of science. Why, Mr. Chairman, the most humble research scientist in the Department of Agricultre is at this time contributing more to his country than the most useful Member of Congress. The most humble engineer in the General Electric Laboratory or the Radio Corporation of America Laboratory is more useful to humanity than the most brilliant orator of this House. The trouble is that the legislative branch of government has not kept abreast with science. Government has lagged, science has advanced We have permitted an unbalanced system of distribution to continue while science has increased production. We are living in the paradoxical state where there is great overproduction on the one hand and want and misery on the other. This is not the fault of science. This is the fault of government. This is the fault of men who have control of the governmental affairs of the country.

"I want to plead with my colleague, the gentleman from New York (Mr. Taber), in his eagerness—and he is sincere and works hard on these bills—not to be too hasty in cutting down these appropriation to continue this scientific work, so that when the time does come we will have the information available. I repeat, if the science of goverment had only advanced along with the progress made in electricity, chemistry mechanics, transportation and agriculture, we should not to-day find ourselves in the midst of a ruinous financial crisis. While science and the arts and mechanics were progressing, government was struggling along with laws and economics founded on principles accepted centuries ago. Today we are still endeavouring to struggle along under construction and limitation of a constitution drafted and accepted at a time when steam had not yet been applied, before the railroads, before the telegraph, when electricity was entirely unknown, and in the days of hand production. Yes, gentlemen, science has forged ahead, and nothing that ignorance, petty politics, lack of vision, or hope to continue the old system may try to do can stop the onward march of science. So let not Congress seek to mitigate its shortcomings by attempting to adjust the universe with its own snail-like pace." (Extract from *The Hawaiian Planters' Record*, Fourth Quarter, 1933 Vol. XXXVII No. 4. Pages 167 and 168.) H. L. L.

• **The Bullock cart.** (The Development of Mechanical Transport in India by Lieut. Col. F. P. Barnes, D. S O., O. B. F., M. I. M. E., Mechanical Transport Adviser to the Indian Army.) (p p. 447–448). The bullock cart is the principal means of transport in India, it is the vehicle of the Indian villager, and the Indian villager is always poor. There can be no question of abolishing it, and it will continue for years to be the most extensively used form of transport in India. But there is no reason why it should be allowed to do the damage it does, and there is no harm involved to the villagers in reducing the bullock cart's present

powers of destruction. The wheels of these carts are large artillery type wheels shod with an iron rim some 3 inches in width. Anyone who has driven in India will recollect how frequently the wheels of bullock carts are loose and wobbling upon their axles. Either they lean drunkenly inwards until they rub against the upper side of the cart or they gape outwards until it seems that they must fall outwards flat upon the road. The action is that of a skater using alternatively the outside or inside edge instead of the flat of his skates. The weight of the cart instead of resting upon a 3 inch rim is resting upon an edge, and that edge cuts into the road like a knife and does enormous damage.

The remedy is to prevent the wheels from wobbling, and this can be done quite simply by packing up the wheel on the axle with iron washers. These could be made for a few annas by any village blacksmith. In course of time they would wear thin, but they could be kept in use for years and passed on from one cart to another.

If the police were empowered to run in a villager using a cart with badly wobbling wheels, the defect would soon disappear and roads would take a new lease of life. The damage done at present is so great and the remedy so simple that it is a matter for surprise that no such action has yet been taken. [*Journal of the Royal Society of Arts*, Vol. LXXXI No. 4192. 24—3—193] .

Forest Genetics. Supplementing its grant of $ 2,100 last spring, the Carnegie Institution of Washington has just made a grant of $ 2,800 as emergency aid to the Institute of Forest Genetics, located at Placerville, California. [*The Journal of Heredity*, Vol. 24. No. 12. December 1933. p. 480.)

Irrigation and Soil Salts. (The effect of irrigation on soil salts at the Gezira Research Farm, Wad Medani, Sudan) by H. Greene and the late R. H. K. Peto. In order to ascertain whether subsoil salts moved upwards under the influence of irrigation an elaborate investigation was carried out at the Gezira Research Farm, Medani. It was found that the small apparent changes which occur under normal irrigation and cultivation are largely due to swelling and shrinking of the surface soil occasioned by changes in moisture content and to mechanical disturbance and settling which depend on cultivation. Apart from these apparent changes there may be a small downward movement of salt through the soil material; there is no upward movement.

When the salt content of the surface soil is increased by application of soil improvers or by other means, rains and watering rapidly wash down the salt and in the course of time the soil column returns to its normal profile.

Salts introduced by the irrigation water are also washed down from the surface layers. The observations recorded show an increase in the average salt content of a 6 ft. column of soil which is roughly equivalent to the amount of salt introduced (about 1 ton per acre per 3 years). [*The Jour. of Agri. Scien.*, Vol. XXIV, Part I. Jan. 1934, p. 42—58].

Vitamin C in Turnip. Juice from the turnip is recommended as a good depression substitute for orange juice or tomato juice. Attention is called to its value as a cheap source of scurvy-preventing vitamin C by Dr. E. W. McHenry, of the University of Toronto School of Hygiene, in a report to the *Journal of the Canadian Medical Association.* In Toronto one cent will buy 1,100 vitamin C units from turnip juice, whereas the number of vitamin C units from one cent's worth of lemon juice are 180, from orange juice 220, from tomato purchased as juice 170 and from tomato juice prepared from canned tomatoes 180. [*Science*, Vol. 79, No. 2043, Supplement page 6].

Scindhi Cattle for the Philippines. A shipment of Red Scindi cattle consisting of one bull and three cows arrived on the College Campus on December 8. This is a dairy-breed of Indian cattle which will be used in the Department of Animal Husbandry in connection with its animal improvement work. [*The Philippine Agriculturist*, March, 1934].

Research Notes.

A note on the occurrence of sterility in Bengal gram.

(*Cicer arietinum.*)

As a continuation of the observations reported under the same title in the February (1934) issue of the Madras Agricultural Journal by the first author, seed from the remaining sixteen apparently normal (non-sterile) single plants of culture 176 was sown in individual lines during the present season (1933-34) for a preliminary study of the heritability of the character, sterility. Out of the sixteen progeny lines, six produced 'Normal' plants while the remaining ten segregated into 'Normals' and 'Steriles' as shown in the Table below.

Progeny No.	No. of 'Normals'	No. of 'Steriles'	Total population.
176/1	38	9	47
176/4	17	10	27
176/5	23	8	31
176/6	16	7	23
176/7	23	7	30
176/8	23	11	34
176/11	20	9	29
176/12	31	4	35
176/14	17	8	25
176/15	21	8	29
176/2	28	nil	28
176/3	28	,,	28
176/9	25	,,	25
176/10	28	,,	28
176/13	29	,,	29
176/16	41	,,	41

Note:—The populations are small and the data merely indicate that six lines are pure for 'Normals' while the remaining ten segregate for 'Normals' and 'Steriles'.

The sterile ones could be spotted out from the very early stages and they have already been described in the previous note. In addition it has been observed that they are comparatively late in flowering and that the structure corresponding to the ovary encloses minute stamen-like organs and some green bodies. The 'Steriles' appeared vigorous as reported previously and none of them set seed. The government Mycologist, Agricultural Research Institute, Coimbatore, who examined some of them has reported "that no fungus could be found in sections either of flowers or of leaves". Now that it is confirmed that the observed case of sterility is inherited and not brought about by any local environmental influences, larger populations from some of the segregating lots will be raised to study the inheritance on a quantitative basis.

Agricultural Research Station, Nandyal. C. Jagannatha Rao, B. A.
21—4—1934 P. Subramanyam B. Sc. A.I.

Correspondence.

Locust Eggs.—Destruction.

Mr. M. H. Hassan, Health Inspector, Masjid-I-Sulaiman, South Persia, writes: I will be thankful if you can throw some light on how to destroy locust and their eggs. I will be much obliged if you send me a reply at your earliest convenience. Last year locust spoiled every thing over here, so we are afraid this year too as eggs of locust were seen last year.

Rao Sahib Y. Ramachandra Rao, M.A., F.E.S., Locust Research Entomologist, to the Imperial Council of Agricultural Research, Karachi, replies as follows :—

It is not clear from the letter of the correspondent, which species of Locust he is referring to in his letter. The locust that usually appears in the dry regions of North-West India and in certain years spreads as far East as Assam and as far South as Madras Presidency is the Desert Locust—*Schistocerca Gregaria*. This locust also invades Iraq and Persia during years of over-multiplication, and it is just possible that the reference made by the correspondent may be to this locust.

On the other hand, Persia and Iraq are also subject to attacks of another species, viz. the Moroccan Locust—*Dociostaurus Moroccanus*. The life histories of these two locusts are very different. The Moroccan Locust has only one generation in a year and lays its eggmasses usually in stony soil at the end of summer i.e., about July or August. The eggs hibernate throughout the cold season and begin to hatch after the fall of spring rains in March or April of the year following. The hoppers feed on the vegetation in the desert and the adult locusts begin to fly about in swarms as soon as they get wings and cause a great deal of damage to the crops, and ultimately lay eggs and die away. In the case of the Desert Locust, the winter is passed in the adult stage. As soon as the weather warms up in spring, the locusts gather into large swarms and fly long distances in search of suitable situations with sandy moist soil wherein to lay their eggs The eggs hatch within 2 to 4 weeks and the hoppers become full grown in 5 to 6 weeks more. The new generation of adults—which are pink in colour—start flying and move on to other places in swarms. If the conditions of the weather are favourable, there may be two or more generations in a year.

It will, therefore, be apparent that the measures to be adopted will be different in the case of these two locusts. In the case of the Moroccan Locust the hopper stage occurs generally in uncultivated areas, but since it is in the flying stage that the locust is dangerous to crops, and since, in that stage it is difficult to control, the fight will have to be carried into the desert areas for nipping the evil in the bud.

On the other hand, the Desert Locust may lay eggs in cultivated areas also, so that the cultivator will have to keep a watch for the appearance of egglaying swarms and tackle them at once. Egglaying locusts are generally sluggish and may be killed in numbers. If eggs have already been laid, the eggmasses may be dug out or the egglaid areas marked out and ring-trenched, so as to trap in all the hoppers as they emerge from eggs. In the hopper stage the locusts can be tackled by digging trenches across their line of march, or by erecting barriers of iron sheets if the ground is hard or stony. Poison baiting with baits of bran, sodium fluosilicate and either molasses or salt has also proved to be very effective. It is, however, difficult to control the locusts when once they are on the wing.

Crop and Trade Reports.

Cotton Crop—Madras—1933-34. Fifth or Final Report. The average of the area under cotton in the Madras Presidency during the five years ending 1931—32 represents 9 per cent of the total area under cotton in India.

2. The area under cotton in the Madras Presidency in 1933—34 is estimated at 2,095,800 acres against 1,976,100 acres for the corresponding period of last year and 2,044,500 acres according to the February forecast of the current year. The present estimate for the Presidency represents an increase of 6·4 per cent over the finally recorded area of 1,970,250 acres in 1932—33. Last year's estimate exceeded the actuals by 5,850 acres or 0·3 per cent

3. Picking of cotton is in progress and may be finished by the end of this month.

4. A normal yield is expected in East Godavari, West Godavari, Salem, Coimbatore, Tanjore and Madura. A yield below normal is expected in the other districts. In Guntur, the crop is affected with leaf curl disease.

The seasonal factor for the Presidency works out to 99 per cent of the average for irrigated cotton and 92 per cent for unirrigated cotton, the final figures according to the season and crop report of last year being 98 per cent and 90 per cent respectively. On this basis, the yield works out to 441,800 bales of 400 lb. lint as against 409,570 bales in the previous year, an increase of 7·9 per cent, and against an average of 527,100 bales. It, is, however, too early to estimate the yield with accuracy as much will depend on future weather conditions and their effect on the second crop and on the amount of damage done by insect pests.

5. The estimated area and yield under the several varieties are given below:-

(Area in hundreds of acres, yield in hundreds of bales of 400 lb. lint).

Variety.	Area.		Corresponding yield.	
1	2	3	4	5
Irrigated Cambodia	295,8	183,7	126,7	111,9
Dry Cambodia	140.9	141,2	29,8	28,6
Total Cambodia..	345,7	324,9	156,5	140,5
Karunganni in Coimbatore ...	135,3	114,5	31,4	26,7
Uppam in the Central districts...	31,1	41,3	4,7	6,1
Nadam and Bourbon	31,5	40,0	1,6	2,0
Total Salems...	197,9	195,8	37,7	34,8
Tinnevellies *	527,9	507,7	123,9	129,7
Northerns and Westerns ...	879,0	770.0	99,6	79,5
Cocanadas	130,8	158,9	22,5	24,8
Others	13,5	18,8	1,6	2,3
Presidency...	2,095.8	1,976,1	441.8	411.6

* Includes Uppam, Karunganni and mixed country cotton in the South.

6. The table below gives final information so far as it is available on the crop of 1932—33:—

(Figures in bales of 400 lb. lint).

Particulars.	South.		D N & W	R C & O	Total *
	T & S C				
1	2	3	4	5	6
Pressed at Presses plus loose cotton received at mills in 1933—34 ...	165,6	185,1	90,0	31,8	472,5
Add estimate of extra factory consumption in 1933—34	6,0	Nil.	6,0	4,0	16,0
Total crop of 1932—33...	171,6	185,1	96,0	35,8	488,5
Yield as estimated in April 1933 ...	164,5	140,5	79,5	27,1	411,6
Yield as estimated in the Season and Crop Report	169,9	136,8	77,7	25,2	409,6

* T and S=Tinnevellies and Salems C=Cambodia. D—N and W=Deccan—Northerns and Westerns. R—C and O=Rest of the Presidency—Coconadas and others.

Note. (1) Item 1. The entries mainly relate to the crop of 1932—33. The early sown crop in the Deccan, however, generally comes into the market from December in each year. The figures are taken from the weekly returns furnished by mills and presses.

(2) Item 2,—The figures are approximate.

(3) Figures of carry over of crops and arrivals and despatches are not available.

7. The wholesale price of cotton lint per imperial maund of 82 2/7 lb. as reported from important markets towards the close of March 1934 was about Rs. 17—2—0 for Cocanadas, Rs. 16—5—0 for red Northerns. Rs. 20—3—0 for white Northerns Rs. 15—5—0 for Westerns, Rs. 24—2—0 for Cambodia, Rs. 22—14—0 for Karunganni. Rs. 19—11—0 for Nadam and Rs. 22—10—0 for Tinnevellies. When compared with the prices reported in February 1934, the prices are higher in the case of all varieties except Cocanadas and Westerns which show a fall of one per cent and two per cent respectively. The price is higher by 22 per cent and in the case of white Northerns and by 4 to 11 per cent in the case of the other varieties.

Groundnut Crop—Madras—1934—First Report. The area sown with the summer or irrigated crop of groundnut during the three months of January to March 1934, is estimated at 41,800 acres as against 49,200 acres for the corresponding period of last year. a decrease of 15 per cent. The reduction in area is due to the fall in the price of groundnut.

2. The figures by districts are given below:—

Districts.	Estimate of area sown with irrigated ground-nut from January—March.		Increase + or decrease - of the area in col. (2) as compared with the area in column (3)
	1934	1933	
1	2	3	4
	Acs.	Acs.	Acs.
Anantapur... ...	200	200	Nil.
Cuddapah	4,000	4,000	Nil.
Nellore	200	100	+ 100
Chingleput ...	3,500	3,000	+ 500
South Acrot ...	20,000	25 000	- 5,000
Chittoor	5,000	6,500	- 1,500
North Arcot ...	1,000	2,000	- 1,000
Trichinopoly ...	800	1,000	- 200
Tanjore	4,800	4 800	Nil
Madura	2,000	2,000	Nil.
Ramnad	300	600	- 300
Total...	41,800	49,200	- 7400

3. The wholesale price of groundnut per imperial maund of 82 2/7 lb. as reported from important market centres towards the close of March was Rs. 2—14—0 in Vizagapatam, Rs. 2—10—0 in Vizianagaram, Rs. 2—8—0 in Guntur and ranged from Rs 2 to Rs. 2—6—0 in the other centres.

Gingelly Crop—Madras. 1933—34. Final Report. The average of the areas under gingelly in the Madras Presidency during the five years ending 1931—32 represents 12·3 per cent of the total area under gingelly in India.

2. The area sown with gingelly up to the 25th March 1934 is estimated at 84°,500 acres. When compared with area of 806,490 acres estimated for the corresponding period of last year, it reveals an increase of 5·2 per cent. This year's estimate also reveals an increase of 1·5 per cent over the finally recorded area of 835,819 acres last year. Last year's estimate fell short of the actual area by 3·5 per cent.

3. 240,500 acres have been reported as sown since the previous forecast report was issued in January, as against 171,900 acres during the same period last year. These late sowings were mainly on wet lands in the Circars, South Arcot and the South where gingelly was raised as a second crop after paddy.

4. As compared with the actual area sown last year, there has been a decrease in area except in the Circars, Kurnool, South Arcot, Trichinopoly, Tanjore, Ramnad and Tinnevelly.

5. The yield has been below normal except in Vizagaptam, Kistna, Kurnool, Cuddappah, Ramnad, Tinnevelly and South Kanara where it has been normal or slightly above normal. The condition of the late sown crop is generally fair.

The seasonal factor for the Presidency works out to 92 per cent of the average as against 100 per cent according to the season and crop report of last year On this basis the yield is estimated at 106,900 tons as against 112,230 tons in the previous year and an average yield of 107,570 tons.

College News & Notes.

Results of the B. Sc. Ag. Examination. The following students passed the several examinations of the B. Sc. Ag. degree examinations this year.

Final examination Part II (*Old regulations*). S. Adinarayanamurthi, R. Alagiamanavalan, U. Ananda, P. S. Anantanarayanan, C. Balasubramaniam, Bennet P. Masilamani, K. V. Chellapathi Rao, M. R. Devarajan, M. Edwin Amirtharaj, K. V. Gaurangamurthi, C. K. Gopalakrishnan, D. Hanumantha Reddy, V. Jayaraman, M. Kandaswami, C. Krishnamurthi, K. Krishnamurthi, P. R. Kunhi Anujan Rajah, M. Lakshmikantham, K. Minakshisundaram, S. Muthuswami, C. Parthasarathi, S. V. Parthasarathi, G. Radhakantam, P. Rama Rao, Ramakrishna Reddi, P. C. Sahadevan, G. Satyanarayana, G. Satyanarayana Rao, P. Seetaramiah, V. Srinivasan, M. Srinivasa Rao, R. Subbiah, A. Subrahmaniam, Tayi Ramanujulu, C. Vadamalai, G. Venkataratnam, G. Venkatasastry, K. Viswanadham, P. S. Viswanathan.

Second year. Part II. (*New regulations*). C. Bhujanga Rao, P. Govinda Rao, S. D. Kanakaraj, M. Kasiviswanathan, C. P. Kesavan, M. M. Krishna Marar,* K. S. Kutti Mudali, K. Lakshmanan A. Mariakulandai, G. Narasimhamurthi, U. Narasingha Rao, N. Raghava Rao, T. S. Ramakrishnan, V. Sadasiva Iyer, R. Soundira Rajan, K. Sriraman, B. Suryanarayanamurthi, M. Venkataramiah, M. Venkata Rao.

Passed with references in subjects:—S. Satyanarayanamurthi, D. Satyanarayana, (Engineering); T. Srinivasan, (Animal Hygiene), S. Arunachalam, S. Balakrishnan Nair, P. Govinda Rao, G. Kameshwara Rao, G. Murugesan and V. Narayana Pillai, (Agriculture).

Second year. Part I. (*Old regulations*). Azimuddin Sheriff, K. R. Sundaresan, N. Muthuswami, C. Vadamalai.

First year. Part I. (*New regulations*). Y. Adinarayana Reddi, Albert Rajiah, Albuquerque, R. Ali Hyder, Annaswami, T. Arunachalam, D. Achanna Sastry, Colaco James, R. Gitachari, C. Hanumantha Rao, C. T. Ittyachan, K. Jayaram, K. Kannian, Mellukutty Menon, R. H. Krishnan, N. Krishnan Unni Nair, M. K. Lingian, S. Maragathavel, K. T. Narayanan Nambiar, N. A. Parasuraman, A. Raghavan, K. Rajabapaniah, S. Rajaraman, P. Ramanatha Rao, Ramanarayana Menon, N. Ranganathachari, S. Sangameswara Sarma, K. Satyanarayanamurthi, S. Sivaraman, M. V. Sreetharan, S. Vaidianathan, G. Venkataramana, V. G. Venkataramana Rao, P. Venkateswara Rao, Y. B. Narasimham, G. Shivashankar Rao, R. Krishnamurthi, H. Ramanatha Rao.

The Woodhouse Memorial Prize. We understand that the Woodhouse Memorial Prize for 1933 was awarded to Mr. D. S. Rajabhooshanam, M. A, Assistant in Millet Section for his essay on "Application of Modern Statistical Methods to Yield Trials".

The Late Mr. A. J. Wilson. Estate residents were shocked to hear of the sudden and unexpected death at the Ooty Hospital, of Mr. A. J. Wilson, District Veterinary Officer, Coimbatore, on Friday the 11th May 1934. Mr. A. J. Wilson was formerly Veterinary Assistant in the Agricultural College and by his genial and affable personality endeared himself to one and all of the estate residents.

Condolence Meeting. Under the auspices of the Madras Agricultural Students' Union, a meeting was held on Sunday the 13th May, when resolutions were passed expressing sorrow at the passing away of Dewan Bahadur K. Rangachari and Mr. A. J. Wilson. The resolutions have been communicated to the respective families.

To honour the memory of the Late Dewan Bahadur K. Rangachari, associated with the College and Department for a long time, the flag on the College Tower, was flown half mast on Monday 14th May 1934.

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* Gets distinction in Engineering.

Weather Review (APRIL—1934)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	0·0	−0·8	0·3	South	Negapatam	1·0	+0·4	8·7
	Berhampore	0·0	−0·8	0 0		Aduthurai *	2·6	+1·7	8 9
	Calingapatam	0·2	−0·7	0·2		Madura	1·8	−1·2	6·1
	Vizagapatam	0·1	−0·6	0·1		Pamban	0·9	−0·8	11·5
	Anakapalli *	0·4	−0·8	0·4		Koilpatti *	4·4	+1·3	11·4
	Samalkota *	0·0	−0·5	0·0		Palamkottah	0·3	−2·3	9·5
	Cocanada	0·7	+0·2	0·7					
	Maruteru *	0 5	+0·1	0·5					
	Masulipatam	0·4	−0·3	0·4	West	Trivandrum	3·3	−1·3	10·3
	Guntur *	1·1	+0·4	1·1	Coast	Cochin	5·2	+0·3	11·4
						Pattambi *	2·4	−1·1	5 9
Ceded	Kurnool	1·9	+1·4	1·9		Calicut	6·7	+3·3	7·1
Dists.	Nandyal *	1·6	−0·6	1·6		Taliparamba *	0·2	−2·3	2·6
	Hagari *	1·8	+1·3	1·8		Kasargode *	1·1	−4·2	3·9
	Bellary	0·9	+0·1	0·9		Nileshwar *	0·4	−1·2	2 3
	Cuddapah	0·	+0·2	0·7		Mangalore	0·2	−1·1	1·4
	Anantapur	0·5	...	0·5					
Carnatic	Nellore	0·2	−0·2	1·1	Mysore	Chitaldrug	2·0	+0 9	2·1
	Madras	0·7	+0·2	2·8	and	Bangalore	3·6	+2·1	4·1
	Cuddalore	0·1	−0·5	1 9	Coorg	Mysore	4·5	+2·0	5·7
	Palur *	0·3	−0·5	2·2		Mercara	0·7	−2·1	0·9
	Palakuppam *	0·1	−1·0	3·8					
Central	Vellore	0·1	−0·9	2·7	Hills.	Kodaikanal	2·9	−1·6	17·9
	Salem	2·3	−0·5	3·6		Coonoor	2·5	...	15·1
	Coimbatore	2·4	−0·6	4·1		Kallar *			
	Coimbatore Res. Inst. *	1·4	−0 5	3·0		Ootacamund *	2·0	−1·1	8·2
						Nanjanad	1·9	−1·3	7·0
	Trichinopoly	0·4	−1·3	5·6					
	Hosur cattle farm *								

* Meteorological Stations of the Agricultural Department.

Summary of General Weather Conditions. Dry weather prevailed in the Peninsula till the 7th when conditions became favourable for the occurrence of thunderstorms in Malabar and South Madras. Widespread thundershowers were experienced in Malabar and scattered local showers in South Madras intermittently throughout the month.

In connection with the temporary advance of the monsoon in South Bay of Bengal the conditions became markedly unsettled in Central and South Bay to west of Andamans on the 17th. The unsettled conditions developed into depression which centred within a degree of Lat. 14°N. and Long. 91°E. on the 19th morning. The depression intensified into storm in the course of the day but weakened during night and passed away north-eastwards as a low pressure wave through the Gulf of Martaban. The storm caused widespread locally heavy rain in Tennasserim and Pegu on the 18th and 19th, Rangoon recording 14 inches on the 19th. During this period scattered thundershowers occurred in many parts of the Madras Presidency which continued to be active throughout the month.

The western disturbance which was active on 30th March passed away eastwards through Kashmir after causing a few falls of rain there on the 1st and

nearly general rain or snow on the 2nd with local falls in the N. W. Frontier Province and the adjoining hills in the Punjab. The second disturbance originated on the 6th and followed the same course as the first with similar weather changes. The third caused fairly widespread thundershowers in N. W. Frontier Province on the 8th, 9th, and 10th and lay over the Punjab on the 11th. The latter passed away eastwards after fairly heavy precipitation of hail and rain along its course including the Kumaon hills. The next two disturbances occurred at close intervals which gave local showers in the Punjab and widespread thunderstorms in N. W. Frontier Province and Kashmir on the 23rd and 24th, in North Baluchistan and in East and North Punjab on the 24th. Light showers were also recorded in the North Punjab hills on these days. The last disturbance caused clouds in North Baluchistan on the 26th and passed away eastwards with a few local showers in Kashmir.

The day temperatures were above normal in Gujarat, North Deccan, United Provinces and North-east India after 29th March, similar conditions being experienced in N. W. India and central parts of the country after the 6th till the middle of the month. The temperatures returned to normal from the N. W. Frontier to Assam consequent upon the receipt of widespread thundershowers after the first fortnight. Subsequently in these places the day temperatures continued to be below normal over the rest of the month. Nearly general rain has been recorded in Assam throughout the month.

The humidity was in excess about the middle of the month in the Peninsula and was slightly in defect in parts of Malabar and Deccan during the latter half, the same being quite normal elsewhere. During the first week the maximum was above normal, normal in the second week and below normal over the rest of the month. Cuddapah, Kurnool and Nellore recorded 108°F. on 25th, 26th and 23rd respectively, and Cuddapah 109°F. on 29th. The minimum temperature was almost normal for the month.

Thundershowers were received in many parts of the Presidency, the rainfall being in excess in parts of Malabar, Mysore, and Madras Deccan, and mostly in defect over other parts of the Presidency. The highest rainfall recorded were Calicut 3·7″ (15th) and Mysore 3·3″ (17th).

Weather Report of the Research Institute Observatory:

Report No. 4/34.

Absolute Maximum in shade	102°F.
Absolute Minimum in shade	67°F.
Mean Maximum in shade	97°·4F.
Mean Minimum in shade	72°·2F.
Total rainfall	1·38″
Normal rainfall for the month	1·84″
Departure from normal	0·46″
Heaviest rainfall in 24 hours	0·63″
Number of rainy days in the month	3·
Mean daily wind velocity	2·5 M. P. H.
Mean 8 hours wind velocity	1·9 M P. H.
Mean humidity at 8 hours	72 7%
Total hours of bright sunshine	291·1 Hrs.
Mean daily hours of bright sunshine	9 7 Hrs.

Summary of weather conditions. The pressure was steady throughout except for a day or two when there was no rain. Thundershowers were experienced locally accompanied with severe lightning and thunder. The rainfall was below normal for the month. The maximum temperature of 102°F. was the

highest on record for the month. The first fortnight was marked by very high maximum which was considerably lowered with the receipt of thundershowers during the middle of the month. The mean humidity was almost normal, the mean maximum and minimum temperatures being slightly above normal. The days were hot and nights extremely sultry, the rainfall of 1·38 inches not contributing towards the improvement of the weather conditions except to bring down the maximum from 102°F. to 95°F. during the latter half of the month.

C. V. R. & T. S. L.

Departmental Notifications.

Gazette notifications. The High Commissioner for India has granted Mr. S. V. Ramamurthi, I. C. S. an extension of leave on average pay for two months with effect from 3rd May 34. Mr. P. Venkataramaya, Assistant Agricultural Chemist, to officiate as Government Agricultural Chemist, Coimbatore, vice Rao Bahadur B. Viswanath Garu granted leave. Mr. C. V. Seshacharya, A. D. A. Madura, l. a. p. for three months from 23rd April or date of relief.

Appointments, postings and transfers. The following officiating appointments in the Madras Agricultural Subordinate service—class i, upper subordinate, iii grade (75—7½/2—105) are ordered with effect from 7th May 1934. Mr. G. Konda Reddy Agricultural section (for studies of Village consumption of cotton), iii circle, Guntur. Mr. B. W. X. Ponnaya, B. Sc. Ag. Assistant, Millets Section Coimbatore, vice Mr. P. Krishna Rao on leave. Mr. K Raghunatha Reddy, B. Sc. Ag. Agricultural section (studies of Village consumption of cotton) iii circle, Bellary; Mr. K. Bhushanam, B. Sc. Ag. Assistant, Chemistry section Coimbatore, vice Mr. T. S. Lakshmanan on other duty. Mr. T. Venkataramana Reddy, B. Sc. Ag. to officiate as Assistant, Millets section, vice Mr. P. Seshadri Sarma on other duty, to report for duty at A. R. S. Hagari, Mr. F. L. Daniel, B. Sc. Ag. Agricultural section, iv circle, St. Thomas Mount, vice Mr. P. S. Narayanaswami, on other duty. Mr. N. S. H. V. Krishnamurthi, B. Sc. Ag. Agricultural section, A. R. S Maruteru, vice Mr, S. Ramaswami Iyer, on other duty. Mr. P. N. Muthuswami, B. Sc. Ag. Upper subordinate, Co. 2. cotton multiplicatiou scheme, viii circle, Coimbatore. Consequent on the creation of temporary posts for work in the scheme for studies of village consumption of cotton, the following appoi tments are ordered. Mr. K. Saptharishi, offg. Upper subordinate Agricultural section VI circle, to be temporary Assistant in the scheme in the same circle. Mr. K. Kuppamuthu offg. Upper subordinate, Agricultural section, to be temporary Assistant, in the scheme, to continue to work in the VIII circle.

Consequent on the creation of posts of Assistants for work in the Dry Farming Scheme, Hagari, the following transfers and postings of Upper subordinates are ordered :—Mr. P. Seshadri Sarma. Assistant Millets section, Coimbatore, to be temporary Assistant, in the scheme. Mr. B. L. Narasimhamurthi offg. Assistant, *Millets section, Hagari, to be temporary Assistant in the scheme.* Mr. Abdul Samad, offg. Upper subordinate. Agricultural section (IV Circle) to be temporary Assistant to the Soil Physicist in the scheme, to report at A. R. S. Hagari. Mr. L Narasimhacharya, F. M, Central Farm, Coimbatore, is transferred to II circle, Guntur. Mr. R Krishnamurthi, Assistant, cotton section, A. R. S. Guntur. is transferred to Coimbatore. Mr. A. Ramdoss, Assistant cotton section, Coimbatore, is transferred to A. R. S Guntur. Mr T. S. Lakshmanan, Assistant, Chemistry section, Coimbatore is appointed as temporary Upper subordinate, Agricultural section, for the Cambodia and Co. 2. Cotton multiplication scheme with effect from 7th May and is posted to the VIII circle. Mr. T. Paramanandam, F. M., A. R. S. Guntur, on the expiry of his leave is posted as A. D. Guntur and will also be

in additional charge of the Vinukonda subcircle. Mr. D. Bappiah, A. D. Guntur, is transferred as A. D. Kaikalur. Mr. K. V. Seshagiri Rao, A. A. D. Allagada is transferred as A. A. D. Tadpatri. The Assistant Demonstrator, Karur is transferred to the Borstal school, Palamcottah. Mr. K. K. Subramania Iyer A. D Madura, on exhibition duty is transferred as A. D. Nunguneri, on relief by Mr. C. S. Namasivayam Pillai. Mr. L Sankarakumar is posted to Periakulam subcircle. Mr. S. V. Ramachandran, A. D. Periakulam is transferred to Tirupathur. Mr. K. M. Jacob on the expiry of his leave is posted as A. D. Manjeri vice Mr. P. Kannan Nambiar granted leave. Mr. G. K. Subrahmania Iyer A. A. D. Krishnagiri is deputed to work in the scheme for studies of Village consumption of cotton in the VIII circle. Mr. K. Kuppamuthu A. D. is posted to Krishnagiri.

Leave. Mr. N. Krishna Pillai, A. D. Tiruvettipuram, l. a. p on M. C. for two months from 13th March. Mr. P. Kannappa Pillai, A. A. D Nunguneri, l. a. p. for three months from 1st May or date of relief. Mr. C. S. Namasivayam Pillai, A. A. D. is granted extension of leave on half average pay for three weeks from 30th March. Mr. V. Panduranga Rao, Assistant, Millets Section is granted extension of l. a p. for 19 days from 13th May Mr. P. S. Narayanaswami Iyer, Assistant, Entomology section is granted extension of l. a. p. with M. C. for three weeks in continuation of leave already granted. Mr. P. M. Appaswami Pillai, A. F. M., L. R. S. Hosur, is granted l. a p. for two months from 18th April or date of relief.