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EDITORIAL

The war and control of prices:— For some time past there has been an incessant demand from a section of the public for Government intervention on the matter of controlling the prices of commodities including food stuffs. While we are in sympathy with the just demands of the consumer in checking profiteering, there is one aspect of the question to which we wish to invite the attention of Government. Judging from the trend of prices prevailing at present, it is hardly right to suggest that there has been any profiteering on the sale of foodstuffs produced in India. Barring a temporary rise in the price of refined sugar, the price levels of the agricultural products have remained more or less stationary. On the other hand, the cultivator has today to pay enhanced rates for his prime necessities such as, clothing, implements, manures, pest and disease fighting devices, lighting, and building materials. It has also to be remembered that the cultivator has for several years laboured under the disadvantages of low prices, poor marketing facilities and in some specific cases from foreign competition. In the matter of exportable produce like wheat, oil seeds, cotton and plantation crops, higher freights and war risks have militated against his realising the full benefits of the slight advance of prices in the world's markets. The war has however just brought in a ray of hope and experience has shown that it will take several months before the benefits of increased prices trickle down to the actual cultivator. Any precipitate action towards price control will not in our opinion, be equitable and we trust that due consideration will be given to the interests of the silent tiller of the soil.

Fodder Crops in the Madras Presidency—A Review.

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Introduction. India has to maintain a dense population of over 200 per square mile, by methods of farming applicable only to tracts with about 2 persons to the square mile. The chief, and perhaps the only way to remedy the chronic under-nourishment of this dense population is by increasing the *per capita* consumption of milk and milk products. For this, a dove-tailing of arable and animal husbandries into one mixed-farming system is very urgently needed. As pointed out by Mr. Hilson in 1928, "the fodder problem in not only Madras, but the whole of India, is a very important and a very urgent one. Better fodder means better cattle and more manure of better quality ; this helps the farmer to raise better crops, get bigger profits and adopt a better standard of living as well as a higher level of mixed farming, with bigger and better fodder crops as an essential unit therein." The difficulty comes in, however, when one tries to formulate mixed-farming systems for all the widely varying conditions of climate and soils in India. For instance, in Sind and certain parts of the United Provinces, the introduction of irrigation into the existing dryland farming resulted in the deterioration of the excellent breeds of cattle that thrived there before. For efficient milk production, the nutritive ratio of the feed, i. e., the ratio between the digestible crude proteins and the combined digestible fats and carbohydrates, should not be wider than 1 : 10. Since, the usually available cereal straws, such as paddy, wheat and ragi, have only a nutritive ratio of 1 : 70 and even the better kinds of green fodders like sorghum and guinea grass

have a ratio of only 1 : 12, the need for including legumes like lucerne and sunnhemp with a ratio of 1 : 4, in the daily feed, would be obvious.

With regard to the fodder crops available, Benson wrote as far back as 1879 from Saidapet, "This country is pre-eminently favoured with forage crops that could, with ordinary farming skill, produce abundant fodder of first rate quality .....There is no reason why, for want of proper fodder, this country should not produce good livestock,instead of the miserable, degenerate animals that now serve for the cultivation of the fields as well as for transport on the roads" Thus, the urgent need for better mixed-farming methods, giving due prominence to forage crops is obvious; and good forage crops also are available. It would, therefore, be useful to review at this stage the past performance and the present position of all the fodder crops tried in this province so far.

Sorghum (Sorghum vulgare). Tamil—*Cholam.* Telugu—*Jonna.* To quote the words of Mr. Benson again, "This crop has scarcely any rival at all as a fodder crop." Being essentially a crop of semi-arid, sub-tropical regions, it is very tolerant to high temperatures as well as low moisture conditions, and is eminently suited to be the mainstay of fodder in regions of low to moderate rainfall. In fact, it needs less water per pound of dry matter produced than perhaps any other cereal crop, its average water requirement being 294 lb per pound of dry matter as against 309 for maize—its nearest rival, 388 for Sudan grass, 375 for teosinte, 470 for wheat and 600 to 900 for leguminous fodders like lucerne and cowpea. It is not however suited, even as a fodder crop, to tracts having long periods of heavy rainfall.

In South India, where 4,632090 acres are under sorghum, the variety Periamanjal cholam, seems to be the most widely suitable type for fodder. The periods of sowing and of harvest in different parts of the Presidency are summarised below :—

A. **Rainfed** (91. 3% of total area) 1) Early crop; Sown in July—August, harvested by December--January. On the uplands of Vizagapatam and Godavari, and the districts of Bellary, North Arcot, Chittoor, Salem and Coimbatore. 2) Late crop; (a) *as a grain crop.* Sown—September—October, harvested by January—February. On the deltas of Godavari and Kistna and the districts of Guntur, Nellore, Kurnool, Bellary and Cuddapah; (b) *as a fodder crop.* The black soils of Madura, Ramnad and Tinnevelly.

B. **Irrigated.** (8. 7% of total area). Time of sowing not always definite, but usually sown in February and harvested by June. In the districts of Coimbatore, Madura, Tinnevelly, and to a lesser extent in Salem, Trichinopoly, Ramnad, Chittoor, North Arcot, Guntur and Anantapur. The yields of Sorghum in the different stations of the Presidency are given in the following table.

Average yield of Fodder Sorghum, in lb. per acre.

Agricultural Research Stations.	As straw from grain crop		As a pure fodder crop		Variety found most suitable	Remarks.
	Rainfed	Irrigated	Rainfed	Irrigated		
				(Green wt.)		
Berhampur				...		
Anakapalle				14,970		
Samalkota				...		
Maruteru				...		
Guntur			3,500		N 23/10	
Chintaladevi			3,400		*Pedda Jonna*	
Hagari	2,000			18,450		
Nandyal			3,590		N–29/82	
Palur				14,820	*Kaki Jonna*	
Tindivanam			5,430	21,830	*Periamanjal*	
Aduturai				14,530		
Pattukottai				15,930		
Central Farm, Coimbatore	3,150	6,460*		23,960	*Periamanjal*	* Chitrai cholam
Hosur	3,150			19,120	,,	
Gudiyattam				20,750	,,	
Taliparamba and Coconut Stations				10,410	*Periamanjal*	Maximum given. Yields very variable.
Pattambi			4,750		,,	
Koilpatti		5,500	3 540	19,100	*Irungu*	
Nanjanad (The Nilgiris)			Failure			

Sorghums in different tracts. (The Northern Circars.) Attempts were made at Berhampur in 1932 and 1933 to introduce sorghum as a fodder crop in the paddy fields during the off-season. This could be done only in fields that were sufficiently moist to be ploughed and sown, after the harvest of paddy by the end of December. Even in these fields, the peculiar tendency of the local clay-loams to cake up into hard pans, made one or two irrigations necessary, to help the crop during February and March. The outturn was 10,000 lb. the first year, but the 1933 trial was a failure. At Anakapalle, sorghum as a grain crop did not quite fit in with the local rotations, but for fodder it could be grown both as a rainfed crop in June giving an outturn of 9,000 lb. per acre, as well as under irrigation, after the harvest of summer ragi in April. The yields ranged in this case from 10,000 to 25,000 lb. per acre. No mention is made of any attempts with sorghum at either of the two deltaic stations, Samalkota and Maruteru.

In the Guntur tract, sorghum is the staple fodder both as a pure fodder crop sown in June and as straw from the October-sown grain crop. It was formerly usual for ryots here to reserve 5—6 acres for pasture, but with the increasing popularity of tobacco cultivation and the consequent rise in land values, they now tend to depend more and more on the upland taluks for

their fodder supply. On the Guntur farm the average yield for the rainfed crop works out to 3,500 lb. of dry fodder per acre. The best variety is found to be the Nandyal N. 23/10. Periamanjal cholam grows well enough, but is inferior in the quality of hay, besides being more liable to rust attack. Experiments to determine the optimum sowing time have shown that from June till the middle of July was the most suitable period. Manuring, with cattle manure as well as fertilizers like ammonium sulphate and superphosphate, was found both useful and economic, the nett profit over five years, working out to Rs. 13/- per acre. To improve the feeding value of the fodder, it was found best to grow sorghum mixed with *pillipesara* (Phaseolus trilobus, Ait) in the ratio of 3 : 1. Higher proportions of the legume tended to pull down the jonna yields.

In the carefully developed dry-farming system of the Ceded districts, sorghum forms a vital unit, the grain being consumed by men and the straw by cattle. The yields are on the average 3,600 lb. of straw per acre at Nandyal and 2,000 lb. at Hagari, although, wherever irrigation was feasible, (as at Hagari) the outturn goes up to 18, 450 lb. The variety N. 29/82 was the best at Nandyal, but at Hagari the Coimbatore variety Periamanjal has been found to come up very well as a fodder crop. A number of tests were carried out at both these stations to determine the optimum spacing between drill rows—but the wide seasonal fluctuations made most of the results inconclusive. At Nandyal, the local practice of 10½" between rows was found to be the best on the whole, although in years of poor rainfall, wider spacings of 16" to 28" were often preferable and closer spacings of 8" in good seasons. At Hagari too, the existing local practice of 18" spacing between rows was found to be the most profitable, although wider spacings (21—27") improved grain yields and close spacings increased the outturn of straw. Owing to the large areas of 40—50 acres, managed by a single pair of bullocks, farmyard manure is scarce and quite inadequate for any manuring of sorghum. Experiments indicate that applications of poudrette, ammonium sulphate, and super phosphate could be beneficial in favourable years. However, the low average rainfall (about 20" at Hagari and 28" at Nandyal) makes manuring rather a risky practice, because in droughty seasons, manured plants wither up much sooner than unmanured.

The Ongole breeding tract, with its 33" of rainfall, depends mainly on jonna straw for cattle feed. The yields on the Chintaladevi Farm (1918-1932) averaged about 3,400 lb. of dry fodder from the June-sown rain-fed crop. Here too, manuring was found uneconcmic.

In the South Arcot alluvial tract round about Palur, formed by silt deposits from the two rivers Pennaiyar and Gadilam, wells are numerous and consequently the cholam yields too, are high, averaging 14,800 lb. of green fodder per acre. On the Palur Farm Periamanjal cholam has not done very well, the two best types being Kaki jonna from Madanapalle and Sen cholam from Polur. In years of favourable rainfall, it was often possible to raise a ratoon crop yielding up to 8,800 lb. of green fodder from the

June-sown crop of cholam. At Tindivanam too, cholam is the main fodder, and curiously enough, Periamanjal cholam, which did not stand very high at Palur, was the best at this station, giving an average yield of 5,430 lb. rainfed and 21,830 lb. under irrigation. In the Cauvery delta at Aduturai although paddy is the chief food crop and paddy straw the chief fodder, cholam could also be grown successfully, in Samba fields before paddy. The fields were kept ready ploughed and in June, as soon as water was received in the channels, Periamanjal cholam was sown and harvested by September giving an outturn of 14,500 lb. of green fodder in good time for transplanting the main Samba crop afterwards. It is not mentioned however, what the after-effect was, of such a cholam crop on the yield of the subsequent paddy crop.

Among the districts, Coimbatore stands first in the area under irrigated cholam having nearly 40% of the total of 135,000 acres in the presidency. In rainfed acreage it stands as the fifth. Periamanjal cholam is the dominant variety of the district, with an average yield of 3,150 lb. of straw from the rainfed crop and 23,960 lb. as irrigated green fodder. On the Central Farm, about 25 acres have been under sorghum every year, to meet the fodder requirements of a large dairy herd and about 40 pairs of work cattle. It has been grown here on quite a variety of soils, black soil dry lands, red soil dry lands, red soil garden lands, and even in the heavy wetland paddy soils. The cost of production in this last instance worked out very cheap being only 4 as. per 1,000 lb. of green fodder, as against Rs. 2/- in the garden lands. It was observed at the Central Farm, that the fodder yields of Periamanjal cholam, when sown between August and January were poorer than when sown from February to July, as the crop tended to rush to flower from September to January. Hence for these months, fodder maize was preferable, as it gave uniform yields all the year through, while from February till July, sorghum was better.

The sorghum crop, especially when sown thick for fodder, is notorious for pulling down the yields of crops that follow it. This has been traced to the activity of the dense network of cholam roots tending to make the soil somewhat alkaline, for about a year afterwards. Attempts were made at the Cotton Breeding Station, Coimbatore and at Koilpatti, to ameliorate this deleterious after-effect by mixing legumes like sunnhemp cowpea, pillipesara, cluster beans and lablab, along with sorghum, in various proportions, but none of them was very effective. However, a mixture of three parts of cholam with one of pulse, preferably cluster beans in the garden lands (at Coimbatore) and lablab (*D. lablab*) in the dryland black soils, was found to improve the feeding value of the mixed fodder, without affecting appreciably the sorghum outturn.

At the Millets Breeding Station, an exclusive fodder strain, A. S. 3355, characterised by very sweet and juicy stalks, with about 12% sucrose content, has been evolved from the Patcha jonnas of Nandyal.

It is well known that fodder crops are best cut soon after they flower, and sorghum is no exception to this. It is however dangerous to feed it before flowering, especially in cases where the crop after a vigorous start, got stunted through by subsequent adverse weather conditions. It then contains a cyanogenetic glucoside in quantities sufficient to prove fatal to animals. It has also been noted that a ratoon crop is usually more poisonous in the early stages than a similar stage of the original crop.

With regard to the feeding value of sorghum, certain preliminary experiments at Coimbatore indicate that the relative efficiency, i. e., the quantity of fodder consumed per pound of milk produced, is in the descending order, Guinea grass, fodder sorghum, and then fodder maize.

At the Central Cattle Farm at Hosur, about 30—40 acres are put under irrigated sorghum each year besides a large area of rainfed crop. The average yield is 3,150 lb. for the rainfed and 19,120 lb. for the irrigated crop.

The heavy rainfall on the West Coast militates against sorghum being ever popular there, but all the same Periamanjal cholam has been grown with fair success at Taliparamba and on the Coconut Stations, both in the wetland areas and as a rainfed June crop on the mōdan lands (hilly upland areas). The yields, of course, have been very variable, ranging from 4,000 to 10,400 lb. of green fodder per acre, with an ever-present possibility of the crop getting swamped out by heavy rains. Further south at Pattambi, where the annual precipitation is nearly 40" less than at Taliparamba, the yields have been less variable, with an average of 4,750 lb. green fodder per acre.

In the Southern tract of Madura, Ramnad and Tinnevelly, where there are 265,000 acres of rainfed cholam and 136,000 acres of irrigated cholam, cholam is very important as a fodder crop. It is generally sown in September—October as a rainfed crop on the black soils, in rotation with cumbu the staple food crop and cotton the cash crop, and harvested by February. The seed rate is as a rule very high, sometimes going up even to 120 lb. per acre, although tests at the Koilpatti farm, point towards 80 lb. as the optimum. With higher seed-rates, the fodder which is already fine and thin-stalked gets still thinner and finer, but as the amount of grain recovered falls short of the seed sown, the practice is uneconomic.

The variety best suited to the Southern tract is undoubtedly the local irungu type *(Sorghum dochna* (Forsk) var *irungu* (Burkill, Snowden). This type is shorter in duration, more drought resistant and less susceptible to earhead bugs and sugary disease than Periamanjal cholam. Persistent attempts to introduce this on the Koilpatti Farm, have not met with success. Periamanjal does not also stand crowding so well as irungu does. Even when its yields do exceed the local type, the stalks are so much stouter and coarser that what is gained in outturn is lost in feeding.

After numerous tests, 6" between drill rows have been found to be the best spacing in this tract. The time of sowing, in a tract so completely

dependent on the north-east monsoon, is of course determined by the earliness or otherwise of the rains. Since hardly any moisture is left in the soil by December, as a rule, the earlier the sowing, the better the yields. The crop is usually allowed to get fully dry before harvesting. The earheads are first clipped off and then the straw cut by sickles and stocked in the field for a day or two before being carted away and stacked up. It was found at the Farm that cutting the crop earlier, at the (shot-blade) stage itself, gave a definitely better quality of fodder, even though the outturn was somewhat less, and moreover the yield of the subsequent cotton was not so adversely affected as when cholam was cut after setting seed. But against this practice there were two very strong objections, one sentimental, the ryot looking upon it as something akin to infanticide, and the other practical, owing to his inability to recover any seed for subsequent sowings, unless by laying down separate seed multiplication plots The average yield for a rainfed irungu crop in the black soils of the Farm, works out to 3,540 lb. of dry fodder per acre On the red soils, under irrigation the yields are 5,500 lb. dry straw from a grain crop, and 19,100 lb. green material from a fodder crop.

Certain early trials with 'nitrolim' and 'fish guano' showed 46—60 % increases in yields, but later experiments (1930—1934) with ammonium sulphate and super-phosphate proved that manuring was uneconomic, as the increases were insufficient to cover the cost of fertilizers.

Besides the attempts to introduce periamanjal cholam, trials were also made here with certain foreign types as well. Thus, in 1915—16, a variety from the Belgian Congo was tried under irrigation and in 1932 a Bombay type, Bilichigan cholam was grown on the black soils, but neither had any success. The Belgian Congo type grew well enough, upto 10 feet in height and tillered very freely, was sweet stalked and well relished by cattle, but the seed setting was so poor that it had to be discontinued. The Bilichigan cholam was severely affected by 'calacoris' bugs.

On the Hills, although sorghum was a failure at Nanjanad, Periamanjal cholam has been a regular fodder crop at the Imperial Dairy Farm at Wellington and also in some places round about Coonoor (6,000 ft. above Sea level). The yields at the Dairy Farm range from 10,000 to 15,000 lb. of green fodder per acre.

Certain exotic types, such as "Chinese sugarcane" and "Planter's Friend" (at Saidapet in 1871), American types Red Kafir and Dwarf Milo in 1910 at the Central Farm, Coimbatore and *S. margaretiferum* in 1932 at Taliparamba, have been tested, but none of them have proved suitable for South Indian conditions. A few Bombay types of Jowar tried at Hagari in 1934, were found to mature earlier and thus escape the drought.

Sudan grass (*Sorghum sudanense*) was noted as promising at Hagari in 1917 and at the Central Farm in 1919 ; here it was sown in July and gave a single cutting of 9,100 lb. per acre in October, but dried up

thereafter and is not mentioned afterwards. This popular fodder grass of America and Australia does not seem to have a future in this Presidency.

Maize (*Zea mays*). Although this crop often equals sorghum in fodder outturn and is in some respects even superior, on account of its quicker growth, non-poisonous nature, and uniformity of yield all through the year, it is not so hardy or so widely adaptable to soil and climatic variations as sorghum. It was a common irrigated fodder on the Saidapet Farm, the yields varying from 12,000 to 17,000 lb. More recently, in the Northern Circars it has not been a success, either as an early or as a late crop, but at Guntur it has been grown regularly as a rainfed crop from 1923 onwards in both the early and late seasons, although the yields have ranged only from 1,640 to 4,100 lb. of green fodder. At Hagari it is an irrigated fodder since 1931, with an outturn of 4,350 to 11,600 lb. Consequent on poor yield of 2,200 lb it was not continued at Nandyal, after its first trial in 1930. On the Ongole Cattle Farm at Chintaladevi it was a rainfed crop off and on from 1921 to 1932. The yields here too, as at Guntur, were only moderate, averaging merely 4,000 lb of green fodder per acre. On the East Coast, Palakuppam was the only place where it was tried and there it proved in 1927 an effective trap-crop for the parasitic weed striga. The next year, maize was grown in the same field and gave a striga-free crop of 4,900 lb. per acre At Coimbatore it has been a favourite forage crop since 1910 in maintaining a large dairy herd. Unlike sorghum, which tends to rush to flower, and gives a smaller outturn from sowings in September to January, the yields from maize are fairly uniform all through the year; hence from August to January it is better to grow maize for fodder, reserving sorghum for the other months of the year. At Hosur also, maize has been a close second to sorghum as a main-stay of green fodder for milch cows, with an average outturn of 13,300 lb. It was observed here that if maize was cut and fed at the right stage, i.e, just when the cobs were forming, there was a marked improvement in milk yields. Once this stage was passed the feeding value deteriorated very rapidly, and it is therefore important to utilize this fodder just at the right stage. On the West Coast, maize was tried as a rainfed inter-crop in the coconut plots at Kasargod in 1930 and gave 3,500 lb. green fodder per acre. Further South at Pattambi, however, the yield was much poorer, never exceeding 2,000 lb. as a rainfed crop on *modan* lands. It was a failure in wetlands also. At Koilpatti it has occasionally been grown under irrigation in the red soil area. The yields were usually only moderate ranging from 3000 to 3,800 lb., except in 1936, when, consequent on a heavy dressing of poudrette, it shot up to 30,800 lb. per acre.

Teosinte (*Euchlaena mexicana*). This ancestor of maize from Central America was introduced at Saidapet about 1881, and in 1885 Benson reported on it thus: "It is doubtless a heavy yielder, but cannot withstand drought and is therefore limited in its scope to moist tracts or where irrigation is possible. The fodder is moreover very watery and devoid of any

sugary matter and is not quite palatable to stock." In 1932, it was introduced at Coimbatore and after trials at various other centres was found to be inferior to sorghum as a rainfed crop, although equal to it under irrigation. Contrary to Benson's report, however, it was very well relished by stock at Hosur, being distinctly sweet at the flowering stage and like maize capable of stimulating milk production when cut and fed at that optimum stage. At Guntur it gave 4,000 lb. green fodder as an early sown crop and 2,900 lb. in the "pairu" or late season. Cattle relished it better than jonna, but the outturn was less. At Palur too, the July sown crop was a success, yielding 34,900 lb. per acre and was about two weeks earlier than fodder sorghum, but the October sowings gave only 3,600 lb. Too much moisture in October proved detrimental to its success when sown in September at Aduturai (1932), but the March sowings fared better, and produced 6,200 lb. per acre. The average at Aduturai works out only to 4,100 lb., so that it cannot be classed as a great success in the Tanjore delta. At Coimbatore, teosinte has been grown regularly since 1932, but only on about 20 – 25 cents each year. The average yield comes to 28,400 lb. per acre, as compared to 21,100 lb. from sorghum. At Hosur, the yield was 25,100 lb.; at Taliparamba it was 20,800 lb. under irrigation, but the yield as a rainfed crop was only 930 lb. At Pattambi, however, both the irrigated as well as rainfed crops were failures. At Koilpatti also the dry land yields were disappointing, being only 1,500 lb. green, but the irrigated yields were better, averaging 10,200 lb. On the hills it has been a success. producing 19,500 lb. green fodder per acre.

Guinea grass (*Panicum maximum*). This grass, a native of tropical Africa was introduced into South India, about 1870 and has now become so well acclimatised as to be classed as one of the best fodder crops available. It is a tufted, profusely tillering, surface feeding, perennial grass that thrives best on well drained loams. With liberal irrigations and manuring it gives its first cutting six months after planting and thereafter continues to yield well for about three years without replanting, at the rate of seven or eight cuttings a year. It thrives well on sullage water and can also be conveniently grown along field bunds and sides of water channels, providing a nutritious succulent fodder for milch cows and young stock.

Napier's Fodder (*Pennisetum purpureum* old name – Elephant grass) is similar but often gets more rank and coarse than guinea grass. In 1872, a tall grass was noticed growing in the midst of a paddy crop at Saidapet, grown from purchased seed. The seeds from this grass, when collected and sown next year, gave the first cut within 83 days, with a total annual outturn of 21,000 lb. per acre. In 1917 this grass (*Pennisetum purpureum*) was reintroduced at Coimbatore with seed obtained from the South African Department of Agriculture and soon proved to be the heaviest producer of green material ever grown on the farm, the average annual yield of 99,200 lb. being nearly twice that of guinea grass and four times as much as fodder sorghum. Although, on analysis it showed a higher moisture content, in

practical feeding it was found that the serrated leaf edges caused mouth-sores in cattle, so that they could not consume it in quantities sufficient for heavy work or milk production. Hence, guinea grass was on the whole the better fodder, though Napier's fodder was a heavier yielder. At Samalkota, guinea grass produced 86,500 lb. per acre per annum. At Guntur both the grasses have been grown regularly from 1931 onwards, on about half an acre of garden land, with an average outturn of 15,400 lb. At Hagari, the yields were poor in the beginning, being only about 4,500 lb. but after 1926, probably as a result of better cultivation, they have improved to an average of 13,000 lb. per acre. At Chintaladevi, guinea grass was both a rainfed as well as an irrigated crop with an yield of 5,000 lb. and 22,000 lb. respectively. Both the grasses have figured with success at Palur since 1917, guinea grass yielding 23 000 lb. and Napier's fodder 48,000 lb. The average cost works out to 356 lb. per rupee for the former and 462 lb. for the latter. At Tindivanam, guinea grass was somehow very poor, yielding only 3,200 lb. against 24,900 lb. from Napier's fodder; but at Aduturai they were both equally good, producing as bundside grasses an annual outturn of 37,600 lb. per acre. On the Central Farm, guinea grass was first grown in 1914 and within two years was recognised to be as good as or even better than sorghum as a forage crop, being semi-permanent, able to thrive on sullage water, and a heavier yielder than sorghum. The area under it rose from two acres in 1918, to about 12 acres by 1927. The average yield works out to 49,000 lb. and the cost to 570 lb. per rupee, as against 506 lb. per rupee for sorghums and 376 lb. for fodder maize. The cuttings were usually heaviest soon after the south west monsoon, and grew lighter with the approach of flowering during the cold months. Removal of flower heads as they appeared did not improve the fodder yields. As mentioned above Napier's fodder yielded nearly twice as much and so was cheaper to grow but being liable to get too rank and hard-stemmed, it had to be cut earlier. At Hosur, the two grasses have been grown regularly since 1925, with an average yield of 27,500 lb. for guinea grass and 23,900 lb. for the other. Being essentially garden land crops, they have not become very popular on the West Coast. They grew well enough during the monsoon months, but owing to lack of irrigation, got stunted from December to February, just when green forage was needed most. However, guinea grass has been grown at Pattambi along bunds and the sides of water channels. The cost of growing it worked to one Rupee per 655 lb. In the Southern tract, guinea grass has been regularly grown at Koilpatti on about 30 cents in the red soil area since 1917, the annual outturn per acre averaging 49,000 lb. in 6 cuttings.

The Lesser Millets as Fodder. *Cumbu (Pennisetum typhoideum).* Although the straw can only be classed as a famine fodder, the green crop is a very useful, short-period forage, eminently suited for making silage. As early as 1879, Benson observed at Saidapet that it "grew very well indeed under irrigation, yielding 15,000 lb. within a period of 75 days or so, although of course it was not quite equal to cholam either in quantity or

quality." It has been grown under irrigation at Hagari from 1930, with an average acre yield of 11,300 lb., while at Palur the conditions were apparently not so congenial that even as a rainfed crop from July to September the yields worked out to 7,600 lb. per acre. At Chintaladevi also it was a regular irrigated summer fodder, but the yields here were all very low, averaging only 2,300 lb. per acre, probably on account of the inherent low fertility of the soil. At the Central Farm, its usefulness was recognised as early as 1910. It was tested against fodder sorghum in 1933 and produced within 33 days an outturn of 31,000 lb. as compared to 15,000 lb. from sorghum in 104 days Another advantage of cumbu over sorghum was that it could be cut and fed to stock at any stage of its growth, without danger of hydrocyanic poisoning. In spite of these, however, cumbu has not figured as a fodder crop in subsequent years. For the West Coast cumbu seems to be better suited than sorghum; a variety *Pennisetum leonis*, from Sierra Leone, was tried in 1933 at Taliparamba and grew very well, with an yield of 13,500 lb. as an irrigated crop in the wetlands. At Pattambi, local cumbu has been grown with success since 1930, yielding 9,100 lb. per acre and providing an excellent material for ensilage. In the Koilpatti tract, cumbu is an important food crop of the dry lands; on the farm, a variety from the Belgian Congo was tested in 1916 and found good as an irrigated fodder crop in the red soil area. Local cumbu has also been grown in the red soil, from 1930, and has yielded 16,300 lb. per acre on the average, although on the rainfed black soils, it was definitely inferior to irungu cholam as fodder.

Ragi (*Eleusine coracana*). Though third in importance among the millet food crops, this has not been tried anywhere as a fodder producer. The straw by itself is only an indifferent fodder, but it improves on ensilage and is then well relished by cattle. *Samai* (*Panicum miliare*) is another minor millet that has possibilities as a quick-growing fodder. At Saidapet it was reported in 1879, to have yielded 47,000 lb. per acre under irrigation, in two cuttings within 138 days. At Aduturai (1933—1936) it gave 13,200 lb. as green manure, within a period of 55 days, but it has not, somehow been tested any time, as a fodder producer, either at Coimbatore or at Hosur. It was tried at Pattambi without much success, but at Nanjanad it has been very successful, both as a grain crop (the Badagas preferring it to their time-honoured Korali (*Setaria pallidifusca* Stapf & Hubbard) as well as a green manure, along with lupins.

Other Grasses. Under this heading are included those intermediate between crops like guinea grass, that are cut and fed, and the genuine pasture grasses. Since, unlike temperate countries, the dry season in India extends from six to eight months (October to May), permanent pastures alternate in most cases between extravagance and penury. Thus, soon after the monsoon, from September till December there is more grass than anyone knows what to do with and later, just when fodder is needed most, there is only bare land, dotted here and there with semi-dry tussocks of grass

Under such conditions, the conservation of the monsoon flush, either as hay or as silage is the only solution. A number of grasses, both indigenous and exotic have been tried in this province, to evaluate their suitability for periodic cuttings, for hay and for making into silage. The more important of these are noted below :—

Kikuyu grass. (*Pennisetum clandestinum*). This was first tried on the Central Farm in 1924 and at Hosur, from slips obtained from the North West Frontier Province. It yielded 19,800 lb. per acre at Coimbatore and was noted as fairly drought resistant, but was less so at Hosur, and was discarded in 1926, as being more suited for pastures than for periodical cuttings. In the cooler habitat of the Hills, however, it fared better. Thus at Nanjanad, it was found to grow very well as a binding grass on bunds, and sides of water channels, able to stand both frost and water logging very well indeed.

Rhodes grass. (*Chloris gayana*), was grown in a small plot on the Central Farm in 1916 and gave great hopes but proved disappointing when grown the next year on a field scale. At Hagari too, it was promising at first in 1917, but suffered so badly from drought in 1919 that its cultivation was given up. At Hosur, however, it has been pronounced remarkably drought resistant, being in fact reported as not very happy at all under irrigations. The average annual yield here has been 10,800 lb. per acre.

Spear grass (*Heteropogon contortus*) This is the most prominent grass of the "grass lands" at Hosur, on about 800 acres each year with an average yield of 1,100 lb. of hay per acre. This crop too, is extremely hardy and drought resistant, being observed to be intolerent of more than 8—10% moisture in the soil. If allowed to ripen fully it becomes not only unpalatable on account of the hard 'spears' or awns, but also somewhat deficient in minerals and feeding value. Cattle consume such ripe hay only in quantities just enough for maintenance but not for any increase in weight or milk production. It is therefore preferable to cut it for hay before flowering, even though the outturn is somewhat diminished thereby, but this, however, was not always practicable, owing to rainy weather just then. It has therefore been necessary to supplement this ripe spear grass hay with other richer feeds. The silage too, from this grass was often found to be very dry, unless care was taken to cut it with the dew on, i. e., before eight in the morning, and pit it immediately. The hay could be rendered more palatable by first combing out the spears in the field by means of a special implement drawn by a single bullock. The grass is allowed to ripen just enough for the spears to get dry and become matted up by the wind, the comb is then set at the requisite height to engage these matted awns and drawn through the crop in the field. The combed-out awns are swept out at the head-lands. Various attempts to replace this grass by other more palatable grasses, at least in the more low lying fields at Hosur, were made but none was a real success. For example, Kolukkattai grass (*Cenchrus ciljaris*) was tried in 1926, but, though it came up well, it was not quite so

drought resistant as spear grass. This Kolukkattai grass has also been tried with varying success at various places in the province but seems to grow best only in the Kangayam tract. Thus at Samalkota, it was reported to be a success in 1933, the only year it was tried there. At Guntur it was tried in 1926, but owing probably to an adverse season, it did not come up well, and so was discarded. However, at Chintaladevi, although it took some years to get well established, it eventually proved quite good. No special mention is made of it at the Central Farm, Coimbatore, although some of the paddocks have been put under this grass since 1925.

Abyssinian Teff grass (*Eragrostis abyssinica*). This native of Transvaal was introduced in 1913 with seed from Kew and tried at the Central Farm at Coimbatore. It grew well enough and was relished by cattle, but was not firm rooted enough to stand cutting or grazing. The yields too were rather low and so it was abandoned in 1918. Another grass Efwatkala grass (*Mallinis minutiflora*) was got from Rhodesia in 1922 and grown on the Central Farm for five years. Under irrigation it yielded 17,300 lb. per acre per annum but this too was discarded, as it was found to be rather evil-smelling at certain stages of its growth and was then rejected by cattle.

(To be continued).

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Norwegian and Italian chickens of the same breed differ markedly in temperament, according to Professor N. Jaensch, of the University of Marburg. Professor Jaensch's description of the behaviour of northern and southern chickens reads almost like a popular statement of the difference between Nordic and Mediterranean human races. The northern fowl, he says, walks more proudly, goes quietly and directly on its intended course; the southern bird is more excited and agitated and dashes about moving its head continually. The Norwegian chicken eats until it has had enough and then quits; the Italian can be induced to overeat if it sees its fellow-fowls picking up grain.

A note on the melon cultivation at Sidhout.

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Introduction. "Grow more fruit" and "eat more fruit" have become the slogan of the day. Fruit culture is becoming popular not only because of the increased money return it gives to the cultivator but because many have begun to realise the nutritive value of fruits. The old fallacy, that fruit is an article of luxury, is slowly giving ground. In this short note an attempt is made to give an idea of the cultivation of melon—a cheap, luscious and nutritious fruit which belongs to the family of cucurbitaceae.

When we talk of melons, we are reminded of Sidhout, since Sidhout melons are reputed to be the best in S. India. We can also reasonably suppose that melons were first raised in these parts, though this crop is now grown in many places.

Soil and temperature. Soil plays an important part in the cultivation of melons. Since the cultivation of this crop is done in only certain river beds it shows that certain special conditions of soil and temperature are essential for the growth of this plant. River beds with gravelly sand are not quite suited—fine sand with a very slight admixture of river silt is the best. Coarse sandy soil is often rectified by the addition of fine silt. The problem of drainage does not arise in river beds, but there must exist a sufficient subsoil moisture for the successful growth of this crop.

This being a summer crop, raised in Cuddapah district, it goes without saying that a fairly high temperature is essential. This crop comes up well in river beds of fine sand with plentiful underground water supply and a high atmospheric temperature. This plant is often spoken of as one "with a cool foot and a hot head".

Season and duration. This crop is purely a summer crop raised from the month of January onwards. Usually the cultivation is taken up after Pongal festivals. Even a slight shower or a cloudy weather is detrimental to the plant. The creepers present a sickly appearance if showers are received during the growing period; the fruits lose their normal taste if showers are received during the fruiting season. Hence bright weather is absolutely essential during the entire season. The duration of the crop is about 70 to 80 days.

Preparatory cultivation. Since melon cultivation is not assessed by the Government on the ground that it is a precarious crop, the right of cultivating a particular plot is decided by the priority in selection by the ryots themselves. When the water level in the river goes down the selection of plots is done. Usually the ryot raises his melon garden on the same place year after year unless three is a change in the course of the river. Gardens are laid out close to one another without leaving space between them. By

this method the gardener fences only three sides leaving the fourth to be fenced by his neighbour.

The preparation of the plot consists in levelling the sand and digging pits about 8" in diameter and 3" apart in the row, and rows four feet apart. The depth to which pits are dug depends on the layer where moisture is reached—since sites are selected close to the water course, the pits are generally shallow. Digging of the pits is done either with a mammatti or a sand scoop.

Seeds and Sowing. Seeds: Melon seeds generally keep their viability only for about an year. The practice is to collect good seeds from selected fruits and preserve them in ash. This is done by mixing the wet seeds with ashes and the whole mass is made into a cake and preserved by drying.

Nursery :— The seeds are not directly sown but only sprouted seedlings are transplanted in the prepared pits. Very near the water source, sand is excavated till the moist layer is reached. Melon seeds which were soaked overnight are thickly sown in these shallow plots and covered with moist sand; usually these nursery plots will not be more than a square yard. About the 4th or 5th day the seedlings which may measure about 2 inches in length will be ready for transplanting. These seedlings are transplanted in doubles in the prepared pits. A few cultivators prefer to spread a piece of cloth over the seeds sown in these pits and then cover the pits by putting a moist layer of sand of about an inch or two in depth. This is supposed to facilitate the easy removal of seedlings for transplanting without damage to the seedlings. When these seedlings are transplanted no watering is necessary since their roots are placed at such a depth where moisture is present.

Seed rate :— About 950 seeds go to an ounce. Twenty ounces will suffice for an acre.

Manures and Manuring :— The manures that are usually applied to this crop are farm yard manure, oil cakes, and birds droppings — The use of artificials is not known.

The first manuring is done while transplanting the seedlings when only a handful of well rotten cattle manure is put in each pit and mixed with the soil before planting the seedlings. After a week a mixture of birds droppings and farm yard manure is applied. The quantity applied is about a handful of the mixture for each plant. The manuring is done by scooping out the sand about 2 or 3 inches away from the plant on opposite sides and the manure put in. After another fortnight a third manuring is done as in the previous occasion but on the remaining two sides with a mixture of farm yard manure and oil cake. Still a fortnight later, a final manuring with farm yard manure and cake is repeated but with double the quantity used on the previous occasion.

Irrigation. This item of expenditure in the cultivation of melons is altogether absent due to the presence of the underground water supply. At

the time of transplanting the roots are placed at such a depth where moisture is present and so the necessity of watering at the time of planting does not arise. Subsequently, as the water table in the river bed goes down, the roots get deeper and thus there is a natural adjustment by the plant in procuring its water requirements. In this connection it is worth while remarking that melon cultivation will be successful only in river beds where the water level goes down very gradually. In other words, if the rate of downward movement of moisture in the river bed is high, the root development of the plant may not be possible to that extent to keep the roots in contact with the moist layer, the ultimate result being the drying up of the creepers.

After cultivation. This consists of earthing up and guiding the creepers. A week after planting, earthing up is usually done when manuring is carried out. This operation is repeated when the final application of manure is finished. After this, guiding of the creepers is attended to. Guiding is effected by burying one or two leaves in the sand and thus preventing the creepers getting blown by the wind. Fencing of the melon garden is another important item of work. This is usually carried out as an after cultivation after the creepers have flowered although it is done earlier, at times.

Flowering and fruiting. Melon creepers begin to flower by about the seventh week after planting. The flowers are small and axillary and are yellow in colour. Only a few flowers develop into fruits. Normally one or two fruits per creeper can be expected. But where more than one fruit is got, they are usually undersized. The fruits will be ready for picking in about a month from the date of flowering.

Varieties. More than a dozen varieties are locally known but no effort seems to have been made for the maintenance of the varietal purity. Many of the reputed varieties with very desirable qualities are sadly neglected for want of an encouraging market. The following few varieties are locally cultivated on a commercial basis.

Hingan. This is a good commercial variety the fruit is spindle shaped, orange red in colour when ripe, with coarse white netting and indistinctly ribbed. Hence the fruit is rough to feel. This usually measures 9 inches long and 5 inches in diameter. An average fruit will weigh about 4 lb. The variety stands transport best since it has a thick skin.

"*Laddukirni*". This is a small sized variety. The fruits are very sweet and hence its name. The fruits are round and smooth, usually greenish in colour even when ripe—The good sized ones will be about 4 inches in diameter. The only defect in this variety is its poor keeping quality and so does not stand long transport—These fruits are usually picked when half ripe for distant markets.

Jalbudama. This is the variety that produces very large sized fruits. They are spherical with rough skin having coarse netting. An average fruit measures 9 inches in diameter and weighs about 6 to 7 lbs. Generally this variety is not tasty and is usually put in where quantity and not quality

is required. The variety responds to nitrogenous manure as seen by the development of fruits.

The following are a few varieties that are also grown on a very small scale. They are Bathaskirni, Jamkirni, Burkaikirni, Thellakirni, Pappoye and Adamsha.

Darbija. This is a water melon grown on a commercial scale. The fruits are large and long in shape. They are dark green, smooth skinned and weigh about 10 to 15 lbs. Unlike in the musk melon the water melon is characterised by deeply lobed thin leaves, and the fruits have fleshy red pulp and black seeds when ripe.

Harvesting and Marketing :— In Melon gardens when the fruits ripen a watchman becomes necessary to reduce the damage to the fruits by jackals during nights, not to speak of the pilfering by the neighbouring gardeners. This part of the year being summer the whole family of the gardener prefers to sleep the night in the garden itself.

The period of harvest will extend over a fortnight. The fruits come to harvest at one time, so much so the marketing is found difficult. Unless the prices are favourable, the cultivator is put to loss since the produce has to be disposed of soon after harvest. The adjoining taluks like Badvel, Rajampet and Cuddapah are the usual market. The cultivators themselves cart the fruits to the market and effect the sale. Sometimes wagon loads of fruits are sent to Madras market but this is being slowly given up for fear of incurring loss. Marketing facilities through co-operative movement for better prices do not exist and individual enterprising gardeners occasionally effect sales in distant markets.

Pest and diseases. There are not many pests and diseases for this crop. Rust on leaves is noticed but damage is not much. The pests that really do damage are the plant lice. Spraying or dusting is uneconomical considering the value of the creeper. Very badly infested leaves are removed.

Due to the application of oil cakes to the creepers, fly breeding is accelerated. The manure, due to the presence of moisture rots emitting an offensive smell. Attracted by the smell the flies breed by laying eggs in the rotting cake. These flies attack the cattle. They have long proboscis and cause annoyance by puncturing the skin. These flies are identified to be '*Stomaxys calcitraus*'. The cattle become restless. Usually the field operations during this period cannot be carried out during the daytime. The mhoting is done at nights.

Conclusion. We find that the area under melons is slowly dwindling down year after year due to various factors. The most important of these is the glut in the market and consequent low price. Gardens are raised at different periods to overcome this but the practice of raising gardens throughout the summer to have a continuous supply to the market is not in vogue; the floods are expected at any time from the month of April onwards and the damage of submergence of the crop then always exists.

Since the fruit is a delicate one, which easily gets damaged during transit to distant market, air conditioned wagons for quick and safe transport have to be provided by the railway authorities. Also, investigation and later on propaganda work in the direction of preservation of fruits either by canning or preparing products like squashes, have to be made, since the fruits are available in plenty and are cheap.

The economics of melon cultivation.

Details of expenditure (for 1000 plants in 10 cents)

1.	Preparatory cultivation :—			
	(a) Levelling the sandy bed and making small pits at a contract rate of 0—2—6 for 100 pits—for 1000 pits.	Rs.	1	8 0
2.	Manures and manuring :—			
	(a) About 2 cartloads of Farm yard manure at 1—8—0 per cartload.	Rs.	3	0 0
	(b) About 200 lbs of birds dropping.	Rs.	3	8 0
	(c) 10 maunds of oil cakes at 12 as. a md.	Rs	7	8 0
	(d) Labour charges for manuring :—			
	i. Manuring at the time of of transplanting the seedlings.	Rs.	0	8 0
	ii. Manuring with birds droppings a week after transplanting.	Rs.	0	8 0
	iii. Third manuring with a mixture of cattle manure and oil cake.	Rs.	1	0 0
	iv. Final manuring (same as in iii)	Rs.	1	0 0
3.	Seeds and sowing :—			
	(a) Cost of seeds—(local rate) L. S.	Rs.	0	7 0
	(b) The cost of raising nursery and transplanting the seedlings.	Rs.	0	8 0
4.	After cultivation :—			
	(a) Labour charge for earthing up a week after a planting.	Rs.	0	8 0
	(b) Second and final earthing up.	Rs.	1	0 0
	(c) Providing thorn fence—cost of thorn and labour.	Rs.	1	0 0
	(d) Night watchman during fruiting season.	Rs.	4	0 0
5.	Harvesting :—			
	This includes the marketing charges also. Local practice is to sell the garden and the purchaser does the harvesting. Hence under this item L S. is provided.	Rs.	3	0 0
		Rs.	29	0 0

Details of income.

	The cost of 1500 fruits at 2—8—0 per 100 (local delivery).	Rs.	37	8 0
	Profit.	Rs.	8	8 0

N.B.—1. A family of four with one male member can manage a garden of 1000 plants.

2. In the case of private gardeners items 2-(a), 3-(a) and 4-(c) are not to be included. The seed is collected and preserved from the previous crop and the watching is done by the members of his family. The cattle manure is got from his farm.

3. The profit in the case of private gardeners will be (7—9—0+8—8—0) 16—1—0 in addition to providing labour for the entire family.

Cultivation of Rice and the best Method of Marketing.

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The subject, it is needless to say, is of paramount importance to the ryots of the Madras Presidency. About 10·5 million acres are cultivated under paddy at present. There are vast deltas under Cauveri, Godavari and Kistna systems of canal irrigation. It is also cultivated under lift irrigation as in Salem and other districts. But the area under it may be small. It is computed that about 75 % of the population take the rice diet in this Presidency and we may assume that this percentage will increase as the standard of living increases and more and more area is brought under irrigation projects. Rice in this Presidency stands in the same relation as wheat to North Western India. In North India wheat is the common staple food of about 75 % of the population. Rice will continue to be the main cereal of consumption in this Presidency and it will not be replaced easily by any other cereal.

It therefore naturally attracted the attention of the Agricultural Department right from the beginning and it set about to improve rice growing and production. Surveys of rice cultivation were made and a number of research stations was established in different parts of the Presidency as finance permitted, to study the local conditions and improve the local varieties. The needs of the Districts in this Presidency were separately met by establishment of Rice Research Stations. Generally speaking the varieties suitable to one locality are not generally suitable for other localities. To give an example the famous Tanjore *Sirumani* is not suited to Salem District and vice versa. The varieties of Malabar are not suited to the conditions of Tanjore and South Arcot districts and therefore there is the need to group together certain districts and find out suitable varieties for these districts. The time and money spent in search of such strains are well spent and will be amply rewarded in future as they have done in the past.

There are three different breeding methods by which best strains are selected. Firstly, Nature by its mysterious working may throw out a strain as for instance G. E. B. 24. It is a mutant which a breeder discerned, isolated and improved upon. The strain has established its fame and has spread to many parts of the Presidency, not to mention its rapid spread in the adjoining states of Mysore and Hyderabad. It is a very good table rice and it has other desirable qualities, such as ability to stand drought, and non-shedding, resistance to *Piricularia* and foot rot diseases. It is also non-shedding. It is not possible to have all good qualities in a single strain. G. E. B. 24 paddy has the drawback of giving less straw. I mentioned G. E. B. 24 as a sport of nature. Such mutants are very rare and noble nature sheds such bounties only once in a way.

The second method is to examine and select good single plants from an existing variety, (isolate) grow them separately, repeat the best selections from them, and establish finally one or more strains. This is done by experts who have intimate knowledge of rice growing. It will require good deal of time and patience to evolve a strain in this manner.

The third method is more intricate and highly technical. It is only highly trained technical experts that could handle and bring about select strains and it is called hybridisation. By this method it is possible to combine different desirable characters in the same strain. The Research stations are engaged in the last two methods and have already evolved a good number of strains suitable for the Presidency and have released them. These strains have given 10% to 20% increased yield over locals and have spread very much in all rice growing tracts. In Tanjore, Trichinopoly Madura, Tinnevelly and parts of South and North Arcot Districts etc., in the south, in Godavari, Kistna etc. in the north, improved strains of paddy strains have spread. In some parts of these districts they have completely replaced the local varieties and in others in varying degrees. In fact in paddy it is not possible to collect figures of improved strains for the area is increasing from year to year by the efforts of departmental officers as well as by the initiative of the cultivators themselves. The Department is doing its best to spread these strains and it is in fact one of the main items of its activities. In all the Taluk Headquarters Depots, the seeds are stocked and sold. The demand has been so great now that it is not possible to meet all the requirements from Research stations. Paddy seed-farms have been started by the Department, improved seeds have been purchased locally and sold to meet the increasing demand. Organised seed multiplication schemes are also under consideration of the Government. As finances permit they will be given effect to. By these schemes, rapid spread of the strains will be effected I may mention here that it is not enough to purchase a superior strain and grow it in the usual way; scrupulous care is to be taken to maintain the purity of the strain. At first only a small quantity is purchased which we multiply to the entire area at our command. It is good to do so, for the single reason that it is economical and at the same time we get the seed acclimatised to our soil conditions and climate.

Paddy is one of those seeds which get easily mixed up in the nursery in planting, harvesting or in the thrashing floor, drying yard, storing etc. and requires all our vigilance to keep the seed pure. Seed selection and storing should be attended to personally by those interested and not left to those who handle them carelessly and who by ignorance or otherwise do not attach much importance to the purity of the seed. I need not go into details of the advantages of pure seed and the importance it plays in successful agriculture. With all the care and vigilance exercised paddy seed gets mixed up with other seeds in course of time and it is better the seed is replaced once in four or five years. Apart from mixing, the seeds get deteriorated and lose their original good qualities as for instance a fine

seed gets course or disease resistant variety develops a new disease. Such changes are naturally governed by environmental conditions and we have to change or adopt new strains to the different conditions. Therefore what a strain is to-day may be entirely different in years to come and we must be changing with nature.

Where is the need for improvement and increased production? The question has been partly answered. It is wrong to suppose that we are over producing. Our population is increasing as also our consumption, and the standard of living increased with the introduction of prohibition which is to be extended soon over the whole Presidency. Salem district, it is said, is now consuming more of staple food articles such as rice etc. and is drawing its supplies from the adjoining districts chiefly from Tanjore, Trichinopoly and South Arcot. People who used to take *ragi* and *cholam* are now getting more and more of the urban touch and are going in for a rice diet. When the whole presidency goes dry, one can imagine what a tremendous demand is going to be created for rice, so that all the quantities of rice you are going to produce will still be found short. There is a great future for rice and rice growing tracts.

Further, I need not emphasize the importance of increasing our yields with less cost in these days of economic depression and low prices. It did not matter when prices ruled high and when one *Kalam* of Paddy (24 M. M.) was selling at Rs. 4. In those days we could have afforded to forego a bit of production capacity. What was lost in yields was then made up in price. But now when prices have gone down considerably, it is important that the ryots should wake up and increase their production.

It is therefore a sound proposition for acceptance that the yield of paddy per acre should be increased and we shall presently consider ways and means how increase in yields could be effected. It was already stated that by using improved paddy seeds, 10% to 20% increased yield could be obtained by mere change of seed alone. The improved seed may cost a little more than the local seed and that is worth paying for.

By proper cultivation of wetlands with light iron ploughs, it is possible to decrease the cost of cultivation and increase the yield by about 5 %. I mention here, the use of a plough like Cooper No. 25 for wetland cultivation. It is a handy and light plough for using in wet lands and has been found useful. In Chidambaram Taluk more than 200 ploughs are at work and those mostly in wetland cultivation. It suits the local cattle which are small sized animals and also the nature of wetland soils largely. Locally the ryots use a very small wooden plough and sometimes without the iron share resulting in poor and imperfect cultivation. The chief objection raised by ryots against the use of the iron plough is that, their cattle are of small size and even the lightest iron plough gets down deep into the mire in the puddled land and their cattle are unable to cope with the drought. This might hold good in certain cases but wherever conditions are better, it is certainly advantageous to use light iron ploughs and increase the yield.

By adopting improved cultural methods as for instance thin sowing and economic planting, yield could be increased by about 5 %. Further about 60 % in the initial cost of seed per acre is saved.

This improvement of raising thin nursery and adopting economic planting is as old as the Department itself and now vast areas are planted economically in many paddy growing tracts of the Presidency.

By judicious manuring yields could be increased. I am referring here to that aspect of green manuring by growing crops like *daincha, indigo* and *kolinji* and *pillipesara*. It is a known fact that paddy responds to green manuring and in combination with bonemeal or superphosphate the yields could be increased up to 10 % to 25 %. Different soils require different green manure crops. There are certain disabilities which work against growing green manure crops. As for instance *sunnhemp* and *pillipesara* and at times *daincha* are crops liable to be grazed by cattle unless protected by proper fencing or by watch over them. As fencing system is absent in the delta area, it is possible to get over the difficulty by co-operation. If ryots in a village co-operate and sow their green manure crop in a compact block it is possible to grow *daincha* or *sunnhemp* successfully and on large scale. Cultivation of *sunnhemp* for fodder after rice between December-February, in northern districts is a case in point. It is then possible, if necessary, to keep a common watch against cattle trespass. I might cite an example near at hand in South Arcot District. In a village called Modaiyur, Chidambaram taluk, a few ryots joined together last season, got about 20 bags *daincha* seed collectively and sowed about 100 acres in a compact block. It was cut simultaneously and composted. This is a good instance, where co-operation could really help. If one or two ryots had attempted to grow the crop separately, it might have ended in failure. I have now shown how we could increase the yields by using improved seed, by good cultivation, proper manuring etc.

By adopting all the improvements systematically and judiciously it has been in course of years possible to increase the yield of paddy by about 75% more. Records of the Agricultural Research Station, Palur and Central Farm, Coimbatore show that, where a variety yielded 1800 or 2000 lbs. per acre 20—25 years ago, it now yielded 3500 lbs. and more. This shows that by systematic farming and good cultivation we can increase the yields considerably.

Marketing. But it is not enough if we are merely able to produce a certain commodity. Mere production in any scheme of national regeneration will not solve the problems of poverty, indebtedness etc. unless those products are simultaneously marketed to the best advantage. The problems of production and marketing are knit close together and they have to be solved together. How best to market the produce should engage the attention of Rural Development workers as well as the State. Ryots who are generally poor are confronted with expenses specially when their paddy is

about to be harvested or just after it is harvested. They have to pay Government kist or celebrate a marriage or pay a pressing debt which cannot be postponed. They are compelled to take loans at exhorbitant rate of interest from the *sowcars* or sell their new produce when the prices are usually low. They cannot afford to wait for better prices. It is in this way one and all from a rich Mirasdar down to an ordinary ryot are suffering. It is here, where real help is needed either from public bodies or corporations as in the west or from the State. We do not find in our country, such institutions as in the west where co-operative bodies are formed from public funds and help the societies. The burden here largely falls on the State.

Government has therefore come to the aid and formed co-operative societies, known as Loan and Sale Societies, for the benefit of the growers. The Loan and Sale Society will advance loans to the ryots or members on the security of the produce say at 6% interest. The society itself will be financed by the Central Bank at 5% interest. The produce will be sold either by the individual, better still by the Society itself when prices rule high. The Society will then recover the advances paid with interest and the balance handed over to the member. In this way, the member is helped not only to tide over the financial difficulty but is also materially benefitted with extra profit which he gets by selling at favourable rates and further we do away with the middlemen who more or less, like vultures, snatch away the extra gain which really should go to the actual tiller of the soil. As an example, I cite the paddy loan and sale society which is working at Chidambaram very successfully. This is the third year of its working. During the year 1938 the Loan and Sale Society disbursed loans to the extent of Rs. 75,000 in 21 centres among 245 members. The profit, the members got was as much as 10% to 40% extra. The paddy which was selling at the time of pledging at Rs. 1—8—0 per *Kalam* only, was sold later on at 1—12—0 to Rs. 2—8—0 per Kalam. Therefore if paddy could be held up for better price with the aid of a society, it could be sold subsequently at a great profit. It is therefore upto the ryots to follow such example, form Co-operative Loan and Sale Society and benefit themselves.

The Marketing section of the Agricultural Department is trying to improve marketing conditions for paddy. It has made surveys of the rice growing areas in the presidency and is trying to find out ways and means to market the produce to the best advantage of the producer. It has begun to introduce grading of rice in Tanjore District and sell the graded produce at some premium in foreign markets. It has already begun to function and has done some useful work in this direction but much remains to be done. The marketing section is actively engaged in solving several problems connected with marketing of rice and it is hoped that ere long the ryots will have the full benefits of its labours.

SELECTED ARTICLE.

Deforestation and Soil Erosion in Trinidad.

DEFORESTATION AND SOIL EROSION IN THE FOOTHILLS OF THE NORTHERN RANGE CAUSED BY SHIFTING CULTIVATION.

By J. C. Cater, Assistant Conservator of Forests.

The Foothills Region. A recent, and perhaps somewhat superficial, survey has been carried out to determine the amount of deforestation that has taken place in the foothills of the Northern Range, since there is sufficient evidence of erosion to give some cause for alarm. The area surveyed has embraced all the land south of the main ridge of the Northern Range between Maraval on the west and Tacarigua on the east. It is true that there are erosion problems elsewhere in the Northern Range, but it was felt that the area indicated above presented by far the most difficult problems.

There is extremely little flat land in the foothills region, about 75 per cent. of the area is over 500 ft. above sea level and about 25 per cent. over 1,000 feet above sea level. Most of the slopes are very steep, some even precipitous. Roads are confined to the valley flats, but bridle tracks lead up from the roads to the ridges. The rainfall is somewhat variable, being about 70 to 80 inches per annum in the valleys and considerably more on the hilltops. South of the foothills the rainfall drops rapidly to 50 to 60 inches per annum. In normal years nearly all the rain falls during the last 7--8 months of the year, and on occasions the rain is extremely heavy. The period January to the beginning of May is usually marked by a drought, when the vegetation becomes tinder dry.

The soils of the foothills are derived from mica and quartz schists, and from the occasional lime-stone masses such as are found at Laventille and Caneron. Owing to the steepness of the slopes, erosion takes place at such a speed that a proper soil profile is never developed, even under high forest. The hillside soils are very shallow, often with the parent rock only 6 inches below the surface, and where serious erosion has taken place the shallow soil is studded with boulders. Were it not for the fact that the mica schists decompose very rapidly on exposure to the elements, there is little doubt that much of the steeper hillsides, where serious erosion has followed persistent cultivation, would consist of the bare rock. The Soils, particularly those derived from the quartz schists, are by no means fertile, but here are deeper and more fertile soils in the valleys between the hills.

Thn Vegetation. The original vegetation supported by the foothills before the advent of the human race to the island, almost undoubtedly consisted of tropical evergreen rain forest, with a proportion of deciduous and semi-deciduous species, such as cedar (*Cedrela mexicana*), cypre (*Cordia alliodora*), poui (*Tabebuia serralifolia*) &c. Balata (*Mimusops balata* var. Cruegeri) was probably common, as it is still plentiful on the seaward side of the watershed. The last remnants of this forest can be seen on the upper slopes of the Santa Cruz valley near St. Ann's peak, and further east in the Tacarigua proposed Forest Reserve.

During the period of Spanish ownership of the island, the forest in the valley bottoms was cut down and replaced by cacao plantations. After the advent of the French refugees, about the time of the French Revolution of 1793 and later the arrival of English colonists, when Trinidad became part of the British Empire, more forest was cut down in the valleys and on the lower slopes and cacao was planted. A certain amount of cacao was even planted at the

higher elevations, and there are to-day cacao plantations at an elevation of 2,000 feet above sea level on Morne MalD'Estomac at the head of the Maraval Valley.

In the main, however, cacao was confined to the valleys and the lower slopes, and there was never any considerable permanent cultivation of the middle upper and slopes of the foot-hills. For a considerable time past a very large proportion of the slopes of the foothills have been subjected to severe shifting cultivation, which has destroyed almost all traces of the original forest vegetation. To-day the vegetation over most of the foothills consists of a very poor type of second growth containing numerous palms such as gru-gru (*Acrocomia aculeata)* and the trash-palm (*Sheelia osmantha*). The commonest trees are bloodwood *Croton gossypifolius* balsa *(Ochaoma pyramidale*), saltfishwood (*Machaerium robinifolium*), gommier (*Tapira guianensis*), and kiskidee (*Vismia falcata)*. Shrubs are numerous and frequently the whole mass of vegetation is closely tied up with vines and razor-grass. The bush becomes tinder-dry during the normal dry season and is very liable to be overrun by fires Small patches of bracken (*Pteridium aquilinum*) can be seen on the hills to the north of Port-of-Spain, and further east. Between 700 feet and 1,500 feet elevation, there are areas of savannan similar to the Piarco and Mausica Savannahs. There the dominant grasses are *Trachypogon plumosus* and *Thrasya robusta*, while a sedge, *Scleria sp.*, and a coarse grass, *Axonopus equitans*, are also found. The grasses are tufted, with eroded channels between the tufts. The dominant shrubs are *Curatella* and *Byrsonima*. The bracken patches are almost certainly the result of continuous shifting cultivation and fires which have resulted in severe sheet erosion of the originnally shallow soil. It is not known if such areas can eventually revert to forest, but the process of re-establishment is likely to be very slow and probably depends very largely on the prevention of fire. At present fires occur almost every year.

The origin of the hill savannahs is not known with certainty. They may be the result of continuous shifting cultivation and fires, but there is some historical evidence to show that they may be a natural phenomenon, since a Spanish adventurer of the 16th century has recorded that he sailed up the St. Joseph River and eventually reached a natural savannah from which he obtained an extensive view of the island. It is of course possible that the savannahs are the result of human activities long before the advent of the Spaniards to the island.

Cultivation. The methods of cultivation of the hill slopes are wasteful and primitive in the extreme. During the dry season the bush is cut down and burnt. The law requires that fire traces at least 25 feet wide shall be cleared all round a parcel of land which is to be burnt, but adequate precautions are not always taken and frequently fire escapes from the area to be cultivated into the neighbouring bush, and large areas are damaged. No attempt is made at contour-ridging, terracing or planting in lines along the contours, and the extreme steepness of some of the slopes is not deterrent to the would-be cultivator. The fear of praedial larceny drives many cultivators to utilise land at very high elevations, in the hope that the difficulty of extracting the harvest from such situations may deter the thief, who will confine his attentions to the gardens at lower levels.

The burnt land is sown or planted when the rains break, usually during May. The land is then completely bare of vegetation and the heavy downpours play havoc with the exposed soil. Very large quantities of surface soil are removed by sheet erosion and carried down the slopes. Gullying also takes place to some extent, but does not seem to be so severe as sheet erosion. It is by no means uncommon to find stones which were originally on the surface supported, after heavy rains, on a pinnacle of soil two inches or more high. The eroded soil gradually makes its way down the slopes during successive periods of rain and

is eventually deposited on the low-lying lands or carried out to sea. After rain has fallen in the foothills, the rivers which drain them are loaded to capacity with silt and change within the hour from gentle streams to roaring torrents which overflow their banks and floods the flat land in the Caroni plain, destroying small houses and rendering roads impassable.

The crops commonly planted are sweet corn, tomatoes, carrots, chives yams, &c. They have little effect in decreasing the speed of surface run-off water which is not absorbed by the soil. Usually the crop is reaped within six months of planting. A second and sometimes third crop is grown on some land, but often the land is abandoned after one crop, when erosion and the needs of the crop have exhausted the fertility of the soil. The abandoned land gradually reverts to bush through the invasion of plants from neighbouring areas of second growth and the coppicing of stools not destroyed by fire. After the land has rested for a number of years, usually from three or seven, a certain amount of fertility is built up under the cover of the second growth, and it is again cleared for cultivation.

Ownership of Land in the Foothills. Unfortunately the reservation of land as Forest Reserves did not commence until the beginning of the twentieth century when nearly all the land in the western foothills had been alienated. To-day there are under 2,000 acres of land owned by the Crown in the foothills between Maraval in the west and Tacarigua in the east. The rest of the land, some 28,000 acres of which lie above the 500 feet contour, is divided between small and large proprietors in the rough proportion of 2 : 1. The renting of lands for shifting cultivation is quite an important item in the revenue of many of the estates, rentals varying from 2·00 per acre to as high as 8·00 per acre.

Suggested Methods of Control. Shifting cultivation and its attendant evils have now reached serious proportions in the Northern Range foothills, and it is highly desirable that some form of control should be introduced to protect the community. To decide what form the control shall take, however, is not an easy problem. Considerable quantities of food are grown on the foothills, an important matter to a community which is largely dependent on imported foodstuffs, and it is most undesirable to reduce the total land area under cultivation of locally consumable crops.

One method, and the most drastic, springs to mind at once. It is to prohibit all cultivation of the shifting type on land lying above the 300 feet contour, and allow the land to revert to forest. This would undoubtedly result in an enormous reduction in soil erosion and flooding. To compensate for the loss to cultivation of some thousands of acres of land, it will be necessary to find suitable land elsewhere. This should present no insuperable difficulty. Apart from the large areas of derelict land throughout the Colony, where, in spite of the low fertility of the soils, crops of vegetables could be raised under a system of controlled shifting cultivation there are thousands of acres of abandoned or almost worthless cacao plantations on somewhat better soils. Such cacao produces a negligible crop, which it is not economic to harvest, and even requires a considerable expenditure of public funds in the form of a subsidy to maintain it at all. This cacao could be cut down and replaced by a mixed animal and vegetable crop husbandry which would afford a decent return to the cultivator and be of great value to the Colony.

An alternative, less drastic and probably less effective method of dealing with the problem, would be to permit cultivation of the slopes up to a higher elevation, say the 500 feet contour, and try and educate the cultivators in measures which would reduce the rate of surface water run-off and hence erosion. Research work is required to determine what measures are most effective and

economical in preventing erosion, and it is suggested that terracing, contour ridging, planting along contour strips alternating with strips left in bush or grass, and the use of a grass-sod of species having a prostrate form through which the crop is planted in shallow holes should, among other methods, form the subject of experiment. No cultivation of temporary crops should be permitted above the 500 feet contour, but the cultivation of orchard crops such as tonka beans, limes, &c, might be allowed between the 500 feet and the 800 feet. contour, provided the soil was protected by an adequate grass cover and drains were properly aligned and constructed. Above the 800 feet contour no cultivation of any crop other than cocoa should be permitted, and as much of the land as possible should be allowed to revert to forest. The process of reversion to forest could be accelerated by tending operations such as vinecutting, removal of excess coppice shoots, &c. Whatever form of control of cultivation in the foothills is adopted, there is no doubt that the sooner the control begins the better for the welfare of the Colony.

Acknowledgment. The writer wishes to acknowledge the help and encouragement given by Professor Hardy, who suggested the writing of this paper, and to express his thanks to Mr. E. J. Wortley, Director of Agriculture, and Mr. R. L. Brooks, Conservator of Forests, who kindly criticised the paper during its preparation, (*Tropical Agriculture*, Vol. XVI No. 10, pp. 230—232).

The Rape of the Earth.

A WORLD SURVEY OF SOIL EROSION.

By G. V. Jacks and R. O. Whyte, London, Faber and Faber Ltd., 1939. pp. 301 and Index, with 47 photographic reproductions. Price 21s.

(Review F. H. in Tropical Agriculture Vol. XVI No. 10. P. 223—225.)

In the opening chapter of this book, Mr. G. V. Jacks, the Deputy Director of the Imperial Bureau of Soil Science at the Rothamsted Agricultural Experimental Station, England, gives a very readable account of the modern aspects of soil erosion, in which he particularly stresses the broad economic relationships of the problems of land maintenance. " As the result solely of human mismanagement, the soils upon which men have attempted to found new civilizations are disappearing, washed away by water and blown away by wind...Already...nearly a million square miles of new desert have been formed, and a far larger area is approaching desert conditions ". Despite the invention of efficient agricultural implements, the introduction of better varieties of crops, and the increased use of manures, the average output of the land per unit area taken the world over, is rapidly diminishing ; this is mainly attributed to the ravages of soil erosion which " is altering the course of world history more radically than any war or revolution ". Nevertheless, soil erosion is a beneficient process without which the world would long ago have died, being Nature's way of discarding its old worn-out skin and renewing its living sheath of soil from the dead rock beneath" In Nature, it takes place slowly, so that equilibrium is always maintained between soil removal and soil formation under particular conditions of climate. *It is the great acceleration of erosion through human mismanagement that has changed the process into " one of the most vicious and destructive forces that have ever been released by man ".* Deforestation, the destruction of natural herbage by over. grazing and excessive cultivation may so hasten soil removal that fertile land, taking centuries to form, may be entirely lost within a year or even a few days.

Until recently, soil erosion was regarded merely as a local matter, but it is now recognised as " a contagious disease, spreading destruction far and wide ",

and affecting almost every contagious diseases, soil erosion is most easily checked in its early stages : when it begins to threaten an entire social structure, its control becomes very difficult, though at this advanced stage, it may have assumed such serious and spectacular proportions that eventually whole nations, have been roused to exert supreme efforts to combat the menace to their economic security. Thus, in the United States of North America, soil erosion has become a dominant factor in national life and here the greatest attention is now being paid to solution of its many problms.

It is a peculiar circumstance that the systematic intensive cultivation of soils, successfully evolved in Western Europe where modern civilization had its birthplace, has proved elsewhere to be unsuitable as a basis of economic development. No sooner has European civilization been established in a new country than soil erosion, the invariable destroyer of past civilizations, has set in with usual disastrous results. The probable reason for European immunity to soil erosion lies in the fact that the system of cultivation that was evolved in Western Europe is particularly adapted to the prevailing climatic conditions ; it has been the aim there always to maintain soil fertility, and, if possible, to augment it since the profits gained usually vary in direct proportion to the amount of labour put into the land. In other regions, notably the New World, circumstances have been entirely different ; profits have been made mainly by exploiting virgin soils notably prairie grass lands. Such treatment rapidly exhausts even the most fertile soils, which soon become eroded beyond repair, a result attributable to the "general maladjustment of land-utilization practices to the natural environment" since man has not yet proved himself capable of modifying European agricultural systems to suit the new climatic and economic conditions.

Loss of soil fertility is generally accompanied by loss in soil stability, caused primarily by the removal of protective natural vegetation. This deterioration in physical properties is the invariable precursor of erosion, and is manifest chiefly in a reduction of water-holding capacity favouring run-off rather than downward percolation and storage of rain-water. The deterioration is progressive and soil erosion in consequence becomes more and more devastating until finally deep gullies dissect the once fertile fields and recurrent floods overflow the country. "The consequences of erosion by water may be summed up as the localized reduction of productive capacity due to direct losses of soil and of soil moisture, and the general dis-organization of whole regions resulting from the cumulative dislocation of the natural water regime".

Wind erosion though less widespread differs but little from water erosion in its ultimate effects, and, like it, "upsets the equilibrium existing between "the life and the climate of a region". Together they have "made a knowledge of the underlying principle of human ecology one of the most urgent needs of mankind"; ....."unprecedented land wastage.....has set us, with our vast powers, a task that can profitably occupy the surplus human energy released.....by the advance of science". "New outlooks, new aims and new knowledge will be required before the earth is again fit to rear.....another civilization".

These few quotations from the introductory chapter amply indicate the outlook of the authors of this long-needed book. The chapters immediately following are devoted to the presentation of facts concerning different geographical regions that serve as illustrations to the general theme. In Chapters II to V, Europe and the Mediterranean Region, North and South America, Africa, Australia and New Zealand are considered in detail by Mr. R O. Whyte, Deputy Director, Imperia Bureau of Pastures and Forage Crops, Welsh Plant Breeding Station, Aberyl stwyh, while India, China and Japan are dealt with by Mr. Jacks in Chapter VII.

The chapter following (Chapter VII), by Mr. Jacks, discusses the influence of soil on erosion, and attempts to define such terms as "erodibility" and "soil structure". It is here pointed out that "The more favourable the natural external conditions (climate, slope, vegetation) are to erosion the more erosion-resistant the soil itself will become", an axiom which is well illustrated by the characteristic occurrence in the wet tropics of non-plastic, crumb-structured red earths which are known to be little affected by erosion.

The principles of soil conservation are next considered briefly (Chapter VIII G. V. Jacks), with special reference to the now well-known methods of terracing contour-forming, strip cropping, and damming for flood control in river valleys. The reclamation of gullies and the value of grass and of treess in soil conservation schemes are discussed in four more chapters, and dunes and deserts form the topic of Chapter XIII, all by Mr. Whyte, while some special aspects of conservation (flood control, Chapter XIV; road construction, Chapter XV; and wild-life preservation, Chapter XVI) are next considered by the same author.

The social consequences of unchecked soil erosion must necessarily be profound, since they arise from the maladjustment of agricultural communities to their environments. Maintenance and restoration of land fertility often involve an alteration of the conditions of land tenure. Two main sociological problems are outlined and discussed by Mr. Jacks (Chapter XVIII) in this connection; the first concerns semi-arid grasslands; the second problem, and the more difficult one, concerns the tropics, exemplified particularly by East Africa. In the first example, people of European stock who occupied *semi-arid grasslands* easily accommodated themselves to their environment and usually assimilated the native races. Their struggles and progress in Russia and in North America are related in Chapter XIX, where the varying degrees of economic success of different political systems (capitalism, collectivism, socialism) are fully described In the second example, Europeans who colonized *tropical Africa* exercised little caution, believing that the luxuriant vegetation, which is so characteristic of most parts of the tropics, indicated potentially rich soil that could be directly exploited without fear of deterioration. The fallacy of this assumption has been increasingly recognised in recent years, for the rapid onset of soil erosion has made the European settlers and administrations fully alive to the impending disaster. Moreover, the colonists have not been able to assimilate the native populations which subsequently became segregated in reserves where they now practise a mixture of traditional shifting cultivation and modern agriculture highly conducive to soil erosion. The development and ecological results of this relationship in tropical Africa, are clearly described by Mr. Jacks in Chapter XX, comprising one of the most illuminating sections of the book. "Only exceptionally is the white man or the black man the dominant species in a tropical environment ... (In Africa), shifting cultivation , , , was the only system under which (native) races could safely cultivate the tropical forest, and nomadism the only system under which the grassland could be safely pastured...To-day, shifting cultivation, the sign of man's subordination to the vegetation, has become a principal cause of soil exhaustion and erosion in Africa, due to the shortening of the soil's resting period necessitated by increasing populations and the general tendency toward a more settled mode of life since European occupation ... The white man's burden in the future will be to come to terms with the soil and plant world, and it promises to be a heavier burden than coming to terms with the natives". "It seems as though mastery over tropical soils must be secured with the help of the ecologist rather than of the engineer ... the crying need ... is for more biological science". "Human dominance has its allotted period in the biological succession of a region, and we do not know enough about ecology ... to be able to skip the intermediate natural

stages between dominance by forest or savannah and dominance by man". ... " We have to learn not only the appropriate agricultural systems and operations, but also what type of society — tribal, feudal, despotic, democratic or otherwise can co-exist on the soil during its transition from a plant-dominated to a man-dominated type".

One solution of the African problem is segregation, by means of which native and European agriculture may each develop along distinct lines, but the need for soil conservation promises to be the factor which may decide whether this will be a successful solution, for erosion control requires unified treatment and co-ordinated land-utilization practices within each natural region. It is clear that the success of any scheme for permanent soil conservation in East Africa will depend on adjustments in the system of land tenure. Thus, the communal or tribal system fails where land is limited in extent, because soil exploitation soon results in erosion, but individual land ownership is not much better, since the greater the number of properties there are, "the more difficult it is to secure adequate co-operation between the landholders", "A system of land tenure analogous to mediaeval feudalism might well develop as a way out of the impasse created by soil erosion and the conflicting demands of the indigenous and exotic races on the land". The authors suggest, therefore, that "some system which will leave the responsibility for organising and the power to enforce soil conservation in the hands of a few, while the many do the work", may well be the future basis of land tenure in tropical Africa under European influence.

The political and social consequences of soil erosion in South Africa, having nearly reached catastropic imminence, are dealt with in a separate chapter (Chapter XXI) by Mr. Jacks, who comes to the conclusion that the best solution of the difficulties might be "the development of some system of land tenure whereby absolute control of all the land is vested in that class of the dominant race which shows itself capable of organizing for the perpetuation of conservative land-utilization", though it is not suggested that such a solution would be socially the most desirable.

In the concluding chapter, Mr. Jacks further discusses the significance of the paradoxical situation that has arisen in the world in which some of the most densely populated lands still have great reserves of fertility, whereas, in the new countries, rich lands have had to be abandoned to desert only a few decades after their settlement. Recovery by means of vast schemes for irrigating the semi-arid plains in Russia and North America may be feasible, and may induce a reversal of migration of populations back to the land. A dense population is the best insurance against erosion; for this reason, no great future is indicated for civilization in the tropics until the native races have reached a relatively advanced stage in social evolution.

In stressing the very important political and social consequences of land deterioration and soil erosion, the authors of this book have opened up the broader humanitarian aspects of agricultural science in world economy which no serious student of agriculture can afford to reject. (*Tropical Agriculture*, Vol. XVI, No. 10, pp. 223—225).

ABSTRACTS

Hormonal theory of plant development. (*Russian*). Chailakhyan M. K. Bull, Acad. Sci. U. S. S. R. S., 1937, pp. 198.

Results of numerous, chiefly photoperiodic, experiments carried out at the Timirjazev Institute of Plant Physiology, Academy of Science, Moscow, with many plants including several horticultural varieties such as Chrysanthemum indicum, Prunus persica, Diospyros Kaki, Citrus sinensis, Poncirus trifoliata, lupin, sunflower, etc., led the author to his theory, which may be shortly summarized as follows :— Prior to flowering a special flowering hormone called florigen is produced by the leaves. Long-day plants produce this hormone only under long day or permanent light conditions, short-day plants only under short-day conditions and day neutral plants under short-and long-day conditions. Grafting fertile short-day scions on long day stocks and vice versa proved that the flowering hormone is identical for all plants. The hypothetical florigen differs physiologically from growth substances or auxins Whereas the latter are transported basipetally, florigen moves in all directions. Auxin content of plants increases with length of day regardless of their photo-periodicity, while florigen is formed only under certain conditions of photo-periodicity. In some plants the development of florigen depends also on temperature or vernalization. The bulletin is divided into 12 chapters dealing, after a general introduction (1) with sexual development (2) role of leaves (3) specificity of sexual development 4) and its physiological basis (5) formation (6) and transport of florigen (7) movement of florigen from one plant to another when transplanting (8) conditions of its formation (9) accumulation of florigen in leaves (10) florigen as sexual hormone of plants (11) conclusions (12) In this last chapter the practical application of the hormone theory in plant production is explained. By vernalization, photoperiodicity, transplanting and girdling, the concentration of the flowering hormone may be controlled and the flowering thus either forced or retarded, which is especially important in horticulture. Green manuring depressed the water table during growth. The increase in the water-holding capacity of the soil after several years' green manuring was statistically significant but practically unimportant. Loss of soil structure, however, noticeable in the clean cultivated plots, was reduced or removed by green manuring. The following possible explanations of the beneficial effect of organic matter on growth are discussed :— 1. the supply of essential nutrients in a readily assimilable form; 2. good effect on water-holding capacity and soil structure; 3. the supply of some minor element; 4. The supply of readily assimilable iron; 5. the increase in partial pressure of CO_2 within or above soil; 6. the formation of growth substance; 7. direction, nutrition or supply of growth substances through mycorrhizas; 8. influence on soil micro-organisms. (*Horticultural Abstracts* 9 (1939) : 54).

Some effects of green manuring on citrus trees and on the soil. West, E. S., and Howard, A. *Bull. Coun. Sci. indust. Res. Aust.* 120,1938. pp. 36, bible. 41.

A thirteen year green manure experiment with citrus at Griffith, N. S. Wales, is here reported. The growth of a winter green crops, tick beans, increased growth and yield in Washington Navel and Valenica Late orange trees compared with clean cultivated trees. The growth of a summer green crop of cow peas at first caused a decrease but after 10 years an increase in growth and yield. Growth of lucerne offered too strong competition and resulted in decreased

growth and yield. There was a definite seasonal cycle of soil nitrate concentration in the tick bean and the clean cultivated plots, the former having a higher annual mean nitrate content in the surface soil, the latter a higher content in the lower lying soils. Little decomposition took place if tick beans were ploughed in too early. The soil nitrate cycle was little affected by the presence, or absence of citrus. Ploughing in tick bean resulted in a rapid formation of ammonia.

Experiments on compost making. R. C. Wood, Emp. J. Exp. Agric., 1938 6. 350--68, bibl. 10.

The results of a number of experiments conducted by students of the Imperial College of Tropical Agriculture on compost-making are summarized. A note is added on the practical results of these experiments. The conclusions reached are as follows:—(1) It is not possible, even with standard material, to lay down a definite programme for composting. (2) The time available for decomposition affects the methods adopted, as the more rapidly decompostion is wanted to occur, the more expensive will the process become. (3) Of the factors controlling decomposition, aeration and moisture are the most important. (4) Correction for acidity has not been found necessary in the conditions obtaining. (5) The use of inoculating material has not been found necessary unless very rapid decomposition is desired. (6) Farm stock is most economically utilized for the decomposition of farm waste since the best treatment any compost material can have before it goes into the compost heap is under the feet of farm, stock, where it gets brussed and inoculated. (Author's summary except paragraph 6) (*in Hort. Abst.* 9 (1939) : 61).

Study on the vitality of old and new seeds of Mungo (Phaseolus aureus Roxb) —P. A. Rodngo—*Philippine Journal of Agriculture* Vol. 10 3, 285—Pl. 1.

To obtain information on the behaviour of old seeds as plant materials, the author undertook a study on the vitality of old and new seeds of Mungo. P. aureus. The old seeds were 11 years and 4 months old in stores and the new seed used as controls was taken from the crop of the old seed previously made. 100 seedlings of each kind were raised in pots and their behaviour noted. At maturity the plants were harvested and data on the number of pods produced weight of dry pods, weight of straw and weight of seeds per plant were taken. The results showed that there was a significant difference between the straw yeilds of the new and old seeds in favour of the latter. The old seeds gave greater pod yield and bean yield than the new seeds. The author believes that there is evidence of the existence of certain phenomena in seed in storage that are worthy of investigation; The seed would seem to require a certain degree of curing or seasoning before it is capable of attaining the peak of its vitality. This may vary with different crops and should be thoroughly studied so as to take advantage of its economic value.

EXTRACTS

Banana Research in Trinidad.

(From a lecture delivered by Sir Geoffrey Evans before the Royal Society of Arts).

I should now like to illustrate my theme further by giving a brief account of the investigations that are also being undertaken at the College on the banana. The inception of this research was due to the disquieting appearance of a disease which came into prominence about 1919, or just about the time that the College opened in Trinidad. Its spread threatened the vast plantations of bananas that had been established in Jamaica and the Central American Republics. I refer

to Panama Disease (Fusarium cubense). The botanists at the College began work on the problem about 1922, and started a collection of bananas with the object of ascertaining which, if any, varieties might prove to be immune or resistant.

The banana which is usually grown for commercial export is the Gros Michel, also known as the Jamaica banana, and it is this variety which has suffered so severely from disease. In 1926, the efforts of the plant breeders were supplemented by the addition of a plant pathologist, and a plant physiologist, funds being provided by that excellent institution (now alas defunct), the Empire Marketing Board. The proposal was that the pathologist should make an exhaustive investigation into the pathogen itself while the physiological work should involve storage trials and a study of the ripening processes It is curious to note how this research has developed. The pathologist made his exhaustive enquiry into the pathogen and came to the conclusion that the most effective and practical way of combating the Panama disease would be by breeding an immune variety. The same line of work was recommended later when an investigation came to be made into another serious disease that has quite recently appeared in the Western Hemisphere from the Far East, namely, the Sigatoka disease (Cercospora musa). This disease has been known in Fiji and the Ceylon area as a serious disease for twenty years or longer but no one knows how it crossed the seas to Surinam where it was first reported in 1932—33.

The Plant Breeders, headed by Professor E. E. Cheesman, meanwhile had made considerable progress. A number of varieties had been collected and a few of them had proved highly resistant to Panama disease. Practically all these, however (with the exception of the Cavendish types which do not set pollen or seed and are therefore valueless for breeding purposes), are small-fingered types containing many seeds and therefore valueless from the commercial point of view. On the other hand, the seeded varieties presented an immediate difficulty if they were to be used as parents in a breeding programme because the final product must be a seedless banana. It became obvious, therefore, that a knowledge of the genetical basis of sterility in the genus Musa was indicated and, as an outcome, a good deal of cytological investigation became necessary. As a result of this work it is now believed that the chief basis for sterility in bananas lies in the fact that the majority of the edible kinds of bananas such as Gros Michel are triploids, whereas most of the fully seeded types are diploids and have a chromosome number of 22. Hybrids from these two groups are often tetraploids and occasionally are found to have no seed. Hundreds of pollinations have been made, working on this theory and they number between 5,000 and 6,000 made in the last ten years. Even so, I should like to see a far larger number of seedlings raised as it would increase the chance of ultimate success, but existing facilities at the college do not at present render this extension of work a practical proposition Many of these crosses are not successful, others are deliberately made in order to obtain more genetical knowledge of the behaviour of the genus. From the scientific point of view much valuable information has been obtained, and it is now possible to marshal the genus Musa into a few main groups of sub-genera and at the same time it has been found possible to disclose a number of synonyms that have crept into the nomenclature. For instance, the Gros Michel is variously called Jamaica banana in England the Pisang rajah in Malay, etc., and the Cavendish banana is indiscriminately known in other parts of the world as the Canary or Chinese in England, the Governor in the West Indies, the Kinguruve in Uganda, and so on.

With regard to the economic issue, two important results stand out clearly. The first is that many of these small-fruited seed-bearing species of wild bananas show remarkable resistance both to Panama disease (Fusarium cubense) and the

Leaf-Spot (Cercospora musa), and further that their hybrids descended from a commercial type such as the Gros Michel also show resistance.

The second point is that it should also be possible to breed a new variety with the necessary commercial attributes such as seedlessness, long fingers, good flavour and colour, the right shaped bunch for shipping and so on. The nearest approach to this is the new banana I. C. 2 which is the result of a cross between Gros Michel pollinated with M. acuminata, a wild small-fruited and seeded species from the Malayan region. The hybrid is very highly resistant both to Panama disease and Cercospora Leaf-spot, and its fruit is good flavoured and ripens up to a good yellow colour The fingers although thick are slightly shorter than the Gros Michel and the bunches often contain one eccentric hand which makes it a little more difficult to handle on board ship. It is said not to throw such a high proportion of nine-hand or count bunches as the Gros Michel, but this is probably a matter for adequate field management, as owing to its wild parent it suckers more freely than the Gros Michel and is vegetatively more vigorous.

The result is promising, but the plant breeders both in Trinidad and Jamaica have arrived at the conclusion that, although M. acuminata is probably the most valuable parent so far tried, and the I. C. 2 represents the nearest attempt to a commercial banana so far raised nothing better is likely to accrue from this particular combination and that it is essential therefore to seek out a species which is even closer to the Gros Michel to serve as the wild parent. It is believed that Gros Michel originated in the dim and distant past somewhere in the Malaya Burmo-Siam triangle and that one or other of the parents from which it is descended may still occur-probably in a wild state-in that region. Through the assistance of the Colonial Office, the Royal Botanic Gardens, Kew, and the Agricultural Departments in this region, a search is now being promulgated and within the last few years a large number of new species and varieties has been assembled at Trinidad and Jamaica, and the search still continues. Kew plays an important part in this work. Until recently, corms or "bits" were collected from the East or Africa, and, in order to avoid the risk of introducing further diseases and pests into the Western Hemisphere, a quarantine station was erected in 1927 at the Royal Botanic Gardens where the plants are grown for several months before being sent on, after careful inspection, to the West Indies. We are particularly on the look-out for virus diseases such as "Bunchy Top," as we now know that a wild hybrid such as I. C. 2 which is highly resistant to Panama disease and Cercospora can be badly attacked by "Bunchy Top." In fact, Kew has already been instrumental in preventing two or three virus diseases from going to the West Indies. Recently as the investigation has swung over to wild species, seed alone has been dealt with. Banana seeds apparently do not preserve their viability for a long time and so the seeds collected in New Guinea or Burma or other parts of the East are first sent to Kew where, as a precaution, half the consignment is sown and the remainder sent on to the West Indies, It apparently sometimes happens that the seed loses its viability on the voyage between Kew and the West Indies. A large number of young banana plants raised from seed from Burma, New Guinea, Malaya and Assam etc., are being grown at the Kew at the present time.

Turning now to the other aspect of banana research, namely, the problem of ripening and transport, it is interesting to note how the work has developed. It is no use breeding a new banana unless the fruit will stand the long voyage to the European markets satisfactorily. All new types of possible commercial value have therefore to be tested for this purpose. Within the last ten years a well-equipped Low Temperature Research Station has been built at the Trinidad College and its findings have been of the greatest value so far as tropical fruits

are concerned. The immediate problem is the placing on the British market "a bigger and better banana." This involves fundamental research into the physiology of ripening, and a study of the respiration processes including problems of gas storage and the effect of humidity and the reasons for chilling.

The consumer in England does not realize that the banana he eats is really only about half grown. That, bowever is really the case because the "bunch" for the European trade is cut at the stage known as three-quarter full, and it is then hard and green. Under the present arrangements for shipping and transport this is the only possible way as otherwise a high proportion of fruit would ripen and decay on the voyage. The problem before the team of workers, consisting as it does of a pathalogist a physiologist and a bio-chemist, is to devise means of delaying the ripening processes so that the fruit may be left on the plant until it reaches a stage much nearer maturity before it is harvested.

(*The Journal of the Royal Society of Arts* 87 (1939) p p.342—348.

Gleanings.

Entomological Control of Lantana. The rapid spread of Lantana, a garden escape, in Northern Queensland, has brought it amongst the serious weed pests for which the Council for Scientific and Industrial Research, Australia, is seeking methods of control. A report published in Nature, Vol. 144, No. 3635, dated the 1st July 1939. states that in 1935 studies of *Teleconemia lantanoe* were commenced in Fiji. where this bug had been introduced from Mexico, its native home, by way of Hawaii. As it proved harmless to any Australian plants of economic importance, it was established under quarantine conditions in Canberra in 1936. The first liberations were made late in that year in the Northern Rivers area of New South Wales, and afterwards near Atherton in Queensland, and at Rockhampton. Disappointment followed, the bugs seemed to have disappeared, until in April of this year they were reported in the Atherton district in enormous numbers over an area of some twenty four acres. Leaves were falling from the Lantana bushes, flowers had been destroyed and in some instances up to two feet of the ends of branches had been killed as the result of the bug feeding on them. At Rockhampton also there are signs of establishment. Undue optimism is to be deprecated, and it is unlikely that similar success will be attained to that of *Caetoblastis* on prickly pear. It still remains to be seen whether *Teleconemia* can maintain itself in large numbers and whether continuous defoliation will destroy Lantana, nevertheless, the outlook is promising. (*The Indian Forester* Vol. LXV October 1939 No 10).

What's in a Name Again ? The importance of accurate classification and naming of forest insects is brought out in a recent Number of Indian Forest Records (Vol. V No. 3) which gives descriptions of 22 new species of beetle boring the seeds and fruits of forest trees. As a result of these studies it has been found that the so-called cardamom beetle which is regarded as a serious pest of cardamoms in Coorg, Mysore and Madras, actually breeds in the fruits of several forest trees, and only attacks cardamoms when in superfluous abundance. Damage to the crop can be prevented by not growing cardamoms in the vicinity of these dangerous trees or by keeping the ground clean of fallen fruits. None of the other species of seed and fruit beetles attack cardamoms. (*The Indian Forester* Vol. LXV October 1939 No. 10).

A Record for Viability of Seed. From seeds estimated to be between 300 and 500 years old, lotus plants are being grown to-day at the Field Museum of Nature History in Chicago. So far as can be ascertained. this represents the longest duration of delayed germination on record according to Dr. B. E. Dahlgren, chief

curator of botany. The oft-repeated story of the germination of wheat from the Egyptian pyramids is now well-known to be erroneous, Dr. Dahlgren says, the germinating grain having been derived from straw packing in which the Egyptian specimens were being shipped to Europe.

The lotus seeds had lain buried in a peat bed in Southern Manchuria through several centuries, and were received through the courtesy of the University of Chicago's department of botany. At the time these seeds were produced by nature perhaps before Columbus' first excursion into the New World there existed a small lake, about two square miles in area, covered with red lotus flowers identical with the species commonly found in Asia to-day.

Records show that this lake was drained some time between 160 and 250 years ago. Wind-drifted soil then gradually covered the area, and trees and other land vegetation began to grow. In this poplars measure four feet in diameter, and trees that have been of aid in establishing the minimum age of the lotus seeds, thousands of which have been uncovered beneath the soil-bed in which the trees grow. The lower stratum containing the seeds is a peat bed that once was the bottom of the lake.

The seeds resemble small, dark, brown acorns. Their coats are hard as glass and highly polished. These outer covers are so impervious that the embryos inside have been protected through the centuries. (*Scientific American* Vol. 160, No. 5, May 1939). *The Indian Forester*, Vol. LAV, October 1939, No. 10).

Crop & Trade Reports.

Statistics—Cotton—1939-40—Intermediate Forecast Report. Pickings of the mungari or early sown crop in parts of the Deccan are in progress and the yield is expected to be normal. In Trichinopoly, the heavy rains in October and November are likely to reduce the yield of cotton to some extent. In Ramnad and Tinnevelly, the growth of the crop was affected by the poor and insufficient rains in December. The condition of the crop is generally satisfactory elsewhere in the province.

The average wholesale price of cotton lint per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 8th January 1940 was Rs. 22--9—0 for Cocanadas, Rs. 21—6—0 for Red and White Northerns, Rs. 24—9—0 for Westerns (mungari crop) Rs. 26—6—0 for Westerns (Jowari crop) Rs. 24—11—0 for Nadam, Rs. 35--11—0 for Coimbatore Cambodia, Rs. 32—9—0 for Southern Cambodia, Rs. 32—2—0 for Coimbatore Karunganni, Rs. 31—5—0 for Tinnevelly Karunganni, and Rs. 30—14—0 for Tinnevellies. When compared with the prices published in the last report, i. e., those which prevailed on 4th December 1939, these prices reveal a rise of about 19 per cent in the case of Coimbatore Karunganni, 17 per cent in the case of Coimbatore Cambodia, 12 per cent in the case of Westerns (Jowari crop), 11 per cent in the case of Tinnevellies, 9 per cent in the case of Nadam, 8 per cent in the case of Westerns (mungari crop), 7 per cent in the case of Cocanadas, 5 per cent in the case of Tinnevelly Karunganni and 3 per cent in the case of Southern Cambodia, the prices remaining stationary in the case of Northerns (red and white varieties)

Subject:—Statistics—Cotton—1939-40. Third Forecast Report. The average of the areas under cotton in the Madras Province during the five years ending 1937—38 has represented 99 per cent of the total area under cotton in India.

The area under cotton up to the 25th November 1939 is estimated at 1,780,300 acres. When compared with the area of 1,505,400 acres estimated for the

corresponding period of last year, it reveals an increase of 18·3 per cent. The increase in area is general in all the important cotton growing districts outside Guntur and is attributed to favourable rains and good prices at the sowing season. The area under irrigated cotton, mainly Cambodia, is estimated at 153,800 acres as against 129 400 acres in the corresponding period of last year thereby representing an increase of 18·9 per cent.

Pickings of the mungari or early sown crop in parts of the Deccan are in progress and the yield is expected to be normal. In the districts of East Godavari and Trichinopoly the crop has been affected to some extent by the heavy rains in October. Normal yields are expected in all the districts outside East Godavari and Trichinopoly. The seasonal factor for the Province as a whole works out to 100 per cent of the average as against 97 per cent in the corresponding period in the previous year. On this basis, the total yield is estimated at 366,800 bales of 400 lb. lint as against 294,200 bales of last year, thereby representing an increase of 24·7 per cent. The crop is young and it is too early to estimate the yield with accuracy.

The estimated area and yield according to varieties are given below :—

(Area in hundreds of acre, i. e., 00 being omitted ; Yield in hundreds of bales of 400 lb. lint, i. e. 00 being omitted).

Variety.	Area from 1st April to 25th November		Corresponding yield.	
	1939.	1938.	1939.	1938.
(1)	(2)	(3)	(4)	(5)
	Acs.	Acs.	Bales.	Bales.
Irrigated Cambodia ...	1,428	1,274	892	733
Dry Cambodia	1 578	1.596	336	321
Total, Cambodia ...	3,006	2,870	1.228	1.054
Uppam in the Central districts.	200	172	39	27
Nadam and Bourbon ...	221	25	12	2
Total, Salems ...	421	197	31	29
Tinnevellies* ...	4 290	2,700	1,073	639
White and red Northerns ...	1,670	1,630	209	200
Westerns ...	7,440	6,570	930	822
Warangal and Cocanadas ...	901	1,035	168	192
Chinnapatti short staple ...	75	52	9	6

*Includes Karunganni in Coimbatore, Uppam, Karunganni and mixed country cotton in Madura, Ramnad and Tinnevelly.

The local cotton trade is not generally active at this time of the year. The average wholesale price of cotton lint per imperial maund of 82 2/7 lb. as reported from important markets on 4th December 1939 was about Rs. 21—1—0 for Cocanadas, Rs. 21—6—0 for red and white Northerns, Rs. 22—13—0 for Westerns (mungari crop), Rs. 23—10—0 for Westerns (Jowari crop), Rs. 30—10—0 for Coimbatore Cambodia, Rs. 31—8—0 for Southern Cambodia, Rs. 27—0—0 for Coimbatore Karunganni, Rs. 29—11—0 for Tinnevelly Karunganni, Rs. 37—15—0 for Tinnevellies and Rs. 22—9—0 for Nadam cotton. When compared with the prices published in the last report, i. e., those prevailed on 6th November 1939, these prices reveal a rise of about 50 per cent in the case of white Northerns and Westerns (Mungari crop), 37 per cent in the case of red Northerns and Westerns (Jowari crop), 33 per cent in the case of Southern Cambodia, 31 per cent in the case of Tinnevellies, 26 per cent in the case of Tinnevelly Karunganni, 25 per

cent in the case of Cocanadas, 16 per cent in the case of Coimbatore Cambodia, and Nadam, and 9 per cent in the case of Coimbatore Karunganni.

Statistics—Paddy—1939-40. Intermediate Report. The main crop of paddy has been or is being harvested in parts of the Circars, the Deccan, Nellore, the Central districts, Tanjore and Madura. The yield is reported to be normal in the Deccan (Ananthapur excepted), Nellore, Salem and Coimbatore, and below normal in the other districts.

The crop has been affected by drought to some extent in parts of Chinglepet, Chittoor, Ramnad and Tinnevelly and by insect pests in parts of North Arcot and Tanjore. The condition of the crop is generally satisfactory in the other districts.

The wholesale prices of paddy, second sort, per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 8th January 1940 was Rs. 3—1—0 in Chittoor, Rs. 3—0—0 in Madura, Rs. 2—12—0 in Tinnevelly and Virudhunagar, Rs. 2—11—0 in Rajahmundry, Rs 2—10 -0 in Vizianagaram and Vellore, Rs 2—8—0 in Cocanada and Kumbakonam, Rs 2—7—0 in Ellore, and Bezwada, Rs. 2—6—0 in Guntur, Hindupur and Trichinopoly, Rs. 2—5—0 in Masulipatam and Cuddalore, Rs. 2—4—0 in Anantapur and Rs. 2-0-0 in Nagapatam and Conjeeveram. When compared with the prices published in the last report, i. e., those which prevailed on 11th December 1939, these prices reveal a fall of about 17 per cent in Trichinopoly, 14 per cent in Masulipatam, 13 per cent. in Vellore, 12 per cent in Guntur, 11 per cent in Nagapatam, 9 per cent in Bezwada, and Conjeeveram, 7 per cent in Hindupur, 4 per cent in Rajahmundry and Chittoor, and 2 per cent in Cocanada, Virudhunagar and Tinnevelly, the prices remaining stationary in Vizianagaram, Anantapur, Cuddalore, Kumbakonam and Madura.

Subject—Statistics—Paddy—1939-40—Second Forecast Report. The average of the areas under paddy in the Madras Province during the five years ending 1937—38 has represented 13·4 per cent of the total area under paddy in India.

The area sown with paddy up to 25th November 1939 is estimated at 8,486,000 acres. When compared with the area of 8,980,000 acres estimated for the corresponding period of the previous year, it reveals a decrease of 5·5 per cent.

The decrease in area occurs in all districts outside Guntur, Kurnool, Bellary, Salem, Tanjore and the Nilgiris and is due to the late receipt of rains at the sowing time.

The first crop has been generally harvested throughout the Province. Yields below normal have been reported from the Circars and Tanjore. The yield is expected to be normal in the other districts. The crop has been affected to some extent by the heavy rains and floods in November 1939 in parts of the districts of East Godavari, West Godavari, Kistna and Tanjore.

The seasonal factor for the Province as a whole works out at 97 per cent of the average as against 90 per cent in the corresponding period of the previous year.

The wholesale price of paddy second sort, per imperial maund of 82 2/7 lbs. as reported from important markets on 11th December 1939 was Rs. 3—3—0 in Chittoor, Rs. 3—0—0 in Vellore and Madura, Rs. 2—14—0 in Trichinopoly, Rs. 2—13—0 in Rajahmundry, Tinnevelly and Virudhanagar, Rs. 2—11—0 in Bezwada, Masulipatam and Guntur, Rs 2—10—0 Vizianagaram, Rs. 2—9—0 in Cocanada and Hindupur, Rs. 2—8—0 in Kumbakonam, Rs. 2—5—0 in Cuddalore, Rs. 2—4—0 in Anantapur and Negapatam and Rs. 2—3—0 in Conjeevaram. When compared with the prices published in the last report, i. e., those which prevailed on 6th November 1939, the prices reveal a rise of 17 per cent in Hindupur,

16 per cent in Chittoor, 15 per cent in Anantapur, 10 per cent in Tinnevelly, 9 per cent in Cuddalore, 8 per cent in Masulipatam, 7 per cent in Rajahmundry 5 per cent in Bezwada, Guntur and Virudhunagar, 4 per cent in Vellore, 3 per cent in Cocanada, and 2 per cent in Trichinopoly and a fall of 10 per cent in Conjeeveram and 2 per cent in Madura, the prices remaining stationary in Vizianagaram, Kumbakonam and Negapatam.

Statistics—Crop—Groundnut—1939—Fourth or final report. The average of the areas under groundnut in the Madras Province during the five years ending 1937–38 has represented 50·1 per cent of the total area under groundnut in India.

The area sown with groundnut in the Province in 1939 is estimated at 3,534,200 acres. When compared with the corresponding estimate of 3,835.300 acres for the previous year and the actual area of 3,771,588 acres according to the season and crop report of the previous year, the present estimate reveals a decrease of 7·9 per cent and 6·3 per cent respectively. The estimated area for this year exceeds the average area of 3,075,230 acres by 14 9 per cent.

The decrease in area is general outside Vizagapatam, Guntur, Bellary, Anantapur and Malabar. The variations are marked in Kistna (–32,600 acres), Bellary (plus 94,100 acres), South Arcot (–58 700 acres), North Arcot (–53.300 acres, Coimbatore (–32,400 acres), Madura (–39.300) acres and Ramnad (–24 600 acres). The area in the South fell from 282,300 acres in 1938—39 to 199,000 acres) in the current year i. e., by 29·5 per cent. The area estimated for Vizagapatam is the highest reported in recent years.

The harvesting of the summer and early crop of groundnut had concluded by the end of October. The harvesting of the winter or main crop is proceeding.

The crop in Kistna district was affected by the advent of heavy rains at the time of ripening; the unprecedented rains in Tanjore district in November 1939 were also responsible for a large reduction in the yield. The crop was affected by drought in most other districts apart from an attack of insect pests in parts of North Arcot, Salem and Tanjore. The yield is expected to be below normal in all districts except Kurnool and Bellary where a normal yield is expected. The yield is estimated to be low in Tanjore (50 per cent), South Arcot (70 per cent) and North Arcot (75 per cent). The seasonal factor for the Province as a whole works out to 69 per cent of the average as against 86 per cent in the previous year according to the season and crop report. On this basis the yield is expected to be 1,576,500 tons of unshelled nuts as against. 1,613.000 tons in the previous year, a decrease of 2·3 per cent. The average yield an year is estimated at 1,540,280 tons.

The wholesale price of groundnut (shelled) per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 8th January 1940 was Rs. 5–2–0 in Cuddalore, Rs. 4–12–0 in Vizagapatam, Rs. 4–10–0 in Vizianagaram, Guntur and Tadpatri, Rs. 4–8–0 in Adoni, Rs. 4–0–0 in Bellary, Rs. 4–3–0 in Nandyal, Cuddapah, Vellur, Ananthapur and Hindupur and Rs. 3–15–0 in Coimbatore. When compared with the prices published in the last report, i, e.. those which prevailed on 6th November 1939, these prices reveal a rise of approximately 14 per cent in Adoni, 8 per cent in Bellary and Cuddapah, 5 per cent in Nandyal and Hindupur and a fall of approximately 4 per cent in Tadpatri, 3 per cent in Guntur and one per cent in Vizagapatam, the prices remaining stationary in Vizianagaram, Cuddalore, Coimbatore and Anantapur.

Statistics—Pepper— 1939—Final Report. The area under pepper in 1939 in the districts of Malabar and South Kanara is estimated at 104, 600 acres (96,000 acres in Malabar and 8,600 acres in South Kanara) as against the final area of 102,819

acres (94,018 acres in Malabar and 8,801 acres in South Kanara) in the previous year.

The harvesting of the crop is reported to have just commenced. The seasonal factor in both the districts is estimated at 105 per cent of the average as against 80 per cent in the previous year. On this basis, the yield is estimated at 10,550 tons (9,680 tons in Malabar and 870 tons in south Kanara) as against 7,900 tons (7,220 tons in Malabar and 680 tons in South Kanara) in the previous year.

The wholesale price of pepper per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important markets on 8th January 1940 was Rs. 11—10—0 in Calicut, Rs. 11—12—0 in Tellicherry, and Rs. 13—1—0 in Mangalore. When compared with the prices published in the last report, i. e., those which prevailed on 4th September 1939, these prices reveal a rise of 19 per cent in Mangalore, 8 per cent in Tellicherry and 2 per cent in Calicut.

Statistics—Ginger—1939—Final Report. The area under ginger in 1939 is estimated at 11,300 acres in Malabar and 700 acres in South Kanara as against the actual area of 11,330 acres in Malabar and 713 acres in South Kanara in the previous year.

The crop is being harvested in parts and the yield ia esiimated to be normal in both the districts. On this basis, the total yield is expected to be 4,290 tons of dry ginger 4,040 tons in Malabar and 250 tons in South Kanara as against 3,810 tons in the previous year (3,630 tons in Malabar and 180 tons in South Kanara).

Statistics—Crop—Gingelly—1939-40—Third Report. The average of the areas under gingelly in the Madras Province during the five years ending 1937-38 has represented 15·6 per cent. of the total area under gingelly in India.

The area sown with gingelly up to 25th December 1939 is estimated at 601,900 acres. When compared with the area of 575,300 acres estimated for the corresponding period of last year, it reveals an increase of 4·6 per cent. The area estimated for Salem and Coimbatore is the highest reported in recent years.

The estimated area is the same as that of last year in Tanjore and South Kanara; an increase in area is revealed in Anantapur, Chingleput, South Arcot North Arcot, Salem, Coimbatore, Ramnad and Malabar and it is partly counterbalanced by a decrease in area in the rest of the Province. The variations are marked in East Godavari (−25,000 acres) West Godavari)−20,000 acres), Chingleput (plus 14,700 acres), South Arcot (plus 10,000 acres), North Arcot (plus 26,000 acres), Salem (plus 44,000 acres), Coimbatore (plus 10,000 acres) and Trichinopoly (−19,500 acres).

The main crop has been harvested except in the South. The yield was below normal except in Kurnool, Salem and South Kanara where it was reported to be normal.

The seasonal factor for the Province works out to 87 per cent. of the average as against 84 per cent for the corresponding period of last year. On this basis, the yield is estimated at 69,400 tons as against 65,400 tons for the corresponding period of last year, an increase of 6·1 per cent.

The wholesale price of gingelly per imperial maund of 82⅔ lb. (equivalent to 3,200 tolas) as reported from important markets on 8th January 1940 was Rs. 7-8-0 in Cocanada, Rs. 7—6—0 in Vizagapatam, Rs. 6—8—0 in Vizianagaram, Rs. 6—7—0, in Ellore, Rs. 6—4—0 in Rajahmundry, Rs. 6—3—0 in Tuticorin. Rs. 6—0—0 in Tinnevelly, Rs 5—15—0 in Cuddalore and Trichinopoly and Rs 5—7—0 in Salem. When compared with the prices published in the last report i. e., those which prevailed on 6th November 1939, these prices reveal a rise of approximately 16 per cent. in Vizagapatam and Ellore 15 per cent. in Cocanada, 10 per cent. in

Rajahmundry, 9 per cent. in Tuticorin and 4 per cent. in Cuddalore and a fall of approximately 6 per cent. in Tinnevelly and 2 per cent. in Trichinopoly, the prices remaining stationary in Vizianagaram and Salem.

Statistics--Crop—Castor—1939--First or final report.— The average of the areas under castor in the Madras Province during the five years ending 1937--38 has represented 16·9 per cent of the total area under castor in India.

2. The area under castor in the Madras Province up to 25th November 1939 is estimated at 272,600 acres. When compared with the area of 256,000 acres estimated during the corresponding period of last year, it reveals an increase of 6 5 per cent. The estimate of last year was below the actual area of 270,278 acres by 5·3 per cent.

3. An increase in area is estimated in Bellary, Anantapur and Chittoor partly counterbalanced by an estimated decrease in area in the other districts. The increase is marked in Anantapur (plus 14,500 acres).

4. The yield is expected to be normal in all districts except Chittoor where it is estimated to be slightly below normal. The seasonal factor for the Province as a whole is estimated to be 100 per cent of the normal On this basis, the yield is estimated at 26,800 tons as against 25,700 tons estimated for the corresponding period of last year and 22,410 tons estimated in the season and crop report of last year.

5. The wholesale price of castor seed per imperial maund of 82⅔ lb. (equivalent to 3,200 tolas) as reported from important markets on 18th December 1939 was Rs. 6—14—0 in Nandyal, Rs. 5—8—0 in Vizianagaram and Bellary, Rs. 5—6—0 in Salem, Rs. 5—0—0 in Cuddapah, Rs. 4—10—0 in Hindupur and Rs. 4—8—0 in Anantapur. When compared with the prices reported in the previous year i. e. those which prevailed on 19th December 1938, these prices reveal a rise of approximately 35 per cent in Bellary, 31 per cent in Nandyal, 28 per cent in Salem, 19 per cent in Vizianagaram and 12 per cent in Hindupur and a fall of approximately 2 per cent in Cuddapah, the price remaining stationary in Anantapur. (*From the Director of Industries, Madras.*)

Cotton Raw, in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1939 to 12th January 1940 amounted to 486,012 bales of 400 lb. lint as against an estimate of 388,900 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 536,138 bales 426,037 bales mainly of pressed cotton were received at spinning mills and 184,616 bales were exported by sea while 144,362 bales were imported by sea mainly from Karachi aud Bombay.

(*From the Director of Agriculture, Madras.*)

Market Reports

TIRUVOTTIUR MILCH CATTLE MARKET

Market Report No. 24.

Madras, Friday the 15th December 1939.

The arrivals of milch cows continue to be heavy while those of buffaloes have decreased. There is a marked increase of the buying activity at the market as a result of which prices of especially milch cows have improved.

The stock movements during the week were as follows :—

	Stock at Commencement.	Arrival during the week.	Sale during the week.	Balance.
Cows-Ongole	140	158	153	145
Buffaloes-country	150	128	138	150

Prices.

Age.	Milk yield.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole			
1st and 2nd calving	2—3 Madras Measures	80	95
	3—4 ,, ,,	95	120
3rd and 4th calving	2—3 ,, ,,	70	80
	3—4 ,, ,,	80	105
Buffaloes-country			
1st and 2nd calving	2—3 ,, ,,	55	75
	3—4 ,, ,,	75	100
3rd and 4th calving	2—3 ,, ,,	50	65
	3—4 ,, ,,	65	80
Others			
Cows-cross-bred		130	160

Market Report No. 25.

Madras, Friday the 22nd December 1939.

Arrivals of cows and buffaloes have slightly declined and the sales are not heavy. The slightly increased prices that prevailed last week are continuing.

The stock movements during the week were as follows:—

	Stock at Commencement.	Arrivals during the week.	Sale during the week.	Balance.
Cows-Ongole	145	132	97	180
Buffaloes-country	160	116	96	170

Prices.

Age.	Milk yield.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole			
1st and 2nd calving	2—3 Madras Measures	80	90
	3—4 ,, ,,	95	120
3rd and 4th calving	2—3 ,, ,,	70	80
	3—4 ,, ,,	80	105
Buffaloes-country			
1st and 2nd calving	2—3 ,, ,,	55	75
	3—4 ,, ,,	75	100
3rd and 4th calving	2—3 ,, ,,	50	65
	3—4 ,, ,,	65	80
Others			
Cows-cross-bred		130	180

Market Report No. 26.

Madras, Friday the 29th December 1939.

Arrivals of cows from the Ongole tract have been heavy during the week and there is a good stock of cows at the market. The prices of both cows and buffaloes tend to decrease slightly.

The stock movements during the week were as follows :--

	Stock at Commencement	Arrivals during the week.	Sales during the week.	
Cows-Ongole	180	189	169	200
Buffaloes-country.	170	97	106	161

Prices.

Age.	Milk yield.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole.			
1st and 2nd calving	2—3 Madras Measures	80	90
	3—4 ,, ,,	90	120
3rd and 4th calving	2—3 ,, ,,	70	80
		80	100
Buffaloes-country			
1st and 2nd calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	100
3rd and 4th calving	2—3 ,, ,,	50	60
	3—4 ,, ,,	60	80
Others.			
Cows-cross-bred.		130	180

Market Report No. 1 of 1940.

Madras, Friday the 5th January 1940.

Arrivals of cows were low during the week while those of buffaloes have increased. There was a good trade in country buffaloes. The prices are steady when compared with those of last week.

The stock movements during the week were as follows :—

	Stock at Commencement.	Arrivals during the week.	Sale during the week.	Balance at end.
Cows-Ongole	200	80	105	175
Buffaloes-country.	161	142	155	150

Prices.

Age.	Milk yield.	Prices ranging. From	To
		Rs.	Rs.
Cows-Ongole			
1st and 2nd calving	2—3 Madras Measures.	80	90
	3—4 ,, ,,	90	120
3rd and 4th calving	2—2 ,, ,,	70	80
	3—4 ,, ,,	80	100
Buffaloes-country			
1st and 2nd calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	100
3rd and 4th calving	2—3 ,, ,,	50	60
	3—4 ,, ,,	60	80
Others			
Cows-cross-bred		130	180

Market Report No. 2 of 1940.

Madras, Friday the 12th January 1940.

The arrivals of buffaloes have gone down as compared to those of last week. There is a slackening of business towards the end of the week due to the impending Pongal festival. Prices are steady.

The stock movements were as follows :—

	Stock at commencement.	Arrivals during the week.	Sales during the week.	Balance at end.
Cows-Ongole	175	105	130	150
Buffaloes-country	150	79	120	109

Prices.

Age.	Milk yield.	Prices ranging From	To
		Rs.	Rs.
Cows-Ongole			
1st and 2nd calving	2—3 Madras Measures	80	90
	3—4 ,, ,,	90	120
3rd and 4th calving	2—3 ,, ,,	70	80
	3—4 ,, ,,	80	100
Buffaloes-country			
1st and 2nd calving	2—3 ,, ,,	55	70
	3—4 ,, ,,	70	100
3rd and 4th calving	2—3 ,, ,,	50	60
	3—3 ,, ,,	60	80
Cows-cross-bred		120	180

(Madras measure of milk=4 lbs.)

BIOLOGICAL ABSTRACTS

(*From the Office of the Editor-in-Chief, Biological Abstracts.*)

Men engaged in research in medicine, public health, ecology, agriculture, forestry, botany or zoology, geography, and other fields, will welcome the announcement that *Biological Abstracts* is undertaking a more complete abstracting and segregation of the current research literature in bioclimatology and biometeorology. The section *Bioclimatology-Biometeorology* will appear within the section *Ecology in Biological Abstracts*, and will be under the editorship of Mr. Robert G. Stone of the Blue Hill Observatory, Harvard University.

The increasing interest in climatic and meteorological factors in their relation to biology, medicine, and agriculture is one of the significant trends of modern science. Ecologists have long appreciated, the importance of temperature, humidity, radiation, barometric pressure, wind movement, and meteorological factors generally, as important factors in controlling the distribution and abundance of animals and plants. Foresters, horticulturists, and entomologists have likewise been concerned with the interrelationships of climatic and meteorological factors to the organisms with which they work. The developments of air conditioning and aviation have lately brought other important research groups into the field resulting in an increasing amount of research. This is often the work of individuals and groups not now in effective contact with biologists and frequently appears in periodicals not commonly consulted by biologists.

In all civilised nations diverse research groups have sprung into being which, though they often devote much attention to the same fundamental natural forces, still work in practical isolation from each other, with a different background of training, and associations, belonging to different societies meeting at different times and places, publishing in different journals, reading different literature, investigating different types of things. These groups, however, are beginning to apply common ideas and common methods to the study of situations that are basically similar. For example, techniques and concepts derived from a study of the influence of weather factors on the spread of influenza or the common cold are likely to have a very high transfer value as applied to the study of the spread

or survival of plant disease or economic insects. Conversely, it should be possible for research workers in the field of public health to make use of many findings of the entomologists, forestors, ecologists, plant pathologists, and other biological groups.

The abstracting journals of broad scope, like Biological Abstracts, are admirably suited to the sort of synthesis of fundamental knowledge that this situation demands. Inaugurating this service Biological Abstracts will be fulfilling one of the functions for which it was originally intended: that of providing an effective tool for research workers by co-ordinating the literature of border-line fields.

Under the sectional publication plan this material will be found, at present, not only in Section A, *Abstracts of general Biology*, but also under Section B' *Abstracts of Experimental Animal Biology*, Section D, *Abstracts of Plant Sciences*, and Section E, *Abstracts of Animal Sciences*.

College News and Notes.

Students' Corner. Students' Club—*Literary Activities*:— Dr. Jesudasan of Tirupattur Ashram delivered a lecture on "Students and Villagers" on 8—1—40 in the premises of the Students' Club. Dr, Paton, a co-worker with Dr. Jesudasan also gave a short talk on his experiences in rural India. Mr. H. Shiva Rao, the vice-President of the club presided on the occasion.

Under the chairmanship of Mr. R. C. Broadfoot, Principal of the college, Dr. W. Burns, Agricultural Commissioner with the Government of India addressed a gathering of students and officers on the estate on 16—1—40 at 6 p. m. in the Freeman Hall. In the course of his lecture, Dr. Burns stressed on the need for improvement on every little phase and item of agricultural operations.

Sir T. Vijayaraghavacharya, member of the Indian Central Cotton Committee, addressed the students on 19—1—40 with Mr. Roger Thomas, B. Sc. a former Deputy Director of Agriculture of the Madras Agriculture Department and Member I. C. C. C. in the chair. Sir T. Vijayaraghavacharya treated the audience to a most humorous and thought-inspiring address.

Students' tour. The students of B. Sc. II were taken on an agricultural tour to the West Coast from the 3rd to the 12th January. They visited the Agricultural Research Stations at Kasargode, Taliparamba and Pattambi, besides several private farms and demonstration centres. The party was accompanied by Messrs. P. A. Venkateshwaran and M. Kalimuthu, Teaching Assistants in Agriculture.

Selection Examination results. The College Board met on the 9th January 40 to select students of B. Sc. I, II and III for the University examination to be held in April next. Oue student of B. Sc. I was detained by the board.

Games-Interclass match for the Victory cup. In the club day cricket fixture, class II. In Football, class III lost to class I. In the Inter-tutorial cricket match C. R. Srinivasa Iyengar's wards won over Sri P. V. Ramiah's wards.

Madras University Inter-collegiate finals. This match was played at Madras between the Agricultural College Eleven and Medical College at the latter's grounds. The match ended in a defeat for our team. The college eleven is however to be congratulated for reaching the finals.

Honey Week. The Honey Week Celebration was inaugurated by P. M. Khareghat Esq. C. I. E., I. C. S., Vice President of the Imp. Council of Agricultural research on 18—1—40 at 4-30 P. M. in the premises of the Insectary,

A distinguished gathering was present on the occasion. The Exhibition connected with the Honey Week was held from the 18th to 25th January 40.

Indian Central Cotton Committee. At the invitation of the Government of Madras, the winter session of the Indian Central Cotton Committee was held at Coimbatore. The meetings of the committee took place at the old Forest College buildings, Coimbatore between the 15th and 20th of January 40. The members of the committee were treated to a number of tea-parties, lunches and dinners Most of the parties were held in the Freeman Hall of the Agricultural College. The Government of Madras was 'At Home' to the members of the committee at a delightful luncheon party held on the 20th of January in the Freeman Hall. Most of the members of the committee visited the Agricultural College and Research Institute and the Cotton Breeding Station.

Foot and mouth Disease. The restrictions imposed on the movement of vehicular traffic and entry into the Central Farm, as a result of the alarm caused by the serious outbreak of foot and mouth disease in the vicinity of the estate, have been lifted with effect from the 10th of January 40. It is gratifying to note that no animal in the central farm has been a victim to this disease during this period, owing to the efficient control measures taken.

Congress House Exhibition at Madras. As usual the agricultural Department participated in this annual exhibition, which unfortunately was the scene of a very disastrous fire. The department, in common with others, sustained serious losses in the form of several valuable exhibits. The loss would have been enormous but for the courageous stand of the departmental officers on duty in the stall, who not only saved a large amount of departmental property, at great risk to their lives but extended free help to enable many visitors to escape to places of safety. The conduct of the Officers on duty at the stalls on the ill fated day has been highly commended.

Vaccination of residents on the estate: As a result of smallpox scare in the neighbourhood, vaccination of estate residents—particularly children, was arranged on the 4th January.

Personal. Mr. C. Ramaswamy of the Agricultural College who was selected to play for the Indians in the presidency match against the Europeans scored a brilliant century in the first innings. While we heartily congratulate him for his splendid performance in the fixture, we note with regret his recent announcement of retirement from first class matches in future.

It is understood that Dr. R. Sankaran, M. A., Ph. D., Cotton Assistant has been offered the post of Cotton Botanist, Sind. We offer our felicitations to him.

We are glad to note that Mr. T. Krishnamurthy, B. Sc., Ag. an old student of this college has been appointed Agronomist at Pusa.

We congratulate Mr. P. A Venkateshwaran, B. A., B. Sc. Ag., Teaching Assistant in Agriculture, on his appointment as the Warden of the Agricultural College Hostel. This is the first time that a non-gazetted officer is appointed to this post.

Visitors. Rao Bahadur B. Viswanath, Director of the Imperial Institute of Agriculture, New Delhi. visited the Cane Breeding Station on the 4th January. Dr. Chona, the Sugarcane Plant Pathologist, and Dr. Lall the Entomologist, from the Imperial Institute also visited the Cane Breeding Station and the Agricultural College Research Institute between 4th and 6th January. Dr. J. S. Patel, formerly Oil Seeds Specialist, Coimbatore and now Jute Specialist, Dacca visited the Research Institute on 29—12—39.

A batch of 100 students, from Perianayakanpalayam, Ramakrishna Vidyalaya, accompanied by their headmaster visited the Agricultural College and Central Farm on 15—1—40.

Mr. P. H. Rama Reddy, Director of Agriculture, Madras, stayed in the estate from the 11th to 22nd January, in connection with the meetings of the Indian Central Cotton Committee.

Obituary.

We very much regret to record the death of Sri A. P. Balakrishnan Nayar, B. Sc. Ag., Agricultural Demonstrator, Omalur at an early age of 38 years, at his native place Paruthipulli in Palghat Taluq on 22—12—39. Mr. Nayar was born on 22nd April 1902 and was appointed in the department on 19th July 1926. He was an enthusiastic and energetic officer devoted to his duty and a man of pious disposition. We offer our condolences to the bereaved family.

Woodhouse Memorial Prize.

In Memory of Mr. E. J. Woodhouse, Late Economic Botanist and Principal of Sabour Agricultural College who was killed in action in France in 1917, a biennial prize in the form of a Silver Medal and books of a combined value of Rs. 100. will be awarded to the writer of the best essay on a subject to be selected from the list noted below. The length of essay should not exceed 4000 words.

The competition is open to graduates of Indian Universities and to Diploma holders and Licentiates of recognized Agricultural College in India who are not more than 30 years of age on the date of submission of their essays.

Papers should be forwarded to the Director of Agriculture, Bihar, Patna, before the 26th June, 1940.

Failing papers of sufficient merit, no award will made. Essays must be typewritten on one side of paper only.

for Director of Agriculture, Bihar.

Subjects for essay.

1. Importance of Physiological studies in Modern Plant breeding.
2. Dominant species as an Index of Soil Texture.
3. Modern methods of inducing mutations and polyploidy and their value for Indian Agriculture.
4. Problems of wheat improvement in India.

Science, Vol. 90, No. 2334, 22nd September 1939.

Chromosomes in growing grain have their numbers doubled when the seed is treated with a fungicide distributed under the trade name "Granosan", Dr. Dontcho Kostoff, of the Institute of Genetics at Moscow, has discovered. Seeds treated with the compound are not attacked by fungi, whereas seeds treated with colchicine are frequently killed by these parasitic forms.

Weather Review—DECEMBER 1939.

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	1·5	+0·8	32·5	South	Negapatam	0·3	-11·1	55·6
	Calingapatam	0 0	-0·7	28·9		Aduthurai *	0 5	-8·1	56·2
	Vizagapatam	0 3	-0·4	32·9		Madura	0·0	-1·8	36·2
	Anakapalli*	0·8	+0·6	40·3		Pamban	0·6	-6·9	29·4
	Samalkota*					Koilpatti*			
	Maruteru*	0·0	-0·5	50·4		Palamkottah	0·3	-3·7	17·8
	Cocanada	0·0	-0·9	59·7					
	Masulipatam	0·0	-0·9	47·7					
	Guntur*	0·0	-0·1	34·6	West Coast	Trivandrum	0·5	0·0	71·6
						Cochin	0·1	-1·6	133·8
Ceded Dists.	Kurnool	0·0	-0·2	20·0		Calicut	0·0	-1·1	115·3
	Nandyal*	0·0	0·0	0·0		Pattambi *	0·1	-0·7	97·2
	Hagari *	0·0	-0·1	21·3		Taliparamba *			
	Siruguppa*	0·0	-0·2	21·3		Kasargode *	0·0	-0·9	113·8
	Bellary	0·0	-0·1	18·5		Nileshwar*	0·0	-0·7	121·3
	Anantapur	0·0	-0·3	28·8		Mangalore	0·0	-0·5	116·3
	Rentachintala	0·0		28·2					
	Cuddapah	0·1	-0·8	26·6					
	Anantharaju-pet *	0·4	-1·6	31·6	Mysore and Coorg	Chitaldrug	0·0	-0·3	34·1
						Bangalore	0·0	-0·5	35·2
Carnatic	Nellore	0·3	-2·9	37·3		Mysore	0·0	-0·4	30·0
	Madras	0·9	-4·9	33·7		Mercara	0·0	-0·7	104·7
	Palur *	0·2	-7·3	53·6					
	Tindivanam *	0·2	-4·3	40·5	Hills	Kodaikanal	0·5	-3·9	70·1
	Cuddalore	0·7	-6·5	67·2		Coonoor			
Central	Vellore	0·3	-2·4	40·2		Ootacamund *	0·0	-1·21	67·60
	Salem	0·2	-0·8	48 1		Nanjanad *	0·0	-1·8	52·0
	Coimbatore	0·0	-0·2	25·0					
	Coimbatore A. C. & R. I.*	0 0	-1 5	26·7					
	Trichinopoly	1·0	-1·6	52·1					

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

Weather Review for December 1939. Weather has been dry over the country except for a few light local showers in parts of South East Madras, Malabar and N. Madras Coast. On the 4th a cyclonic storm formed near Lat. 10—11 N. and long. 92°—93° E. moved in a North Westerly direction to Lat. 19° N. and Long. 88°E. on the 9th and became unimportant on the 10th. This storm caused a few falls of rains in Orissa, The rainfall was in very large defect

Skies were moderately clouded in the Madras Presidency and clear or lightly clouded elsewhere. The humidity was in excess locally in Malabar, Hyderabad and North Madras Coast and in defect in the Bombay Deccan, South Hyderabad and Konkan,

The maximum temperature were above normal in Konkan and North Madras Coast, and below normal in Mysore and Madras Deccan.

The minimum temperatures were above normal in Mysore and South East Madras and below normal in the Bombay Deccan and North Hyderbad.

Weather Report for the Research Institute Observatory.
Report No. 12/39.

Absolute maximum in shade	...	87·0°F.
Absolute minimum in shade	...	56·2°F.
Mean maximum in shade	...	83·8°F.
Departure from normal	...	Nil.
Mean minimum in shade	...	64·9°F.
Departure from normal	...	−0·2°F.
Total rainfall	...	Nil.
Departure from normal	...	−1·5″
Heaviest fall in 24 hours	...	Nil.
Total number of rainy days	...	Nil.
Mean daily wind velocity	...	1 m. p. h.
Departure from normal	...	−2·0 m. p. h.
Mean humidity at 8 hours	...	75%
Departure from normal	...	−3·8%

Summary. Dry fine weather prevailed during the month with a slight drizzle on the 13th. The rainfall was nil and 1·5″ below normal. The day temperatures were normal and the night temperatures were slightly below normal. Skies were moderately clouded and the humidity was in defect. P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notifications.

Leave.

Name of Officers.	Period of leave.
Sri. B. Ramiah, Dy. D. A. (on leave)	Extension of l. a. p. on m. c. for 4 months and leave with m. c. on half average pay for 2 months from 1—12—39.

Subordinate Services.

1. Appointments.

Sri. M. Achanna Sastri, B. Sc. Ag., Fieldman, Agricultural Research Station, Samalkota—to officiate as Upper Subordinate, Agricultural Section till further orders vice Sri. K. Gurmurthi on other duty and is posted to I Circle.

Sri. K. Dorai Raji, B. Sc. Ag., Fieldman, Agricultural Research Station, Pattambi—to officiate as Assistant in Chemistry Section, Coimbatore till further orders vice Sri. K. Govindan Nayar on leave.

Sri. M. Subrahmanya Chetty, Officiating Farm Manager, Agricultural Research Station, Guntur on return from leave on 3rd January 1940 is appointed to officiate as Assistant in Cotton till further orders Vice Sri. R. Balasubrahmanya Ayyar on leave.

2. Promotions.

The following provisionally substantive promotions of Upper Subordinates in the Agricultural Section are ordered with effect from 15th August 1939:—

From IV Grade Rs. 120—10—170 to III Grade Rs. 200.

(i) Sri. M. P. Gourisankara Ayyar, Permanent Upper Subordinate, Agricultural Section IV Grade to III Grade (*Provisional*)

(ii) Sri. P. Abhishekanatham Pillai, Permanent Upper Subordinate, Agricultural Section IV Grade to III Grade (*Provisional*)

(iii) Sri. F. G. Muthuswami Ayyar, Permanent Upper Subordinate, Agricultural Section, IV Grade to III Grade (*Provisional*)

From V Grade Rs. 85—5—120—to IV Grade Rs. 120—10—170.

(i) Sri. N. C. Tirumalai Acharya, Permanent Upper Subordinate, Agricultural Section, V Grade to IV Grade (*Provisional*)

(ii) Sri. P. A. Venkateswara Ayyar, Permanent Upper Subordinate, Agricultural Section V Grade to IV Grade (*Provisional*)

(iii) Sri. S. S. Katchapeswara Ayyar, Permanent Upper Subordinate, Agricultural Section V Grade to IV Grade (*Provisional*)

Transfers.

Name of officers	From	To
Sri C. Krishnamurthy,	A. R. S., Anakapalli,	A. D., Nellore District.
„ N. C. Tirumalai Acharya,	F. M., C. B. S., Coimbatore,	A. D., Srivilliputhur.
„ P. S. Krishnamurthi,	Asst. in Entomology, Bellary Division,	Nellore Division.
„ M. Jeevan Rao,	F. M., F. R. S., Kodur,	A. D., Sidhout.
„ A. Raghavan,	A. D., Sidhout.	F. M., A. R. S., Nandyal.
„ S. Ponnuswami Naidu,	Asst. A. D., Ambasamudram,	A. D., Rapur, Nellore Division.
„ J. V. V. Suryanarayana.	A. D., Rayachoti,	A. D., Cuddapah.
„ K. Ramanujachari,	F. M., A. R. S., Nandyal,	A. D., Atmakur.
„ S. Mahadeva Ayyar,	A. D., Kodaikanal,	Pomological Station, Coonoor,
Janab P. P. Syed Muhamad Sahib,	A. D. (on leave),	A. D., Omalur.
Sri M. Somayya.	A. D., Yellamanchilli,	A. D., Tuni.

Leave.

Name of officers.	Period of leave.
Sri V. T. Subbiah Mudaliar, Upper Subordinate, Agricultural Section.	L. a. p. for 3 months from 3—1—40.
„ P. Seetharamiah, Botany Assistant. A. R. S., Anakapalli,	L. a. p. for 2 months from 12—1—40.
„ B. Shiva Rao, A. D., Tuni,	L. a. p. for 2 months from 1—2—40.
„ K. Rajabapaniah, Orchard Manager, A. R. S., Guntur.	L. a. p. for 30 days from 3—1—40.
„ S. Muthuswami, A. D., Madurantakam,	L. a. p. for 1 month and 2 days from 15—1—40.
„ K. M. Jacob, A. D. (on leave) Challisseri,	Extension of leave on half average pay on m. c. for 3 months.
„ C. S. Seshagiri Iyer A. D. (on leave)	L. a. p. for 4 months from 20—9—39.
„ P. Nagadhara Naidu, Asst. A. D., Madakasira	L. a. p. for 1 month from 5—12—39.
„ K. Govindan Nair, Asst. in Chemistry, Coimbatore.	L. a. p. for 3 months from 3—1—40.
Janab A. Abdul Samad, Asst. in Oil Physics D. F. S., Hagari.	L. a. p. for 30 days from 3—1—40.
Sri. P. S. Venkuswami Ayyar, A. D., Chingleput.	L. a. p. for 3 months from 3—1—40.

„ R. Balasubramaniya Ayyar, Asst. in Cotton A. R. S. Guntur. L. a. p. for 29 days from 3—1—40.

„ L. Sankarakumara Pillai, A. D., Rasipuram. L. a. p for 2 months from 4—12—39.

„ V. Kuppuswami, F. M. A. R. S., Nandyal. L. a. p for 3¼ months from 22—12—39.

Agricultural College and Research Institute, Coimbatore.

Additions to the Library during the Quarter Ending 31st December 1939.

A. Books.

1. *Soil Science.* Isgur, B. (1938). 2. *Micropedology.* Kubiena, W. L. (1938). 3. *Handbook of Fertilisers.* Custafson, A. F. (1939). 4. *The Minor Elements & Their Relation to Plant and Animal Nutrition—Bibliography.* Wallis, L. G. (1939). 5. *The Crop Atlas of India.* Revised Edition (1939). 6. *Hesperides : A History of the Citrus Culture and use of Citrus Fruit.* Tolkowsky, S. (1939). 7. *The Vegetable Growing Business.* Watts, R. L. and Watts, G. S. (1939) 8. *Diseases of Vegetable Crops* (Revd. Edn.) Walker, J. C. (1939). 9. *Farming : How to begin.* Street, A G. (1939). 10. *Standard Methods for the Examination of Dairy Products.* American Public Health Assn. Publication (1939) 11. *Price fixing by Government in the United States 1926—1939. A list (selected) of references.* Bercaw, L. C., Comp (1939) 12. *Advertising : Theory and Practice.* Sandage, C. H. (1939).

B. Annual Reports, Proceedings etc. of Agricultural Department.

1. Madras Electricity Dept., Annual Report for 1938–39. 2. Madras Chemical Examiners' Annual Report for 1938. 3. U. F. A. S. I. Tea Scientific Dept., Annual Report for 1938-39, 4. Bengal Agricultural Dept., Experimental Station Report for 1937–38. 5. Bombay Agricultural Dept., Annual Report for 1937–38. 6. India Meteorological Dept., Annual Report for 1938–39. 7. Imperial Dairy Expert (New Delhi) Annual Report for 1937–38. 8. Indore Institute of Plant Industry—Progress Report for 1938–39. 9. Indian Central Cotton Committee—Annual Report of the Director of the Technological Laboratory for 1938–39. 10. Central Provinces and Berar Agricultural Department—Annual Report of the Experimental Farms for 1937–38. 11. Punjab Irrigation Research Institute Annual Report for 1938. 12. United Provinces Agricultural Dept., Annual Report for 1937–38. 13. Burma Agricultural Dept, Agri. Stations Report for 1938–39. 14. Amani Agricultural Research Station Annual Report for 1938. 15. National Institute for Research in Dairying (Reading) Annual Report for 1938. 16. Fiji Agricultural Dept., Annual Report for 1938. 17. Louisiana, Crowley Rice Experiment Station—Biennial Report for 1937—1938. 18. Proceedings of the Association of Land—Grant College and Universities for 1938. 19. Wisconsin Agricultural Experimental Station—Annual Report for 1938.

C. English Translations of Scientific Articles published in other Languages.

1. The Origin and Selection of the Cotton Variety by Tangins. 2. The Soviet Breeding Methods by N. I. Vavilov. 3. Intravarietal Crossing by V. F. Khitrinskii.