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# The Problem of Rice Production in Malabar and its Solution

*By*

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Out of the annual normal deficit of 5 lakhs of tons of rice (husked rice) in the Madras Presidency, Malabar with an acerage of 9 lakhs of acres and a production of about 3·5 lakhs of tons of rice has a deficit of 2 lakhs of tons. It is therefore evident that the problem of the rice deficit of the Madras Presidency is chiefly one of its production in Malabar. The rest of the rice deficit districts have other cereals to depend upon as an alternative but Malabar stands on a different footing The only cereal that is grown is rice and there is even a positive dislike for any other cereal; for the matter of that even wheat, as the recent rationing has shown. The wheat off-take per individual was the lowest in Malabar compared with any other district. Thus rice plays a very important role in the economy of Malabar agriculture.

A detailed description of the different soil and weather conditions (which are beyond human control) the general rice cultivation as at present practised, the tenancy system in Malabar etc., may be necessary as it is only on this back-ground that any programme of increasing the output of rice in this district could be discussed.

**Soils:** The soils of this tract belong to the red ferruginous series and have been mostly derived from the low-level laterite, a younger generation of gneiss, through the action of water expect along the coast which is sandy—mostly transported—with yellowish clay sub-soil. The soils in the three types of rice cultivation i. e. the *modan* (Dry land), the *palliyal* (Single crop) and *wetland* (Double crop) are derived from the same source but the hilly nature of the country and the consequent washing of finer particles lower down brings about a difference in mechanical texture of the several types. Analysis of soils of the Malabar District conducted by the Madras Agricultural Department sometime ago shows the following variation:—

| | | | | |
|---|---|---|---|---|
| Nitrogen | .... | 0·05 % | to 0·15 % | and above |
| Lime | ... | 0·10 % | to 0·20 % | and above |
| Magnesia | .... | 0·10 % | to 0·20 % | and above |
| Total P-2°5 | ... | 0 05 % | to 0·20 % | and above |
| Potash | .... | 0·10 % | to 0·30 % | and above |

From the chemical analysis therefore, it cannot be considered that these soils are deficient in the major plantfoods.

**Weather:** The rainfall which is about 80 inches in the Palghat taluk increases as we go westwards and northwards to about 150 inches in the extreme north of the district. The greatest variation between them is in the three south-west monsoon months of June-August. During the rest of the year the rainfall is almost the same in all places. The range of average rainfall during the several periods for the past 40 years is as follows :–

| | | | |
|---|---|---|---|
| April–May | .... | .... | 8″ to 12″ |
| June–August | .... | .... | 62″ to 120″ |
| October–December | | .... | 10″ to 16″ |
| January–March | .... | .... | 0″ to 2″ |

The rainfall in April and May and more so its distribution, is very important in Malabar. These rains help preparation of all types of land; sowing of modan lands, broadcasting in the wetlands and nursery raising for the transplanting of the first crop Any erratic distribution is sure to reflect very adversely on the final yields of the crop. More than three-fourths of the annual rainfall is received during the three months of June to August. The break between the southwest and the retreating monsoon, generally from the last week of August to the middle of September, is again an anxious period on the West Coast. If the drought continues, the *palliyals* suffer badly and the second crop planting also gets delayed with proportionate reduction in yield.

Extremes of heat and cold are unknown on the West Coast, the average maximum of the several months varying only from 88° to 92° F. and the minimum from 70° to 78° F. with the mean range from 78° to 85° F. But the humidity is exceptionally high, the average for the year being round 80 per cent, the three months of June, July and August recording more than 90 per cent. If August happens to be very humid, it has been found that the crop grows very rank and the setting of the grain is impaired. It would seem advantageous to shift forward the flowering phase by putting in the crop slightly later if irrigation facilities are available in the later stages of the second crop.

**Cultivation:—** With an area of 9 lakhs of acres in the district, paddy cultivation is carried on under a diversity of conditions but in the main there are three types. (a) The *modan* or the dry paddy. (b) The single crop land (mostly from June to October or July to January as in the '*Karinkora*' areas or January to April as in the '*Cole*' areas) and (c) The double crop areas along the valleys.

The modan lands constitute the unoccupied dry lands of the district and paddy is grown once in two or three years. The rest of the season they are left fallow or an occasional crop of gingelly is taken from September to December. Tapioca or ginger in some places and rarely chillies are some of the other crops. The fallowing of the *modan* for two or three years is in our opinion not a sound practice though the reason adduced is somewhat convincing. It is said that the lands are subject to permanent assessment by Government if cultivated continuously for three years and to avoid this there is an intervening fallow. True, with the very poor constitution of these lands, both physicial and chemical, some fallow is necessary but foregoing a crop for a small charge as assessment would approximate to the maxim 'Pennywise and poundfoolish'. The bulk of these lands have still to be terraced and levelled with proper contour bunding to increase their waterholding capacity. Probably here the State has to undertake the reclamation portion of the work as it is not satisfactorily attempted by the *Jenmies* (Landlords).

Broadcasting of the first crop is carried on in 75 per cent of the double-crop area in the district and the lands are prepared from the time the second crop is harvested as and when the lands permit of such cultivation. The ryot is very eager to sow the crop at the earliest opportunity. His eagerness is partly explained by the fact that if he misses the earliest opportunity of sowing, it may be that he may not get another; or the next rains may be so heavy that he may not be able to sow for a long time to come. The later the sowing goes beyond a certain date the poorer the crop: for, before the monsoon becomes vigorous which may be any time from the first week of June, the broadcast crop should have made sufficient growth to be able to stand the heavy rains. It may sometimes happen that after an auspicious sowing and a good germination the rains in May so necessary to keep the tender crop going may be so scanty that a heavy reduction in yield results whatever the quantity of rain received later. The broadcast crop is thus governed by a large element of chance for its success.

It may be asked why at all broadcasting should be resorted to under such risky conditions. It is believed that a broadcast crop withstands floods that occur in June better than a transplanted crop. But this is not a valid argument, for, where the bulk of broadcasting is done as in Palghat, floods are not so vigorous as in those areas where transplanting is more commonly adopted. The real reason, however seems to be that it is a relic of the old custom. When the population of the district was small and land was in plenty it would not have been possible to practise transplanting on a large area and so the broadcast system was adopted. But in the system of transplanting, one feature which has to be specially taken care of is the age of seedbed. With short-duration varieties, seedlings aged more than 4-5 weeks result in a poorer yield of the subsequent crop. Hence a large area has to be planted expeditiously and though the population in the tract is large the agricultural labour is still very inadequate at present.

On the singlecrop lands the first crop is invariably transplanted as it is not generally possible to sow them till the first week of June, when the only alternative left is to transplant from nurseries. The second crop closely follows the first without any interval, and this is invariably transplanted except in small areas as in North Malabar where it is broadcast.

**Manuring:** The manure that the soils of Malabar receive in only a few basket-fuls of ash and powdered cattle manure for the broadcast crop, and a few head-loads of green leaf where the land lies near some forest or near house compounds with trees. The second crop receives green leaves more often than the first crop.

**Yields:** In spite of the fact that the chemical analysis does not disclose that the soils are very poor in the essential ingredients, the yields of rice in Malabar are very poor, being the poorest in the Presidency. An yield of 5·3 lakhs of tons of paddy is got from the 9 lakhs of acres under rice with an average acre yield of 1300 lbs. of paddy. The average acre yields on the different types of soils are approximately as below:—

| | |
|---|---|
| *Modan* .... .... | 600 lbs. |
| *Palliyal* (single crop) .... | 1,200 lbs. |
| Wet-lands (first crop) .... | 1,400 lbs. |

It is clear therefore that with an abundant rainfall, good drainage, general healthiness of the crop and absence of any serious epidemics, the problem of improving the yield of Malabar should not be very difficult of solution. The seasons of growing the paddy crop as at-present practised have been fitted into the periods when an adequate rainfall or assured water supply can be counted upon with the attendant good and bad consequences.

**Tenures and Tenancy Laws:** Almost the whole of the land in Malabar cultivated and uncultivated is private property and held by '*Jenmum*' right which conveys full absolute propriety in the soil. The land-lord is called a '*Jenmi*' and most of the '*Jenmum*' land is in '*Kanam*' which is a tenure partaking of the nature of both a mortgage and lease. The tenant pays a lump sum (*Kanam*) to the *Jenmi*; an annual rent (*Pattam*) is fixed according to the capacity of the land. The '*Kanamdar*' is at liberty to transfer his interest during his tenancy or to sub-mortgage it. Akin to the '*Kanam*' are several varieties of tenures differing chiefly in the amount and nature of the sum advanced to the '*Jenmies*'.

'*Kuzhi Kanam*' tenure is common only in North Malabar where cultivable waste lands are leased out to the tenants known as *Kuzhi Kanamdars* for making improvements in the lands after receiving a lump sum consideration for the same.

The *Verum Pattam* is a simple lease from year to year and the rent is often the whole of the net produce after deducting the bare cost of the seed and cultivation in which case the tenant is practically a labourer on almost subsistence wages. A large proportion of the land is concentrated in the hands of a small class and the welfare of the agricultural community is therefore largely dependent on the relations between this small group of land-lords and their tenants.

Though the *Jenmies* have the proprietory right in lands, they are not as a rule the cultivators. The actual cultivators are *Verum pattomdars* the majority of whom are extremely poor. Absence of interest by rich *Jenmi* is also one of the indirect causes for the low standard of cultivation in Malabar.

The *Kanamdar* is only an intermediary the majority of whom do not cultivate but lease on to a *Verum pattamdar* fixing a high '*Pattam*'. The *Kanamdar* pays as '*Michavaram*' to the *Jenmi* which is usually low thus making a large profit out of the *Pattam* given by the *Verum pattamdar*.

The low yield in the district may be attributed to the following more important causes.

(1) The use of short-duration varieties for the first crop and in some tracts for the second crop also.

(2) In spite of the heavy rainfall, its distribution is often irregular. For a successful crop under broadcast conditions, good soaking rains in the first fort-night of April followed by at least four to six inches of occasional rains in May, and a not-too-long break between the closure of the South-west monsoon in August and the retreating monsoon in September are necessary. For the second crop this condition delays transplanting, resulting in overaged nurseries and shortage of water in the later stages of the crop, unless some late rains occur in North-east monsoon.

(3) Standard of cultivation is poor, the over-lapping of crops without fallow or without replacing the loss of plant-food by proper and adequate manuring.

(4) The abject poverty and chronic indebtedness of the cultivator who is responsible for actually growing the crop.

(5) The all-too-benevolent Nature, which brings unfailing rains during the monsoon resulting in some crop at least, despite the poor cultivation. The ryot's wits are to be sharpened by a struggle against Nature.

To make good the enormous deficit of the district there is no other way than applying scientific knowledge to agricultural practices on the background of the existing environmental conditions. We may deal with them under three main heads :—

### 1. By Increasing the Area Under Cultivation of Paddy.

#### (a) Bring Fresh Area Under Paddy.

From the returns of the Revenue Authorities, Malabar has 9·6 lakhs of acres of uncultivated lands other than current fallow and 2·5 lakhs of acres under current fallow. The possibilities of bringing a portion of this area under plough on an economic basis under the existing conditions are very remote. The cultivable wastes are situated in very unhealthy surroundings with dearth of labour and transport facilities. Unless these are rectified, involving immense expenditure there is no chance of these areas being brought under the plough.

### (b) Increasing the Existing Area.

**Modan:** It has been pointed out already that this type of dry-land is cultivated once in two or three years with paddy. The rest of the time it will be almost fallow. It is possible to extend the area under this type of land by suitable manuring and conserving the soil and moisture by providing good bunds along the contours. The Malabar ryot has understood and was practising it but owing to the present abnormal dearth of labour, this latter aspect has been neglected and in places gullies have formed eroding the fields. The problem of manuring the modans may have to be tackled from the point of providing a cheap manure as otherwise the gross return, poor as it is, may not pay the cost of manuring. Raising a green manure crop such as wild indigo sown in October rains or *Crotalaria striata* or even raising sunnhemp and ploughing it in during the North-East monsoon rains will be worth attempting. Experience in the Agricultural Research Station, Pattambi, has shown that this is a feasible proposition. By such manuring of these dry-lands higher yields per acre are obtained and with the modest estimate of one lakh of acres of modan land available for cultivation an increased production of a quarter lakh of tons can be achieved.

**Single Crop Lands:** With the provision of adequate irrigation facilities (dealt with in detail later), some of the single crop lands could be converted into double crop areas. On this account about a lakh of acres of additional second crop area can be got which on a modest estimate, is likely to produce half a lakh of tons of more rice.

**Third Crop Areas:** The third crop area is possible of expansion with the provision of new wells and repairs to the existing ones. Many of these have accumulated silt and have become shallow. They are in a bad state of disrepair and have to be renovated.

**Cole Area:** On the *cole* area the *punja* crop as at present grown is a gamble. Either too much rain in April or May or a dearth of fresh water in the storage channels spells disaster to this crop. It would appear possible to practise the '*Udu*' system of cultivation. The proposition is to mix up a short duration and a long duration flood resistant variety. (the proportion to be determined after some experiments and experience in the areas) and plant up or broadcast in January—February. If the season is good the short duration crop may

give a fair yield and the long duration varieties would have grown to sufficient height by the time the floods occur. These varieties grow with the rise of water and their tips are always above the water. These varieties are proposed to be tried in the next season. The selection of the long duration variety has to be done with reference to the depths of water at different places of the cole area. It may be that some of the Assam varieties grown in the Surma valley may be useful here.

### 2. By Improving Yield Per Acre.

The more fruitful line of attack is the attempt to improve the acre yield of the area that is at present grown.

### (a) Improvement in Cultural Practices and Provision of Irrigation Facilities.

Paddy cultivation in Malabar is entirely dependent upon the monsoons which though heavy are often not properly distributed. The seasons are 'set' and therefore under the existing circumstances, where the ryot has no control over the irrigational sources, he has to make the best of the bargain. If the paddy yields are to be improved in Malabar, the cultivator must be made less dependent upon the seasons. At present he is obliged to hasten up his sowings with the earliest rains in April and any drought in May (very common) will surely affect the subsequent yields. He must be able to get over this contingency if it occurs This would involve the provision of a net-work of reservoirs which should store the water of the early rains and supply this water to the fields specially in the initial stages. Possibly the ryot may also be able to raise nurseries with the help of this water somewhat a little later than he is at present doing, enabling him to use seedlings of the right age. It is not unreasonable to find that the ryot in his anxiety sows the nurseries also with the earliest rains and if the setting of the monsoon is late, his nurseries become over-aged with a considerable reduction of yield of the crop resulting from it. Neither can he postpone it very long, lest he is unable to sow afterwards with the onset of heavy rains.

It is a common experience of the ryot that a broadcast crop under wet conditions with facilities for one or two irrigations after sowing in May gives considerably better yields than the dry broadcastings, specially in seasons of drought in May. Thus specially where broadcasting is practised on a large proportion of the area, provision of these reservoirs would go a long way in stabilising yields.

There is another advantage in trying to postpone the sowings and also converting a portion of the dry broadcast into transplanting. As at present practised, broadcasting in April precludes the growing of green manure crops, as the interval between harvesting of second crop and broadcasting the main crop is too short. By increasing this interval by 15 days to a month, green manure crops come up well with the occasional showers of April and May and contribute towards higher yields of paddy.

In the adequate provision of reservoirs by way of small tanks and big wells, even storage reservoirs by anicuts across hill streams a more secure second crop yield results.

The Palghat taluk with large number of such storage tanks for giving one or two irrigations at the later stages of the second crop is a case in point. The assured supply of water from these irrigation tanks later in the season, enables the ryot to grow long duration varieties, which give increased yields. The planting of the second crop depends upon an early start of the North-East monsoon without any undue prolongation in the interval between the South-West and retreating monsoon. If the start of the monsoon is late, planting gets dealyed and the crop suffers from a number of handicaps, viz. (1) an overage of the seedlings, (2) a short growing period, (3) pests and diseases, specially the stem-borer if the cold winds start in October, and (4) late harvest of the crop with the consequent dearth of water in the last stages of the crop. These could be avoided if planting of the second crop is done as early as possible with the help of water in the reservoirs, tanks or wells. With adequate provision of irrigation facilities high yielding long duration varieties can also be used.

### (b) Manuring.

Yields of rice can be surely increased by adequate manuring of the fields. This aspect is important in Malabar for a number of reasons (1) The situation of the rice fields is such that a constant depletion of the finer particles of the soil occur by the gushing of waters in monsoon weather. The rains are of a beating nature and more than 50 per cent of the total rain-fall is contributed by short-lived heavy downpours and this causes a lot of havoc especially in the undulating portions of the country. (2) The intensive cultivation without replenishing the loss of plant-food materials. (3) The soils are very porous and this results in the washing away of the soluble plant-foods. (4) Finally the soils in many places are 'poor', the normal yields being the lowest in the Presidency.

The results of the manurial experiments conducted at the Agricultural Research Station, Pattambi for the past two decades offer a sure method of increasing the paddy yields on the West Coast by manuring (vide Statement I). The following conclusions reached at the station are of interest:—

(1) Green leaf or green manures to the broadcast crop as well as transplant fields increases the yield of paddy (in *modan*, *palliyal* or double crop lands) proportionate to the quantity of leaf applied upto 6,000 lb.

(2) Groundnut cake or ammonium sulphate over a basal dressing of leaf (2,000 lb.) secures increased yields.

(3) Application of groundnut cake at 500 lb. or ammonium sulphate at 150 lb. results in an increased return which covers the cost of the manure even at the prevailing high rates (Groundnut cake at 16 lb. per rupee, ammonium sulphate at 10 lb. per rupee and paddy at 12 lb. per rupee).

(4) When the economics are worked out green leaf is the best. But it is very difficult to get large quantities of leaf required for the enormous areas of paddy in this district.

(5) Application of 300 lb. of cake over 2,000 lb. of leaf gives the highest gross return.

Since production of more paddy is the ultimate aim, the problem of application of artificials has to be viewed on this back-ground and if necessary the sales of cake may have to be subsidised to induce the cultivators to use cake as manure. The fixation of a remunerative price for paddy consistent with the problem of producing the maximum crop has to be taken up by the State.

The other alternative would be a vigorous campaign for the use of green manures on as large an area as possible. The following programme of green manuring is suggested from the experience gained at the Agricultural Research Station, Pattambi.

**For Modan Lands:** (a) Sowing sunnhemp after harvest of paddy crop in August—September and ploughing it in October—November.

(b) Sowing wild indigo in August—September and ploughing it in April rains and sowing paddy; it may be also sown as a mixture with any cro · sown in August—Septem .r-

**For Single Crop Lands:** (a) Wild indigo as a mixture with horsegram sown in October.

(b) Sunnhemp also can be sown in September—October and ploughed in if North-East monsoon rains are favourable.

**Double Crop Lands**—(1) **First Crop:** (a) In the sandy areas which are to be transplanted wild indigo can be grown after the harvest of the second crop; if the North-East monsoon rains are good and if there is sufficient moisture, they may be ploughed up and wild indigo sown.

(b) If this should fail, either daincha or sunnhemp can be raised from March—April and this will be useful for the transplanted crop.

(2) **Second Crop:** For manuring the second crop of paddy, sunnhemp may be raised in '*modan*' after harvest of paddy and a portion of this may be applied to the second crop wet-lands.

The main difficulty at present is the non-availability of green manure seeds at the right time. The uncertainty of the early pre-monsoon rains and also the peculiar position that the actual cultivator occupies in the paddy economy of the tract, are some of the other draw-backs. These impediments, however are not insurmountable. A quickening of the production of green manure seeds in cultivable wastes, importing the seeds and stocking them at different places in the district, enlargement of irrigation facilities to provide one or two irrigations if necessary to the crops, the subsidizing of the sale of green manure seeds till such time as they become somewhat popular, a nominal bonus to growers of these green manure crops are all measures that would speed up the green-manure programme.

(c) **Use of Improved Seed:** By the use of pedigree seed evolved by the Research Station at Pattambi, suited for different seasons it has been found possible to increase the acre yields by 10—15 per cent (Statement II). But as the cultivator on the West Coast is in a state of stupor and has no capital to work with it is very doubtful if he would ever be able to 'buy' the seed from the Agricultural Department which now offers it for sale. The peculiar tenancy laws, his utter dependence upon Nature for successful cropping, the very low standard of living of the cultivators have all been the stumbling blocks for the rapid spread

of the Departmental seed, unlike on the East Coast or in the Deltas. The procedure now adopted on the East Coast of making ryots raise seed farms and procurement of the seed so multiplied, has to be modified with regard to this tract. Again the practice of broadcasting prevalent over large areas in the first crop contaminates the seed and it is very difficult to guarantee cent per cent purity under these conditions. Hence it is essential that seed production and distribution of improved strains in Malabar must be arranged by the Agricultural Department itself throughout all the stages. This may involve the creation of Special Seed Production and Distribution Officer with adequate staff and sufficient number of godowns in important centres.

### 3. Increasing the Standard of Living of the Cultivator.

(a) **Economic Holdings:** In Malabar each person supported by agriculture has 0·9 acres of land. The holdings of Malabar are distributed as follows:—

| Size of Holdings: | | Percentage of Total: |
|---|---|---|
| 0·5 acre and less. | .... | 10 |
| Less than 1 acre. | .... | 38 |
| Less than 5 acres. | .... | 39 |
| Less than 10 acres. | .... | 13 |

For a family of five the estimated economic holding is five acres and so it is evident that more than 87 percent of the population possess uneconomic holdings. A new outlook on the agricultural enterprise by the Government and the landed aristocracy or the *Jenmies* is needed. The Government on its part has to improve the present tenancy laws which are defective and the *Jenmies* or the *Kanamdars* must view with sympathy their tenants' position and also take a living interest in the improvement of their land and thus gradually improve the standard of living of the cultivator when alone, a steady increase in yields can be secured. Kerala including Malabar has the highest literacy in India both among men and women and it should therefore be easy for any programme of agricultural improvement to bear early fruition..

The State should also improve as many irrigational sources as possible. It is encouraging to find that this programme has already been taken on hand by the Government. The poverty of the Malabar cultivator is proverbial and most of

them are heavely in debt. Even the present programme of well-sinking for which there is a great future in Malabar by subsidies etc., has made very poor progress in this part of the country owing to lack of capital with the actual cultivator. This may also have to be done at Government cost and proper water cess may be collected from those who use the water.

(b) **Improvement in tenancy laws:** The three crying evils of the present land tenure system are said to be (1) rack renting (2) the presence of a large class of poor *Verum pattamdars* generally under the *Kanamdars* and (3) inadequate compensation for improvements made.

Without entering into controversial points about the changes in Malabar tenancy the following which are calculated to help the cultivator in taking more interest in the land, are suggested.

(1) The cultivator a *Verum pattamdar* should be made to have a permanent interest in the land by reviving the existing relationship between the landowner and the tenant cultivator.

(2) The number of intermediaries between the *Jenmi* and the actual cultivator is large and this should be reduced to two the *Jenmi* and the cultivator or three at the most; the *Jenmi* the Lesse or *Kanamdar* taking on long leases and the actual cultivator.

(3) Certain disabilities in the cultivation of *modan* lands every year have to be removed by suitable modification of the assessment regulations.

(c) **Intensive Cultivation, New Crops and New Industries:** Another way of looking at the problem of improving the standard of the cultivator in Malabar would be to try and determine the extent of employment which the ryot has actually at present, to find out if he is fully occupied during the 12 months of the year and if not to suggest some suitable sources of employment to him either industrially or agriculturally. Though the industrial potentialities of this region have not been fully worked out the possibilities for such industries giving employment on a large scale are not great. There is an absence of satisfactory employment during the months of May to August, in the bulk of the district. This season of agricultural inertia with its incessant rains also happens to be the season of poverty of cocoonuts, the crop next in importance to paddy and during this following measures are suggested for consideration.

(1) Area under betel and arecanut palms may be increased.

(2) Fruit trees like jack must be grown on more systematic lines and the area to be increased.

(3) Coffee—the Robusta type which is very successful as a garden crop in the Travancore State, in the forest hill regions may be introduced wherever possible.

(4) Pulses to be tried in two seasons in the *modan* and also in other suitable places where the land is not occupied by paddy. Black and greengram also come up very well in these areas as monsoon crops.

(5) Introduction of long staple cotton in dry lands and house compounds from May-October and the intensification of hand spinning. It was found from experience at the Agricultural Research Station, Pattambi that an acre yield of 300 lb. of kapas can be obtained.

(6) Lac Culture: Inoculation may be done in November-December and the crop may be harvested in June-July.

(7) By organising and extending subsidiary industries such as coir manufacture, arecanut curing etc., and introducing bee-keeping for which there is a vast scope in the upcountry areas.

**Resume.**

The production of rice in Malabar can be stepped up to make the district self-sufficient at the present ration level of 10 ounces of rice by the following measures (Vide statement III-d).

(1) Increasing the yield and extending the area under dry paddy by adequate manuring and suitable rotations of the *modan* areas.

(2) Increasing the yields of the single crop land by adequate manuring and also assuring water at the end of the season during August-September through canal or well irrigation.

(3) Converting a portion of the single crop area into double crop area and some double crop area into trible crop area by suitable canal irrigation and irrigation from pumps.

(4) Use of improved strains which are suitable to all types of lands; and