

## Manuring of Rice in Relation to Maintenance of Soil Fertility and Increased Production \*

By

P. D. KARUNAKAR and T. RAJAGOPALAN,  
(Department of Agriculture, Madras.)

According to the "Famine Enquiry Commission Report" recently published by the Government of India, the self sufficiency in cereals at a satisfactory level, should be the cardinal aim of Food and Agricultural Policy of our Government to solve the acute food shortage in the country. As envisaged by Dr. Burns, formerly Agricultural Commissioner with the Government of India, a 30% increase in production of cereals is urgent and there is no reason why this could not be achieved as a result of the "Grow More Food" Campaign launched by the Provincial and Central Governments on an intensive and extensive scale. Taking rice, we produce in the Province an average of only 5 million tons of rice from 10 million acres under paddy - both irrigated and dry; and this is undoubtedly the most depressing part about our agriculture. The low production is mainly due to lack of water and manure. It is the unanimous opinion of the Agricultural experts, that given ample water and manure, the rice yield can be forced up very much higher. The average yield of wet paddy lands (8 million acres) in the Province is about 1,400 lbs. per acre. The population of Madras Province is approximately 50 millions and working at the rate of 16 oz. per head, the total quantity of rice required to feed the whole population is about 8 million tons of cleaned rice per annum. In other words, we have to increase our production of the present 5 million to 8 million tons.

The improved varieties of rice could give a 10% increase. This method of augmenting our food supply has its own limitation and cannot by itself solve even the fringe of our problem. The higher yields of improved strains will also remove more of plant foods from our soils. The only alternative, therefore, for enhancing appreciably our food supply, is manuring.

The problem of increased crop production through manuring has naturally to be approached from two distinct standpoints governing the general manurial policy, namely, (1) the maintenance of soil fertility and (2) increasing the soil fertility for higher productivity. The first objective can be achieved by addition of adequate amounts of bulky organics such as green manure grown "in situ" or brought from outside, farm wastes, composts, farm yard manure etc. The increased production at desired levels consistent with soil fertility on the other hand, can be brought about by a judicious use of easily available nitrogenous and phosphatic fertilisers such as ammonium sulphate and super, over base.

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### I. Maintenance of Fertility.

It is well known that yields of crops at increasing levels of fertility often give an S shaped curve. With soils at low as well as at high fertility levels, yield response per unit of fertiliser ingredient is short of the maximum due to the operation of limiting condition of other factors of growth. Maximum fertility level may tentatively be defined as that point at which no factor is limiting and wherein the addition of one unit of any plant nutrient is reflected best in terms of yields. Under obviously favourable conditions of cultivation and manuring, the maximum yield of paddy has rarely exceeded 4,000 lbs. per acre. The normal fertility level for most of our soils can therefore be fixed at 2,000 lbs., i.e., at 50% of maximum yield. This figure can be taken as the basic fertility level of paddy lands in the Province. The organic substances available for maintaining the basic fertility level are:— (1) Green Manure; (2) Farm Yard Manure; and (3) Composts.

Farm Yard Manure and Composts are required for dry and garden lands. It would not be right to deny their manurial requirements or augment the manurial supply to paddy lands at the expense of dry lands. Dry lands also produce important food crops and the present availability of Farm Yard Manure and compost is woefully inadequate to meet their requirements.

So then, we have to depend mainly, perhaps entirely, upon green manures for maintaining the basic fertility level. It is therefore necessary that every acre of paddy land should grow green manure which may then be expected to supply 5,000 lbs. of green leaf per acre. This is a large order but not impossible.

It has been found by actual experiments conducted for a number of years in the several Agricultural Research Stations at Anakapalle, Samalkota, Maruteru, Aduturai, Coimbatore and Pattambi that fertility of paddy soils in the Province can be kept at suitable levels to produce an average acre yield of 2,000 lbs. by incorporation of 5,000 lbs. of green leaf to supply about 30 lbs. N. per acre. On this basis, the entire needs of our paddy soils for maintaining their fertility, can be met by the application of green manure. It is however desirable to exercise restraint on our optimism regarding the exclusive use of green manures and emphasise the need for proving additional reinforcements in the form of available organics such as oil cakes.

The total quantity of groundnut cakes produced is half a million tons. Fifty percent of this is earmarked for cattle feed and hence 1/4 million tons alone will be available for manurial purposes. Practically the whole of it is being used now for cash crops and very little is available for paddy.

It may be desirable to ensure the supply of this and other cakes to provide at least 15 lbs. N. per acre when addition of 2,500 lbs. of green manure supplying another 15 lbs. of N. only will be necessary.

## II. Increased Production.

We have so far considered the basic fertility maintenance of our soils in terms of yield, namely 2,000 lbs. of paddy per acre. Passing now to increased production, the plan may be fixed at any suitable target. To make our province self sufficient in regard to rice required to feed a population of 50 millions at the rate of 16 oz. of rice per day per head, we have to aim at a production of 12 million tons of paddy. As this is to be obtained mainly from 8 million acres of wetlands under this crop, our target yield should be at least 3,000 lbs. or 50% increase over production at the basic fertility level of 2,000 lbs. per acre. This has to be achieved by application of artificials only, since all our natural sources of manure are earmarked for maintenance of basic fertility and for the needs of dry lands. From an examination of the yield data relating to the manurial experiments on paddy with combination of nitrogenous and phosphatic manures providing 30 lbs. N. and 30 lbs.  $P_2O_5$ , in the typical Rice Research Stations of the Province, it is seen that 3,000 lbs. of paddy yield has been reached in only a few cases. It should not on this score be considered impossible to reach the target, high as it is, by adequate and timely application of the required fertilisers in their proper forms provided other conditions are not limiting. Since at the present time we are not in possession of the knowledge about the nature and amount of the fertilisers needed for arriving at the target of 3,000 lbs. per acre, we have to be satisfied for the time being with the programme for a lower target of about 2,500 lbs. that have actually been reached in the experiments conducted in the various research stations at Samalkota, Maruteru, Aduthurai and Pattambi.

TABLE I.  
Results of manurial experiments on paddy.

Agricultural Research Stations.	Artificials required		Yield obtained by manuring, lbs. per acre.
	N. per acre in lbs.	P. per acre in lbs.	
Samalkota	30	30	2,700
Maruteru	44	32	2,300
Aduturai	30	30	2,700
Pattambi	31	30	2,300

From the data furnished in the table, it may be seen that in most of these stations the supply of 30 lbs.  $P_2O_5$  and 30 lbs. N. in easily available forms, such as super and ammonium sulphate, has given an average yield of about 2,500 lbs. per acre on these farms. To arrive at this target of production therefore 6 lakhs tons each of ammonium sulphate and super are required.

Further, the addition of phosphoric acid is also required for increased production of our paddy soils which are very deficient in phosphates. The application of phosphates in presence of sufficient quantity of organics, has invariably proved beneficial in increasing appreciably the yield of paddy crop. It is therefore absolutely essential for the maintenance and increase of soil fertility that our lands should receive a minimum basic dose of phosphates to supply at least 30 lbs.  $P_2O_5$ . Our available phosphatic resources, apart from Trichy rock phosphate, are bones and fish guano only. Exact figures for the last two are not available. It is felt, however, that the quantity of phosphates from both the sources will be far short of our basic requirements. The deficit in regard to this important fertiliser has to be made good by mineral manures to be manufactured in this country and obtained from abroad.

Thus, the total phosphoric acid requirement for increased crop production will as mentioned before be 6 lakhs tons of super. This may have to be met by starting local industries for phosphoric acid production and /or by imports. Similarly 6 lakhs tons of ammonium sulphate, required for the supply of N. have to be manufactured or obtained from outside.

Based on the above considerations the following schedule of manuring for the paddy tracts of the presidency is recommended to give an average yield of about 2,500 lbs. paddy per acre.

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|----|---|------------|
| 1. | Basic — Green manure to supply 30 lbs. N. ...                               | 5,000 lbs. |
|    | or  |            |
|    | Green manure to supply 15 lbs. N. ...                                       | 2,500 lbs. |
|    | Plus  |            |
|    | Oil cake to supply 15 lbs. N. ...   |            |
| 2. | Plus  |            |
|    | Ammonium sulphate or any Nitrogenous<br>fertiliser to supply 30 lbs. N. ... |            |
|    | Plus  |            |
| 3. | Super or any phosphatic fertiliser to supply 30 lbs. $P_2O_5$               |            |

The significance of adequate and proper manuring has been well understood by the advanced countries like Japan, Spain and Italy. In Japan, composting of waste materials for application to rice, growing of green manure and liberal use of the human excreta, have been practised from a very long time. Artificial fertilisers, such as, super and ammonium sulphate, are supplied with the organics and the dosage is, as much as 70 to 80 lbs. of N in the shape of sulphate of ammonia and about 50 to 60 lbs.  $P_2O_5$  as super. The sale of the chemical fertilisers is made through Co-operative Societies. Superior varieties of paddy evolved by breeding, occupy more than 70% of the rice area in this country and the number of

strains introduced are also limited. The distribution of manure is efficiently controlled by the State. Turning to Spain and Italy in the West, it is no wonder to note that with the magnificent system of irrigation prevailing in these countries, coupled with heavy applications of artificials viz., ammonium sulphate, super and potash the average yield has gone up to the enviable figure of 5,000 lbs. per acre. The practice current in these advanced countries may be emulated to the maximum possible extent, to raise the yield of paddy in our Province.

Above all, the productive capacity of each type of soil should be assessed in relation to its environment and make up. This factor is not directly proportional to the amount of fertiliser applied. A cultivated field should be judged as a biological entity or organism and is therefore subject to the laws governing the organic. It has its critical point of inner effective power which is the resultant of a number of factors. In the words of Pfeiffer (*Soil Fertility, Renewal and Preservation*, Faber and Faber Limited, Lond. (1945) – pp. 148–163) “the natural fertility and production capacity are the functions of (1) the soil; (2) manuring; (3) humus; (4) rotation; (5) climate; (6) weather conditions; (7) quality of seed; (8) weed growth and a host of environmental factors”. All these should be borne in mind in the management of our paddy lands for maximum crop production.

Another equally important point to be considered, is the economic use of fertilisers avoiding wastage and resorting to right method of their application at the proper time. Recent work indicates that small application of fertilisers in close proximity to the seed, the pre-soaking of the seed material in nutrient solutions of phosphates etc., may be effective in increasing the crop yield. Splitting of the doses of manures and their application at different stages of plant growth, has also been found efficient in improving the yield and quality of crops.

In fine, maximum cropping which is closely allied to maintenance of soil fertility demands ingenuity on the part of the farmer, combined with a thorough understanding of his soil and its capabilities. Apart from judicious manuring, careful planning, skilful cultivation and wise selection of variety are also equally important for solving our cropping problems and food shortage.

