# Factors restricting Fertilizer Use with special reference to Rice*

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ONE of the chief arguments for fertilizer use is the economic one. No farmer is likely to use fertilizers on his crop unless he is convinced that the money he spends on fertilizers will be more than repaid out of the increment to his usual crop which the use of the fertilizer is going to ensure. The heavy investment by the tea industry on fertilizer has been the main cause for the spectacular increase in the production of tea in Ceylon which has risen from 247,000,000 lb. in 1941 to its recent level of 455,000,000 lb. in 1961. Likewise, in the case of paddy the application of approximately 3 cwt. of fertilizer per acre of which the unsubsidised cost is about 39, and the subsidised cost about Rs. 19 will result in an increase in yield of about 10 to 15 bushels of paddy which at the supported price is worth Rs. 102 to Rs. 180. The low consumption of fertilizer by the acreage under rubber can similarly be largely explained by the poor response of the adult tree to fertlizers. In the case of coconut, fertilizer consumption which was round 11,000 tons in 1955 has shown a four-fold increase since then and this has likewise been accompanied by substantial increases in crop yields.

Yet in all these crops the actual quantity of fertilizer used is at first glance far below optimum consumption levels. The quantity of fertilizer that could potentially be used by the 1·4 million acres annually cultivated in rice at the average application rate of 3 cwt. per acre would amount to about 210,000 tons. The quantity actually used between 1st October, 1961 and 30th September, 1962, was 47,058 tons or about 32% of the total. Again, for coconut, while the ultimate potential level of consumption would be between 150,000 to 200,000 tons, the actual quantity consumed in 1962 was about 44,983 tons which is about the same level as for rice. Even in the case of tea, which uses more fertilizer annually than the other three crops combined, the quantity used, according to the 1960 rates, is round 130,000 tons. This is not very much more than 80% of the potential total consumption.

*Paper read at the 1963 Sessions of the Ceylon Association for the Advancement of Science.

A closer examination of the scope for fertilizer use in the extents cultivated in the various crops will however reveal that consumption figures are in reality very much better than the ratios quoted. The habit of fertilizer-use among the producers of export crops, for example, is largely confined to estates. In the case of rice it has to be remembered that out of the 1·2 million acres of asweddumized land over 800,000 acres do not enjoy the benefits of controlled irrigation under the major irrigation schemes. Of this extent only about 350,000 acres have been provided with minor structures and earth works. About 500,000 acres have not even such minor devices to control and direct rain water and are entirely dependent for successful cultivation on the timing and frequency of rain. It will be evident therefore that any estimate of optimum consumption level will have to take such factors into account and the judgement on any levels of use will of course be a reflection of the optimum levels so computed.

The economic argument for fertilizer-use, however, depends on a complex of circumstances of which, in my view, the chief determinants apart from water and the availability of seed and planting materials with high response to fertilizers are tenurial conditions and price. The economic argument for fertilizer-use will apply most forcefully to the farmer who has a reasonable notion of scientific agriculture, who cultivates a relatively large extent of land for the market and who has some assurance of selling the entirety of his crop at a fair price. The argument will be least applicable to the peasant farmer who follows traditional methods of cultivation on a negligible portion of land, who is often at the mercy of money lenders and traders and who cultivates largely for reasons of subsistence. Between the two extremes there will always be much scope for pushing fertilizer use initially but as fertilizer consumption levels reach further and further down to the smaller farmers it will become progressively more difficult to inculcate the habit of fertilizer use unless it is accompanied by a combined approach on the many fronts of tenurial reform, agricultural credit, controlled water supply facilities, crop insurance, agricultural extension and the provision of marketing and fair price facilities.

The only information available regarding fertilizer consumption patterns refers to the three major export crops and rice. These data relate only to the use of inorganic fertilizer and there is no worthwhile data in regard to the actual volume and kinds of organic fertilizers used. However, an examination of tenurial conditions will illustrate the point made earlier with regard to the very close connection between tenurial conditions and extensive fertilizer-use.

## TENURIAL CONDITIONS AND FERTILIZER USE

In the case of tea which has the highest record of fertilizer use, the Administration Report of the Tea Controller for 1962 indicates that out of the 100,617 holdings as much as 85·38% are estates of 10 acres and above in extent. 24·41% of the total acreage is held in estates above 100 acres but below 500 acres, while as much as 48·10% of the total acreage is held in estates of 500 acres and above. The Report indicates also that 14·60% of the total acreage is held in small holdings below 10 acres. Some indication of the degree of fragmentation of this extent can be gauged from the fact that while its total acreage is 86,444 acres it is distributed in 97,497 holdings. Further, this extent of land is not entirely planted in tea, 14,619 acres of this total area consisting of lands on which tea is interplanted with other crops. No information is available, unfortunately, as to the details of fertilizer use among the various categories of holdings contained in this analysis, but some indication of the degree of use among the small holdings can be gauged from the fact that it has been thought necessary to begin a Rehabilitation Subsidy Scheme to persuade small holders to apply fertilizers. An examination of the fertilizer-use figures by persons who received permits under the Fertilizer Subsidy Scheme indicates that, even among them, the quantity of fertilizer used is well below optimum levels, inspite of the fertilizer being available to them with a 50% subsidy on the price. For example, permits were issued under the Rehabilitation Subsidy Scheme for fertilizing 81,860 acres in 1962, but the actual quantity of fertilizer issued was 9,609 tons or about half of the optimum quantity needed. *It seems fairly clear therefore that the habit of fertilizer use in the tea industry is largely confined to the estates.*

In the rubber industry, small holdings below 10 acres constitute 29·4% of the total acreage. The Administration Report of the Rubber Controller for 1962 indicates that special arrangements were made for small holders, who were permitted to replant, to obtain their fertilizers, the Rubber Controller's Department bringing the fertilizers in conveniently packed bags practically to their doorstep. The quantity of fertilizer utilized by them through the Department for fertilizing the replanted areas amounted to only 722 tons. Consumption of fertilizer by the rubber industry in 1960 was in the region of 27,000 tons.

No recent information is available regarding coconut holdings, but it is likely that of the 1·1 million acres cultivated in coconut as much as 70% is owned in holdings of less than 10 acres. Up to 1955, the quantity of fertilizer used by the coconut industry is estimated to be in the region of 11;000 tons. In 1956 a Subsidy Scheme was initiated to encourage the use of fertilizers nn coconut land. The connection between the size of the unit cultivated by the farmer and his investment on fertilizer can be illustrated by the

formulation of this subsidy scheme where in the case of estates (or coconut lands of over 20 acres in extent) the subsidy on fertilizer is limited to one-third the cost of the fertilizer whereas in the case of small holders (i.e., lands below 20 acres in extent), the subsidy covers one-half of the cost of the fertilizer. It was possible within four years to push the consumption of fertilizer to four times the quantity consumed before the subsidy scheme was initiated.

Tenurial conditions in the extent under rice offered a sharp contrast. The latest information available is that of 1953 and it can be inferred in the context of our Laws of Inheritance that the position has, if anything, now changed for the worse. 36·2% of the total asweddumized acreage in Maha 1953/54 was cultivated in parcels of less than half an acre each, while 44·9% of this total acreage was cultivated in parcels of between half acre and one and half acres. Thus 81·1% of the total asweddumized acreage at the time was cultivated in parcels of less than $1\frac{1}{2}$ acres each. The extent cultivated in parcels of 5 acres and above was only 3·2% of the total. In certain districts, particularly in the wet zone, fragmentation has proceeded to such an extent that it is no longer possible to divide the land, and co-owners have resorted to division on a functional basis or more often on a time schedule. Under the former system each co-owner performs a particular function in relation to cultivation and all the co-owners share the harvest. Under the latter each co-owner enjoys the use and occupation of the land once in as many years as there are co-owners. Nor is this all. Approximately 45% of all paddy lands in Ceylon are cultivated by tenants who, until recently had no permanent or abiding interest in the lands they cultivated and were liable to pay up to 50% of the total yield, as the owners' share of the crop. These uneconomic sized holdings and the high degree of tenancy naturally resulted in inefficient management and therefore poor yields, lack of capital for investment, chronic indebtedness among cultivators and, more often than not, in the complete absence of any incentives to improve production. It is clear, in this particular field, that unless there is a many fronted attack on these problems, there is little hope for any system of scientific agriculture. The need for this has been realised and the governmental approach to the problem now involves tenurial reform, the provision of credit and agricultural supplies, a subsidy scheme for fertilizer use, price support for marketing of crops, crop insurance, the provision of irrigation facilities, the creation of local platforms for farmers to ventilate their needs and to harness self-help to overcome their difficulties and the provision of agricultural extension work. All these measures in themselves will not be successful unless there is a draw-off of men from this particular crop and this is dependent on the provision of other avenues of employment to the rural population.

## ECONOMIC CONSIDERATIONS AND FERTILIZER USE

The next limiting factor concerns price. One reason why small holders of tea lands do not take readily to fertilizer use is not lack of knowledge—for in some parts of the island, at least most of them supplement their income with labour work on neighbouring tea estates and possess the necessary technical knowledge—but their inability to sell all their leaf at a fair price.

Similarly in the case of coconut, an intimate connection has been established between good coconut prices and investment by farmers on fertilizers. Fertilizer-use figures in respect of the coconut industry as released by the Commissioner of Coconut Rehabilitation are as follows :—

| *Year* | *Quantity* | |
|---|---|---|
| 1959 .. .. | 44,030 | tons |
| 1960 .. .. | 42,176 | ,, |
| 1961 .. .. | 38,800 | ,, |
| 1962 .. .. | 44,983 | ,, |

It will be noticed that between 1959 and 1962 there was a fall in the consumption of fertilizers. This is attributed to the sharp fall in coconut prices which occurred about the middle of 1960.

In the case of rice, price is not a factor to be contended with since the Government guarantees the purchase of all quantities of paddy offered by cultivators at a price which is well above both the world market price of rice as well as the price locally obtained for this commodity. To the extent that this price guarantee has been effective will one of the chief obstacles to pushing fertilizer use on rice be overcome. A recent case study of the Guaranteed Price Scheme (G.P.S.) undertaken for the FAO by the Planning Department indicates that while purchases of paddy under the GPS amounted to approximately 56% of the total production in 1962, about 30 to 35% of total production was retained by cultivators for their seed and consumption requirements. This leaves another 10 to 15% of production which could come under the GPS, but which now finds its way to the open market for a variety of reasons. Some recent arrangements connected with the extension of expanded agricultural credit facilities to paddy cultivators will divert some part of this balance, into the GPS, which is now kept away from it.

Apart from these basic factors, some of which are subject to remedial action and some of which are not, there is very considerable scope for increasing fertilizer use and some of the problems that have to be overcome in any attempt to do so can be recognised and isolated.

## THE FERTILIZER SUBSIDY SCHEME

One of the most dramatic methods of increasing fertilizer use over a very short period is the technique of the Subsidy Scheme. Mention has already been made of the coconut fertilizer subsidy scheme which, within a period of 4 years, increased the consumption of fertilizer four-fold. This basic approach has been adopted by Government in the case of two other crops. A subsidy is available to small holders of tea who apply fertilizers. In the case of paddy a subsidy is available to cultivators of paddy on a much wider basis. It is believed that a similar broad based subsidy scheme will soon be made available to cultivators of two other crops, chillies and onions.

A subsidy scheme will be effective, however, only in so far as it is efficient in its administration. Some of the problems that relate to the successful operation of a fertilizer subsidy scheme can be briefly illustrated from experience recorded under the Paddy Fertilizer Subsidy Scheme. Under this Scheme the subsidy was originally limited, round about 1951, to 10% of the cost of bonemeal and 33⅓% of the cost of the chemical fertilizers to be used on rice. Various amendments were made to the Scheme from time to time but substantially the position in 1959/60 was that—

(1) persons cultivating over 5 acres of paddy were not entitled to the subsidy;

(2) a subsidy of 50% of the cost of the fertilizer was available only to members of CAPSS* and MPCS† situated in districts where the Paddy Lands Act was in operation (at that time the Act was in operation in 6 administrative districts and covered roughly one third the total paddy acreage);

(3) members of CAPS and MPC Societies in other districts were only eligible to a subsidy of 33⅓%;

(4) non-members of Co-operative Societies living in districts in which the Paddy Lands Act has been proclaimed were entitled to a subsidy of 33⅓%, provided they surrendered paddy to the GPS and applied for their requirements of fertilizer through one of these Societies, depositing with the Society Rs. 2 per bushel of paddy sold.

The quantity of subsidized fertilizer sold in that year amounted to 24,548 tons. An Administrative Committee which examined the workings of this subsidy scheme in that year noted three major shortcomings under this scheme:

(*a*) the rather elaborate administrative arrangements under which fertilizer was supplied to farmers and Co-operative Societies;

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* Co-operative Agricultural Production and Sales Societies.

† Multipurpose Co-operative Societies.

(*b*) the lack of adequate storage space for fertilizer in the districts ;

(*c*) the absence of concerted propaganda drives for the increased use of fertilizer.

This Administrative Committee advocated the conferment of a 50% subsidy to all cultivators of rice irrespective of the acreage cultivated by them, irrespective of the area in which they were located, and irrespective also of whether they were members of a Co-operative Society or not. They advocated the need for a network of fertilizer stores in all rice growing districts and indicated how the administrative procedures of the subsidy scheme could be simplified. These suggestions were accepted and the scheme was amended on the lines advocated by this Committee. Within a short period of time all cultivators of paddy irrespective of the extents cultivated and their location, and irrespective of whether they were members of Co-operative Societies or not, became entitled to a 50% subsidy of the cost of the fertilizers, provided they paid the balance in cash. Cultivators who were benefitted by the $33\frac{1}{3}$% subsidy in respect of fertilizers purchased on credit, however, were required to be members of Co-operative Societies since credit is only extended to them through their Societies. Earlier all issues of fertilizer under the subsidy scheme were authorised from Colombo and the actual issues were made largely from Colombo. The scheme was decentralised, issues being permitted from district centres and a network of fertilizer stores established in the districts both by the construction of new buildings and by renting out of private buildings.

In 1959, the Department of Agrarian Services had two fertilizer stores in the districts with a capacity of approximately 3,000 tons of fertilizer. The number of stores increased to 8 in 1961, 28 in 1961/62 and stands at present at 52. The total capacity of these stores is in the region of 24,000 tons. Every season extensive propaganda drives were undertaken through public meetings in the villages by the distribution of leaflets and circulars addressed to Cultivation Committees, Co-operative Socities, etc., and through the press, radio and the provincial administration. As a result of these measures the quantity of fertilizer sold annually under the Scheme increased to 29,000 tons in 1960-61, 38,000 tons in 1961/62 and 47,000 tons in 1962/63. It will be seen therefore that for a subsidy scheme to successfully operate the following factors seem to be essential ;—

(1) fertilizers must be readily available to the cultivator without too many elaborate administrative formalities to be gone through ;

(2) the fertilizer must be made available to him more or less at his door-step; and

(3) there must be adequate extension work and propaganda for the use of fertilizer.

The entire edifice rests on the premise that the fertilizer recommendations themselves are efficient and that they will really ensure an adequate increase in yield to the cultivator who uses them. This is of course always difficult, but it is particularly so in the case of rice where, until recently, recommendations were made on the basis of climatic zones and where no recommendation is made on the basis of the particular soil of a particular field cultivated by a particular cultivator even now. At present fetilizer recommendations are on the basis of a D. R. O's division. To proceed to formulate them on the basis of smaller units will be progressively more and more difficult, but to the extent that this is done there will be increases in fertilizer consumption.

A connected problem in relation to the extensive use of fertilizer is the question of the kinds of fertilizer made available under any subsidy scheme. The correct approach involves some degree of deference to consumers' choice, however illogical, in the selection of the fertilizer subsidized. Under the Paddy Fertilizer Subsidy Scheme the fertilizers subsidised are ammonium sulphate 20.6% N, rock phosphate 27.5% $P_2O_5$; muriate of potash, 50% $K_2O$; and urea, 46% N. Within the specifications under which these fertilizers are purchased in bulk by the Department of Agrarian Services there was room for two types of sulphate of ammonia to be offered. One was a by-product of the coke industry and the other was the crystalline white synthetic variety. The response on the part of the cultivator to the former variety was adverse and there was definite evidence of preference for the latter. It is possible that more fertilizers could have been sold during the last financial year if the kind of sulphate of ammonia offered had been different.

Another problem attached to the successful working of a subsidy scheme is contained in the number of its beneficiaries. Under the tea industry, for instance, the total number of holdings amounts to approximately 100,000, under the rubber industry it amounts to roughly 150,000. Under the coconut industry the total number of beneficiaries will be very much more, but when it, comes to paddy it is estimated that there are approximately one million families or about half the rural population, engaged in rice cultivation. It is obviously much more difficult to formulate a subsidy scheme in the case of rice than in the case of other crops. For these reasons it becomes necessary to interpose a secondary agency between the individual farmer and the administrative unit which deals with the actual administration of the subsidy. In the case of both coconut and rice the Co-operative Society has been chosen as the intermediary agency, while for sometime, in the case of rice, the Cultivation Committees formed under the Paddy Lands Act were also chosen for the same role. The more agencies there are the more difficult becomes the question of organizing itheir smooth and co-ordinated working, for it is then necessary to prevent overlapping and duplication among these agencies. But they perform a useful

and necessary service. Of the fertilizer sales in 1961/62 under the Paddy Fertilizer Subsidy Scheme, for example, 42% or 13,483 tons was sold out of a total issue of 38,075 tons to members of Co-operative Societies, through their Societies on loan under the 33⅓% subsidy scheme. 45% of all issues, or approximately 16,000 tons was obtained under the 50% subsidy for cash. The bulk of this quantity was also sold to cultivators through their Co-operative Societies. Cash purchases by individuals amounted to not more than 2% of the total issues. This is explained by the fact that, whereas it could have been unnecessarily tedious and expensive for small cultivators to purchase their individual requirements of fertilizer from a district store, the Co-operative Society was able to obtain this for them in bulk, store it, and issue it at the appropriate time of cultivation.

## CREDIT FOR BUYING FERTILIZERS

A Survey made in 1957 of rural indebtedness indicated that total rural debt was in the region of Rs. 500 million of which about 48% or Rs. 245 millions was owed to undesirable sources of credit such as money lenders and traders. The percentage of indebted families in the rural areas was as high as 54% and the average debt per indebted family was Rs. 790. In this context the need for credit is evident. For a considerable time credit has been made available to cultivators of rice. It will be seen that it was this credit facility that promoted the consumption of 42% of all sales of fertilizer in 1961/62. The subsidy in itself would not have been secured this consumption.

In regard to paddy, the formulation of a credit scheme becomes simplified by virtue of the existence of the GPS and the possibility of linking up of credit, eupplies and marketing. This same condition does not obtain in regard to the export crops, which explains the absence of credit schemes for cultivators of coconut. The formulation of such a scheme in spite of these difficulties may be one answer to increasing fertilizer use among coconut cultivators. A similar scheme of linking credit, supplies, marketing and a fertilizer subsidy scheme is now under consideration for two of the principal subsidiary food crops, i.e. chillies and onions. In respect of these crops the GPS prices have been raised to make them more attractive. Credit has recently been offered for a variety of purposes including the purchase of fertilizer and a subsidy scheme on the same lines as for rice is now under consideration. If the subsidy scheme receives Government approval it is likely that considerable sales of fertilizer should occur among the cultivators of these crops.

## BULK SUPPLIES OF FERTILIZER

There are other problems also in relation to the successful operation of subsidy schemes. One such relates to the effective provision of bulk supplies to feed the increase in demand. The difficulty here is connected with governmental tender procedures and the concentration of demand for fertilizer in two peak periods in the year which extend roughly from September to January and April to June. To overcome this problem a State-sponsored Fertilizer Corporation, which will import all fertilizers required initially by coconut and paddy, was mooted and is now under consideration. There are also problems connected with the kinds of fertilizers required. For instance urea which is one of the fertilizers recommended for use on rice is hygroscopic in nature and has to be imported in polythene bags with an outer jute cover. Storage and transport of urea raise serious problems. These are factors which are of course subject to a certain amount of control and need not be discussed in any detail.

## HIGH-RESPONSE VARIETIES

It must be said that one of the reasons for the low consumption of fertilizer among rice cultivators in the period prior to 1959 was due to the lack of any proper response to fertilizers from the local strains of paddy. Fertilizer consumption coincided with the advent of H4 and it spread because of the adaptability of H4 to the climatic and other conditions of most parts of the island. Where H4 was not particularly suited, as for example in Galle district, a drop in fertilizer consumption has been noticed in recent years. It will be idle to talk of fertilizer use, therefore, without the existence of proper seed and planting materials with high response to fertilizers and to the extent that these are available will one of the serious limiting factors be absent.

Fertilizer use is but a part of a system of scientific cultivation and cannot therefore be advocated in isolation. Thus the absence of adequate seed material the absence of adequate care in cultivation operations such as sowing, transplanting, use of insecticides, pesticides, weedicides etc. will be limiting factors to extended fertilizer use. The necessity for these measures has been realised in so far as the cultivation of rice is concerned and a concerted attempt is now been made by the Departments of Agrarian Services and Agriculture to promote the use of proper seed materials and agro-chemicals. A subsidy scheme is in operation in respect of supplies of improved seed and a premium of Rs. 2 is offered per bushel to farmers who undertake to multiply improved seed under supervision. This seed once certified can be exchanged for consumption seed by farmers. Credit is available to cultivators through Co-operative Societies for the purchase of agro-chemicals and sprayers and bulk supply arrangements have been organized with the various firms marketing these products.

I do not wish to conclude with the impression that the scope for pushing fertilizer use on an extended basic is limited. Within the frame work of the problems enumerated, there is still considerable scope for extending the use of fertilizer. The basic approach necessary, at least so far as rice and the subsidiary crops in respect of which GPS prices are fixed by the State, is three fold. *First, the creation of as wide and as big a network of district, divisional and village fertilizer stores as possible.* Here the maximum encouragement must be given to Co-operative Societies, Cultivation Committees, and other village organizations to set up their own network of stores within their areas of jurisdiction for the extension of supplies to cultivators. *Secondly, the continued existence of the present subsidy schemes* with the maximum possible degree of refinement in the formulation of the subsidies themselves (recently some amendments have been suggested in this connection to the subsidies offered for rice fertilizers) and the simplification to the greatest possible degree of administrative procedures adopted for the disbursement of these subsidies. It should be made as easy as possible for the cutivator to obtain his requirements of fertilizers without too many formalities. *Thirdly, the necessity for continued and effective extension work and propaganda for fertilizer use allied with the use of good seed material and correct cultural practices.* There is every reason to expect that the continued use of this approach will result in extended fertilizer use at least within the short term.