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FERTILISER CONSUMPTION AND AGRICULTURAL PRODUCTIVITY IN KERALA

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ABSTRACT

Among the various inputs to increase crop productivity fertiliser plays a prominent role. Analysis have shown that the initial enthusiasm in the consumption of plant nutrients in India has faded out. The annual compound growth rate of fertiliser consumption has shown a steady decline from 1960 to 1986. In Kerala, however, after a set-back in the seventies the situation has improved during the eighties, with the growth rates being higher than the national average. In the State the increase in fertiliser consumption is more due to intensive agriculture rather than due to an increase in cultivated area. Regarding the type of fertiliser materials consumed, there is approximately an annual loss of Rs. 10 lakhs by way of use of complexes and mixtures instead of straight fertilisers. The study points out to the need for a micro level analysis of the various aspects of fertiliser use in the State.

The emphasis on agricultural development in India since the sixties has been on practices and technologies which help to increase yields of crops substantially. Among the various inputs which were identified as crucial to this process, chemical fertilizers were considered to be of prime importance. Scientists claim that genetic quality of a variety contributes only 24 per cent of the yield while inputs, especially fertilisers and water, account for the rest (Sankaran, 1989). Also, in the absence of any possibility of horizontal expansion in acreage, intensive agriculture is the strategy for increasing output. In the light of various extension programmes launched by the Government of Kerala from time to time it will be worthwhile to examine the trends in fertiliser nutrient consumption and agricultural productivity in Kerala.

Methodology

Data regarding fertiliser nutrient consumption, gross cropped area and index numbers of agricultural productivity for a period of 28 years (1960-1987) were collected from various issues of Statistics for Planning, a publication of the Government of Kerala. Data on quantity and type of fertiliser material consumed during 1988-89 were collected from the Department of Agriculture, Kerala. Time series

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data on consumption of nutrients in India were collected from various issues of Fertiliser Statistics published by the Fertiliser Association of India.

The growth in consumption of fertiliser nutrients and gross cropped area were estimated for the three decades, 1960-69, 1970-79 and 1980-89 and for the entire period.

The coefficient of variation in the consumption of total nutrients in different districts was calculated.

Results and Discussion

Trends in Fertiliser Consumption

Fertiliser consumption in the State has increased substantially both in terms of total NPK consumption (fifteen times) and on a per hectare basis (four times) during the periods 1960-1987. Yet consumption of fertiliser per hectare of gross cropped area (GCA) here is only one-half of (63.58 kg/ha) that in Punjab, the State with the highest level of fertiliser consumption (123.7 kg/ha.). Considerable degree of variation (coefficient of variation = 33.68) exists in fertiliser consumption among the different districts in the State and this can be attributed to the difference in cropping patterns, irrigation facilities, cropping intensities and high yielding varieties coverage. Moreover, the fertiliser nutrients consumption (in 1986-87) indicate, that the average NPK fertilizer consumption ratio in Kerala (7 : 5 : 6) is much different from the desirable average ratio of 4 : 2 : 1 (Desai, 1986). Whether this is due to lack of awareness on the part of farmers or due to different experiences in agronomic response in different regions is to be identified by a location specific micro—level study.

A detailed analysis of trends in nutrient consumption in the State has given the following results (Table 1).

Nitrogen

Crops require high amounts of nitrogen for their growth, development and yield formation. For every six units of proteins produced, one unit of nitrogen should be absorbed by plants. Nitrogen alone constitutes around 40 per cent of total nutrient consumption in the State. But this is only 55 per cent of what is actually needed¹.

1. Under the assumption of recommendation for local varieties by Kerala Agricultural University for the major crops, i.e., crops contributing more than 4 per cent of gross cropped area.

Table 1. Annual compound growth rate of consumption of major plant nutrients in India and Kerala

Period	Nitrogen			Phosphorus			Potash			NPK		
	Kerala		India Total N	Kerala		India Total P	Kerala		India Total K	Kerala		India Total NPK
	Total N	N per ha of GCA		Total P	P per ha of GCA		Total K	K per ha of GCA		Total NPK	NPK per ha of GCA	
1960-69	18.4* (0.96)	12.4* (0.94)	19.7* (0.94)	13.0* (0.96)	8.5* (0.83)	21.9* (0.92)	19.0* (0.92)	15.95** (0.85)	22.0* (0.92)	16.9* (0.98)	12.2* (0.94)	20.0* (0.94)
1970-79	5.1* (0.74)	3.3** (0.50)	9.7* (0.88)	3.6 ^x (0.25)	1.8 ^{NS} (0.08)	9.2* (0.61)	7.0* (0.62)	5.4** (0.48)	9.7* (0.69)	5.3* (0.59)	3.6** (0.38)	9.6* (0.83)
1980-87	7.4* (0.83)	4.9* (0.61)	6.7* (0.90)	10.0* (0.86)	5.5* (0.92)	8.98* (0.98)	10.0* (0.84)	6.4** (0.64)	5.1* (0.94)	8.9* (0.92)	5.5* (0.88)	7.06* (0.94)
1960-87/ 1965-86 (GCA)	5.3* (0.94)	4.9* (0.86)	8.9* (0.94)	5.0* (0.79)	3.9* (0.67)	9.6* (0.90)	7.0* (0.86)	6.1* (0.81)	8.8* (0.96)	6.0* (0.90)	5.0* (0.85)	9.1* (0.94)

* Significant at 1 per cent level

** Significant at 5 per cent level

NS Not significant

(Figures in parentheses denote the R²)

An analysis of the consumption pattern of this nutrient in the State as well as in India during the past 28 years revealed that the initial enthusiasm in the consumption of this nutrient in the sixties has faded out thereafter. During the decade from 1960, the annual compound growth rate was as high as 18.4 per cent in Kerala and 19.7 per cent in India which went down to 7.4 per cent in Kerala and 6.7 per cent in India.

The various government policies to accelerate food production (GMF Campaign, high yielding variety programme, etc.) might have exerted a positive influence on fertiliser consumption. Thereafter, during the seventies, the growth rate has fallen to one third of that during the sixties in the State (5.1 per cent) and one-half in the country (9.7 per cent) as a whole. Failure of some of the earlier introduced high yielding varieties like Tainan and the slow pace of increase in irrigated area may be some of the reasons for this trend. Perhaps due to the effective extension network in the State introduced during the eighties, coupled with a substantial increase in short term co-operative agricultural credit, growth rate of nitrogen consumption has increased to 7.4 per cent in the eighties while the national figure has registered a continuous decline. On an average, during the past 28 years, the growth rate in the consumption of nitrogen was 5.3 per cent per annum in Kerala whereas it was 8.9 per cent in the country as a whole.

To examine whether the increase in consumption of fertiliser nutrients is due to the influence of an increase in gross cropped area over time in the State, nutrient consumption per unit of gross cropped area was also analysed. As an indication of intensive farming, the per hectare nitrogen consumption also showed a growth rate which is not much different from that of gross consumption except during sixties.

A separate analysis to assess the growth rate in gross cropped area in the State also showed that a significant increase was there only during the period from 1965-70. During all other periods (ie. 1970-79, 1980-86 and 1965-86) the gross cropped area had not increased significantly (Table 2).

Phosphorus

Phosphorus plays a crucial role in the normal growth and establishment of root system, seed formation and hastening of crop maturity and it is an essential constituent of nucleic acids.

Phosphorus consumption in the state is only 56.5 per cent of what is recommended even under assumption of minimum recommendation². As in the

² Under the assumption of recommendation for local varieties by Kerala Agricultural University for the major crops i.e. crops contributing more than 4 per cent of gross cropped area.

Table 2. Annual compound growth rate of gross cropped area in Kerala

Period	Growth rate	R ²
1965-69	3.50*	0.98
1970-79	0.25 ^{NS}	0.17
1980-86	0.13 ^{NS}	0.29
1985-86	0.25 ^{NS}	0.10

* Significant at 1 per cent level.

NS ; Not significant,

case of nitrogen the initial rate of increase in consumption of phosphorus was not maintained in the later periods. During the sixties the growth rate of phosphorus consumption was 13 per cent which was less than that of nitrogen. But the all India consumption rate of this nutrient was more than that of nitrogen. During the next decade, phosphorus consumption in Kerala did not increase (3.6 per cent) significantly but the consumption increased considerably during the eighties (10 per cent) probably due to the same reason as mentioned for nitrogen earlier.

The consumption per unit of GCA in the case of P₂O₅ also exhibited the same pattern of behaviour as that of total consumption.

The overall growth rate of phosphorus nutrient consumption in the State was only half of the national figure and it was more or less of the same magnitude as that of nitrogen consumption in the State.

Potassium

When compared to nitrogen and phosphorus consumption of potash increased at a faster rate in the State and it is very close to the national figure. This may be due to the abundance of horticultural crops, which require a higher dose of potash. The general pattern of consumption is the same as that of the other two nutrients. But the consumption of this nutrient is only 37 per cent of what is actually recommended under the assumption mentioned earlier³. Again, the consequence of uneven growth rate of N, P₂O₅ and K₂O is also worth studying.

Total Nutrients

The annual growth rate in the total nutrient consumption was 20 per cent in the

3. Under the assumption of recommendation for local varieties by Kerala Agricultural University for the major crops i.e. crops contributing more than 4 per cent of gross cropped area.

country during sixties and thereafter the growth rate recorded a steady decline (9.6 per cent in the seventies and 7.06 per cent in the eighties). But in Kerala, even though there was a fall in the seventies, the condition has improved during the eighties. The latest growth rate is even higher than that of the country. Based upon this, the projected nutrients consumption in the state will be around 4.24 lakh tonnes by 2000 AD.

The general behaviour of consumption on a per hectare basis is also similar. The average per annum growth in the consumption of all nutrients per hectare of cropped area was to the extent of 5 per cent.

Cost of Fertiliser Materials

Fertiliser alone consists of one of the major items of paid out cost in most of the crops. In paddy it is the second largest single item of cost comprising 10.76 per cent (1985-86) (Joseph, 1982). In banana fertiliser component alone consists of 21.83 per cent of total implicit costs (Indira Devi, 1983). The major plant nutrients are available as straight fertilisers, complexes and mixtures. There are any number of materials of each type. An analysis of the data for 1988-89 shows that of the total nitrogen consumed, 58.15 per cent is as straight fertilisers and the rest as complexes/mixtures. The corresponding figures for phosphorus and potash are 28.72 and 88.48 per cent, respectively (Table 3). A kilogram of nitrogen when purchased as straight fertiliser costs around Rs. 5.22 and as complex or mixtures around Rs. 15. Similar differences are there in the case of other nutrients also (Table 4).

It is seen that there is a difference of Rs. 314 to Rs. 704 per hectare depending upon the duration and variety of paddy, in the total cost of fertiliser between a combination of straight fertiliser and that of complexes/mixtures. In the case of coconut the difference is to the extent of Rs. 1.75 to Rs. 5 per palm per year, depending upon the variety and management practice (Table 5 and 6). Maximisation of production and cost reduction are the two methods to maximise the profit. In a situation where the farmer is a price taker latter proposition becomes more important. In the present state of consumption pattern of fertiliser materials in Kerala there is an annual loss of about Rs. 10 lakhs by way of use of complexes and mixtures instead of straight fertilisers⁴. So simultaneous to the propaganda for bringing more cultivated area under fertiliser use, the correct dosage as well as proper type of fertiliser materials to be used should also be given equal importance.

4. The total nitrogen, phosphorus and potash consumed as complexes/mixtures was obtained from Table 3. If these nutrients were applied as straight fertilisers like urea, super phosphate, and muriate of potash the cost would have been less by Rs. 10 lakhs.

Table 3. Materialwise fertiliser consumption during the year 1988-89 in Kerala State

(Quantity in tonnes)

Name of fertiliser	Total	N	P	K
Ammonium sulphate	13446	2770	—	—
Urea	95102	43747	—	—
Super Phosphate	3629	—	1381	—
Factomphos	116314	23263	23263	—
Muriate of potash	122113	—	—	73268
Diammonium phosphate	2176	392	1001	—
Mussurie Phosphate	61884	—	12377	—
Ammonium Chloride	552	138	—	—
Rock Phosphate	2863	—	859	—
Bone meal	10716	375	2143	—
17 : 17 : 17	49141	8354	8354	8354
10 : 25 : 26	2429	243	632	632
15 : 15 : 15	3466	520	520	520
16 : 20 : 0	1459	233	292	—
C A N	686	172	—	—
14 : 28 : 14	229	32	64	32
Total		80238	50884	82805

Source : Department of Agriculture, Government of Kerala.

Table 4. Cost of different nutrients when purchased as different fertiliser materials in Kerala 1990

(Rs./Kg.)

Fertiliser material	N	P	K
Urea	5.22	—	—
Ammonium sulphate	8.50	—	—
Super phosphate	—	5.44	—
Muriate of potash	—	—	2.22
Mussorie phos	—	3.73	—
Factomphos	14.80	11.90	—
17 : 17 : 17	15.65	15.65	15.65
10 : 5 : 20	19.00	38.00	9.50

Source: Department of Agriculture, Government of Kerala.

Table 5. Fertiliser cost per hectare of various crops, when different combination of fertiliser materials are used (Rs./ha).

	Combination I (Urea+ Superphosphate + Muriate of potash)	Combination II (Urea + Rock phosphate + Muriate of potash)	Combination III (Ammonium sulphate + Super + Muriate of potash)	Combination IV (Ammonium Sulphate + Rock phosphate + Muriate of potash)	Combination V (Factomphos + Muriate of potash)	Combination VI 17:17:17	Difference between Combination II & V
<i>A. Paddy</i>							
1. Local varieties	358.09	324.91	491.69	458.51	638.89	625.00	314.00
2. High yielding varieties							
a. Short duration varieties	633.04	572.35	863.24	802.52	1119.58	1096.00	548.00
b. Medium duration varieties	812.75	735.85	1109.75	1032.85	1439.69	1407.00	704.00
B. <i>Tapioca</i>	647.00	558.00	812.00	702.73	858.00	782.00	300.00
C. <i>Banana</i> (per plant)	2.60	2.29	3.10	2.81	3.64	2.70	1.35

* Based on the fertiliser recommendation by Kerala Agricultural University for the crops discussed above.

Table 6. The total cost of fertilisers for coconut when different combination of fertiliser materials are used, under varying management practices. (Rs. per palm per year)

	Combination I (Urea + super potash)	Combination II (Urea + Rock phos- phate + potash)	Combination III (Ammon- ium sulphate + super potash)	Combination IV (Ammo- nium sul- phate + rock phos- phate + potash)	Combination V 10 : 5 : 20	Difference of expendi- ture between combination V & II
I. General recommendation						
a. Ordinary Management	4.44	4.10	5.62	5.27	6.46	2.36
b. Good Management	6.78	6.24	8.63	8.09	9.50	3.26
II. High Yielding varieties and Hybrids						
a. Irrigated	12.75	11.91	15.85	15.01	19.00	7.09
b. Rainfed	6.78	6.24	8.63	8.09	9.50	3.26

Conclusions

During the sixties the fertiliser nutrient consumption in India was increasing at an annual compound rate of 20 per cent while in Kerala it was only 16.9 per cent. In the seventies the growth declined drastically in Kerala as well as in India. During the eighties there was an improvement in consumption of all nutrients in Kerala and the annual growth rate varied between 7.4 per cent and 10 per cent. This was above the national average. In the county as a whole the growth rate exhibited continuous decline from sixties till now. On an average during the period from 1960 to 1987 the growth rate in the consumption of N, P₂O₅ and K₂O in Kerala was of the order of 5.3, 5 and 7 per cent, respectively, with potassium consumption increasing at the fastest rate. The increase in nutrient consumption is more due to intensification of farming rather than an extension of area under cultivation. The gross cropped area in the State has not increased significantly except during the period 1965-70. There is, approximately, an annual loss of Rs. 10 lakhs by way of use of complexes and mixtures instead of straight fertilisers.

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