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Fertilizer Price Inflation: A Threat To The Green Revolution

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The Green Revolution has provided developing countries with new agricultural potential and increased their dependency on adequate supplies of reasonably priced fertilizers. In Karnataka, India fertilizer prices have doubled and shortages have been reported. Cooperatives have not expanded their crop production loans to meet rising cost of modern inputs.

FERTILIZER PRICE INFLATION: A THREAT TO THE GREEN REVOLUTION

No developing country illustrates the bleak consequences of the current petroleum crisis as does India. Rising prices and declining supplies of petrochemical fertilizers, insecticides, and pesticides may slow the Green Revolution of farm productivity. New high yielding varieties of wheat, sorghum, corn, and rice have required large amounts of fertilizers and pesticides, along with irrigation, to achieve dramatic yields and greatly improved food production in India. If agricultural production inputs are unavailable or too expensive for Indian farmers, they may plant traditional varieties of crops using older methods of cultivation rather than new, high yielding varieties. Consequently, aggregate food production may decline in the near future.

In India, large price increases for nitrogen fertilizer have created farmer resistance to the purchase of fertilizer. On June 1, 1974, nitrogenous fertilizer prices rose from 75 to 90 percent. Price increases were required to compensate fertilizer producers for increased costs of imported feedstock and to prevent financial losses for the Agriculture Ministry's Fertilizer Pool (Nitrogen, July-August 1974). Urea prices jumped to Rs. 2,000 ($253) per ton delivered and imported ammonium sulphate rose to Rs. 925 per ton ($130). Even though food prices have risen, fertilizer use on some crops may be uneconomic. Diversion of chemical fertilizer from food crops to cash crops can no longer be justified at 1974 prices. Moreover, there is evidence of a substantial shift in cultivation within the food crops from wheat and rice to gram, barley, ragi, and sorghum (Fertiliser News, Jan. 1975, p. 63). Cropping patterns could

change fundamentally and easily widen the gap between commercial and marginal sectors of Indian agriculture.

The prices of India's traditional exports - tea, sugar, peanuts and jute - have not risen in proportion to the cost of oil and fertilizers. In addition, large quantities of oilseed cakes, leather, spices and other commodity exports are earmarked for the Soviet Union or Eastern Europe under new barter and rupee trade agreements which do not earn foreign exchange. In 1974-75 the government has contracted for the import of 750 million dollars of fertilizer from all sources including rupee-payment countries and also supplies arranged under trade agreements (The Times of India).

The objectives of this paper are: (a) to present the reasons for the current fertilizer shortage in India, (b) to describe fertilizer price inflation in Karnataka State, (c) to explore the role of commercial and cooperative banks in providing farmers with crop production loans to meet the high cost of modern inputs required for the Green Revolution, and (d) to describe alternative sources of plant nutrients for agricultural production using examples from Karnataka State, India.

FERTILIZER SITUATION FOR ALL INDIA

Major developing countries have expanded their chemical fertilizer use by an average of 13 percent per year for the past five years. However, some countries have reduced their use of fertilizers due to the current high prices and shortages of fertilizer (Willett). India increased fertilizer consumption by only 3 percent in 1973-74 (Fertilizer Association of India, Fertiliser Statistics, p. I-84). Inflation in world petroleum and fertilizer prices have made the assumptions of food produc-

tion costs under the Fifth Five Year Plan (1974-79) obsolete.

Indian officials have expressed concern over the continuing low demand for chemical fertilizers, especially officials connected with individual state authorities. They fear a future reduction in their fertilizer allocations. The central fertilizer pool has suffered losses despite the large fertilizer price increases in 1974. Imported fertilizers normally prove to be the least profitable for the fertilizer pool. The handling of domestically-produced material normally compensates for this, but sales by the domestic producers have been well below expected levels so that the resulting boost to pool finances was much less than anticipated. A recent conference of state co-operative marketing federations in New Delhi expressed great concern over the reduced profitability of their activities and several firms considered withdrawing from fertilizer marketing. Reduced fertilizer use could be the result (Nitrogen, March-April, 1975, p. 13).

The fertilizer dilemma facing both the farmer and the Indian Government arose because the indigenous plants were only able to produce slightly over 50 percent of their capacity of about 2.4 million metric tons. Acute power shortages and labor problems were also responsible for reducing output to a little over 1.06 million tons in 1973. Compounding the difficulties has been the feedstock problem and plant obsolescence. Only about 25 percent of the coke oven gas needed for the Rourkela fertilizer unit was supplied from the cooperating steel complex. The high cost of naphtha or liquid ammonia for petroleum based plants continues to hinder fertilizer production. A major plant breakdown and floods also contributed to reduce fertilizer output. (Fertiliser Association of India, Annual Review, p. 15; Fertiliser News, January 1975; Phadnis).

FERTILIZER PRICES IN KARNATAKA STATE

During the 1973-74 crop production year, fertilizer prices in Karnataka State increased dramatically. Super phosphate and ammonium phosphate prices doubled; urea and ammonium nitrate prices rose over 80 percent; and other fertilizer prices increased more than 50 percent (Table 1). These price changes reflect both domestic and imported fertilizer prices.

Farm harvest prices in Karnataka increased substantially during the period of fertilizer price inflation (Table 2). Paddy prices rose from Rs. 77.76 per quintal (100 kilograms) in 1972-73 to Rs. 119.24 in 1973-74, an increase of 53.6 percent. Other farm level prices also increased during the same period as maize rose 20.6 percent, wheat 60.3 percent, and peanuts 32 percent.

The price of nitrogen per kilogram from urea, assuming 46 percent nitrogen, rose from Rs. 2.09 in 1972 to Rs. 4.26 in 1974, an increase of 104 percent. The factor-product price ratio rose to 3.58. Using ammonium sulphate as the source of nitrogen, the nitrogen paddy ratio remained stable at 3.76 in 1972 to 3.70 in 1974.

The fertilizer-paddy price ratios did not reflect the full cost of nitrogen use: Total costs of fertilizer associated with handling, transportation, and interest rates on production loans were not completely known. However, interest rates on crop production loans from cooperatives rose from 9 or 9.5 percent to 11 percent or more during the last two years. In addition, cooperatives as the farmers' major source of fertilizers were experiencing shortages, further complicating agricultural production problems.

Table 1. Fertilizer Prices in Bangalore District-Karnataka State, India 1970-74

Fertilizers	1970	1971	1972	1973 (up to May)	1974 (From June)	Percent Change 1973/74
	---------Rupees[a] per metric ton---------					--percent--
Ammonium Sulphate	540	560	560	590	925	57
Urea	904	959	959	1050	1960	87
Ammonium Nitrate	625	626	626	626	1145	83
Calcium Ammonium Nitrate	473	594	594	645	1145	78
Ammonium Phosphate	894	909	909	909	1855	104
Diammonium Phosphate	1217	1246	1246	1335	2120	59
Ammonium Chloride	539	539	594	594	1095	84
Muriate of Potash	518	534	543	670	1220	82
NPK - Mixture 15:15:15	912	942	942	942	1700	80
Super Phosphate	291	313	313	550	1100	100

[a]One rupee equals about $.13.

SOURCE: M.B. Nanjappa, Joint Director, Bureau of Economics and Statistics, Government of Karnataka, Bangalore, India, 1974.

Table 2. Farm Harvest Prices of Food and Non-food Crops in Karnataka State, India, 1969-74

Commodity	1969-70	1970-71	1971-72	1972-73	1973-74	Change 1972-73/ 1973-74
Food groups:	----------Rupees[a] per quintal[b]----------					Percent
Paddy	59.16	62.91	71.08	77.76	119.24	53
Jowar(Sorghum) - Kharif	61.23	71.16	73.11	99.32	114.55	15
Jowar - (Rabi)	72.14	84.90	86.84	123.56	135,20	9
Bajra	63.12	62.37	66.53	92.61	97.16	5
Maize	49.87	61.39	65.84	87.79	105.90	21
Ragi(Millet)	69.00	66.43	66.96	92.02	121.25	32
Wheat	100.96	107.97	105.13	139.46	223.57	60
Gram	112.52	93.45	102.87	173.48	209.28	21
Tur	104.86	97.45	120.11	145.97	148.66	2
Non-Food groups: Oil seeds						
Peanuts	131.96	137.81	116.23	182.52	241.05	32
Seasamum	210.86	197.28	207.40	255.67	329.83	29
Mustard	--	160.05	142.66	199.66	249.95	25
Linseed	156.25	143.54	142.96	179.69	305.45	70
Castor seed	97.93	97.93	117.04	181.60	230.67	27
Cotton	194.13	241.03	191.91	224.88	339.14	51

[a]One rupee equals about $.13.

[b]One quintal equals 100 kilograms or about 220 pounds.

SOURCE: M.B. Nanjappa, Joint Director, Bureau of Economics and Statistics, Government of Karnataka, Bangalore, India, 1974.

COOPERATIVES, COMMERCIAL BANKS AND AGRICULTURAL LOANS

Indian cooperatives are a fundamental part of the National Five Year Development Plan and one of the means by which state governments stimulate agricultural development. The Reserve Bank of India finances and subsidizes the agricultural cooperatives through a three-tier organization consisting of the state cooperative Apex banks, district cooperative central banks, and primary agricultural credit cooperative societies at the village level.

In 1972, fertilizer accounted for 82 percent of the value of inputs distributed to farmers by cooperatives in Karnataka State. Seeds made up 9 percent of the value of inputs distributed; pesticides accounted for 1 percent; agricultural implements about 1 percent; and other imputs made up the remaining 7 percent of the value of inputs distributed by cooperatives (Table 3).

Cooperatives finance the farmer's seasonal agricultural operations through the crop loan system. Part of the loan is in cash and part in kind, usually fertilizer and pesticides. In 1972, for example, if a farmer in Bangalore District applied for a loan to finance an acre of high yielding variety of paddy (rice), the local cooperative would approve a loan totaling Rs. 500 and consisting of Rs. 170 in cash, Rs. 280 for fertilizer and Rs. 50 for pesticides (Gururaja Rao). The cash component covers the cost of hired labor and other production expenses. Loan limits for other crops are adjusted to estimated production costs on a per crop per acre basis annually during the field workers conference. The conference consists of representatives of the district cooperative central bank, extension officials, and prominent farmers.

Table 3. Multipurpose Co-operative and Primary Agricultural Credit Societies, South India - 1971-72

State	Number of societies	Membership	Paid-up Capital	Deposit	Loan Advanced	No. of societies undertaking distribution	Value of Inputs Distributed					
							Seeds	Fertilisers	Pesticides	Agril. Implements	Other	Total
		(1,000)	(1,000 Rs.)				(1,000 Rs.)					
Andhra Pradesh	15,054	2,299	105,472	36,661	272,918	289	495	16,304	531	451	2,093	19,874
Karnataka	8,474	1,873	155,035	37,155	443,249	4,000	11,593	107,702	2,386	1,478	8,145	131,304
Kerala	2,084	1,794	111,931	107,156	362,544	1,239	306	68,946	2,718	208	16,220	88,398
Tamil Nadu	5,562	3,351	169,173	48,832	608,091	2,345	281	123,039	3,043	130	--	126,493
Pondicherry	68	16	1,479	65	6,280	59	--	4,613	3	--	--	4,616
Laccadives	5	1	88	40	324	--	--	--	--	--	--	--
South Total	31,247	9,334	543,178	229,909	1,693,406	7,932	12,675	320,604	8,681	2,267	26,458	370,685

SOURCE: Reserve Bank of India, Statistical Statements Relating to the Cooperative Movement in India - 1971-72 Part I, Credit Societies. Contained in Fertiliser Statistics 1973-74, (New Delhi: Fertiliser Association of India, December 1974), p. II-36.

In Karnataka, the "targeted" increase in cooperatives' crop production loans in 1975 is about 11 percent, from Rs. 450 million in 1974 to Rs. 500 million (Fertiliser Association of India, Fertiliser Statistics, p. II-37). This increase includes provisions for both cash and kind components of crop production loans. Other costs of production such as labor and pesticides have risen sharply. Since part of the increase in production loans would have to be allocated to wages, only a small percentage of farmers' production loans would be allocated for increased cost of fertilizer.

In 1970, nationalized commercial banks introduced a program of financing primary agricultural credit cooperatives in seven districts of Karnataka State. Since inception of the program commercial banks have increased the average loan per cooperative society from Rs. 27,000 during the fall of 1970 to Rs. 75,000 in 1974. The average loan per cooperative in 1974 was up 7 percent from 1973 (Registrar of Cooperative Societies). During the same period, however, farmers' production expenses increased at a much faster rate than their production loans. Consequently, the capability of the farmer to buy fertilizer on credit and for the dealer to stock it in advance of the season has been severely limited (Fertiliser News, Jan. 1975).

ALTERNATIVE SOURCE OF PLANT NUTRIENTS

As Indian agriculture faces limited fertilizer availability during the next decade, alternate sources of plant nutrients assume tremendous importance. Bacterial fertilization, organic manuring, composting, and recycling of wastes are practical sources of additional nitrogen and other plant nutrients. Current research on the biological fixation of nitrogen

(seed inoculant approach) indicates that it could increase crop yields and reduce reliance on purchased farm inputs but commercial development may take five to ten years (Hughes and Pearson; Organic Gardening and Farming, June 1975, p. 34). However, organic manuring offers immediate possibilities of increasing the supply of plant nutrients.

Farmers in Karnataka State as well as in other parts of India utilize animal manure, urban compost and green cover crops on a regular basis as a useful supplement to commercially produced chemical fertilizers. The Ministry of Agriculture and Irrigation estimated the amount of rural compost produced in Karnataka State was 7.3 million tons in 1974, an increase of 17 percent over 1973. Urban compost production rose to 5.6 million tons, in 1973 an increase of 86 percent over the previous year (Fertiliser Association of India, Fertiliser Statistics, p. I-154).

The Intensive Agricultural District Programme (I.A.D.P.) has recommended organic manures as part of its package of practices for the farmers growing paddy, ragi and millets since 1962. The eight practices included in the package were: (1) organic manure, (2) improved varieties of seed, (3) recommended seed rates, (4) planting seedlings, (5) line planting, (6) chemical fertilizers, (7) plant protection, and (8) use of rotary weeder. In 1970 Channe Gowda and Jalihal found that of 150 paddy farmers in Mandya District, Karnataka, only 38.7 percent had adopted a combination of three practices which were known to be effective and compatible. Of the farmers adopting a combination of three practices, 20.7 percent had adopted organic manure, improved seeds, and planting young seedlings. The other most commonly used practices were recommended seed rates and line planting (Channe Gowda and Jalihal, p. 278).

Unpublished survey data from 136 farmers in three districts of Karnataka State (including Mandya District) indicates that organic manure was a

major cost item in crop production. On the average, organic manures accounted for 20 percent of the cost of purchased inputs for paddy, sorghum, sugar cane, and peanuts. Organic manure accounted for about 34 percent of the cost of purchased inputs for ragi (millet), hired labor made up about 45 percent, and chemical fertilizer about 20 percent of production costs (Ames and Brown).

Indian officials recognize that organic manure will only marginally meet the needs of plant nutrients required to maintain and increase agricultural output. Fertilizer consumption in Karnataka is the lowest of all states in South India, about 18 kilograms per hectare (Fertiliser Association of India, Fertiliser Statistics, p. I-74). In addition, the average yield of principal crops in Karnataka has not increased substantially in the 1970s except in a few districts selected for the I.A.D.P. or other special projects (Table 4). Consequently, high fertilizer prices may lead to a discontinuance of several recommended practices associated with the Green Revolution.

SUMMARY

The fertilizer dilemma facing the Indian farmer has its origins in the limited domestic production, shortages of raw materials, high cost of naphtha and liquid ammonia, labor unrest, and the high cost of imported materials. Until early 1974, the States subsidized farmers' fertilizer purchases, but subsidies were eliminated and prices rose an average of 80 percent. State cooperative marketing federations suffered financial losses as farmers reduced their fertilizer purchases. These factors contributed to the confusing situation where fertilizer stocks accumulated at the factories and distributors while some fertilizers such as urea continued in

Table 4. Average Yield of Principal Crops, Karnataka State, 1970-74

Crop	1970	1971	1972	1973	1974[1]
	quintals[2] per hectare[3]				
Paddy (rice)	18.60	17.08	17.98	16.31	18.12
Jowar (sorghum)	6.54	7.03	6.25	5.84	7.66
Ragi	8.38	8.38	10.03	8.86	8.76
Maize	32.23	34.43	32.95	31.85	30.08
Bajra	5.16	3.75	3.13	3.01	4.79
Wheat	4.28	3.79	7.80	3.87	5.43
Groundnut	6.12	7.59	7.45	6.46	7.04
Sugar cane (metric tons) (for factory)	-	78.06	86.38	86.98	83.91

[1]Final forecast.

[2]One quintal equals 100 (kilograms or about 200 pounds).

[3]One hectare equals 2.47 acres.

SOURCE: M.B. Nanjappa, Joint Director, Bureau of Economics and Statistics, Government of Karnataka, Bangalore, India, 1974.

short supply.

Agricultural cooperatives face a critical situation in their crop production loan system. Cooperatives need more money to cover farmers increased production costs. However, they have had limited success in expanding crop production loans even with the contribution of nationalized commercial banks. Ultimately farmers have reduced their applications of some fertilizers due to high costs and the lack of adequate finance. The situation could conceivably result in the loss of agricultural output as farmers shift production from food crops like wheat and rice to gram, barley, sorghum and ragi which do not require large applications of expensive fertilizer.

Prime Minister Indira Gandhi has responded to the fertilizer dilemma by asking farmers to economize on fertilizer applications and to utilize organic manure as a source of plant nutrients. Compost can never replace the large amounts of nutrients required to sustain the Green Revolution; however, compost production and utilization can make a contribution to the total resource package available for agricultural production.

There are two important long-run considerations for Indian policy makers. The first is that the real dilemma for the Green Revolution may be problems associated with the supply of irrigation water at critical periods of crop growth, and timely availability of inputs. This may require more emphasis on underlying factors contributing to fertilizer-crop responsiveness. The second consideration focuses on fertilizer saving technologies and practices such as composting, green manuring, and the biological fixation of nitrogen. If present fertilizer and oil price trends continue, research on building humus content of the soil, rotating crops and improving effectiveness of bacterial nitrogen may substitute for practices highly dependent on chemical fertilizers.

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FOOTNOTES

[1]Organic manure is a general term that includes urban and rural compost and farmyard manure. Farmers purchase bullock car loads of urban compost, usually decomposed urban garbage, and spread it on their fields before planting. The exact chemical composition of organic manure was unknown. The average composition of some organic manure indicates that a range of 1.2 to 2 percent nitrogen was possible from a ton of urban compost (Fertiliser Association of India, Fertiliser Statistics, p. I-141).