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POTATO MARKETING IN INDIA: Status, Issues, and Outlook

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Status, Issues, and Outlook**

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Abbreviations and Terms

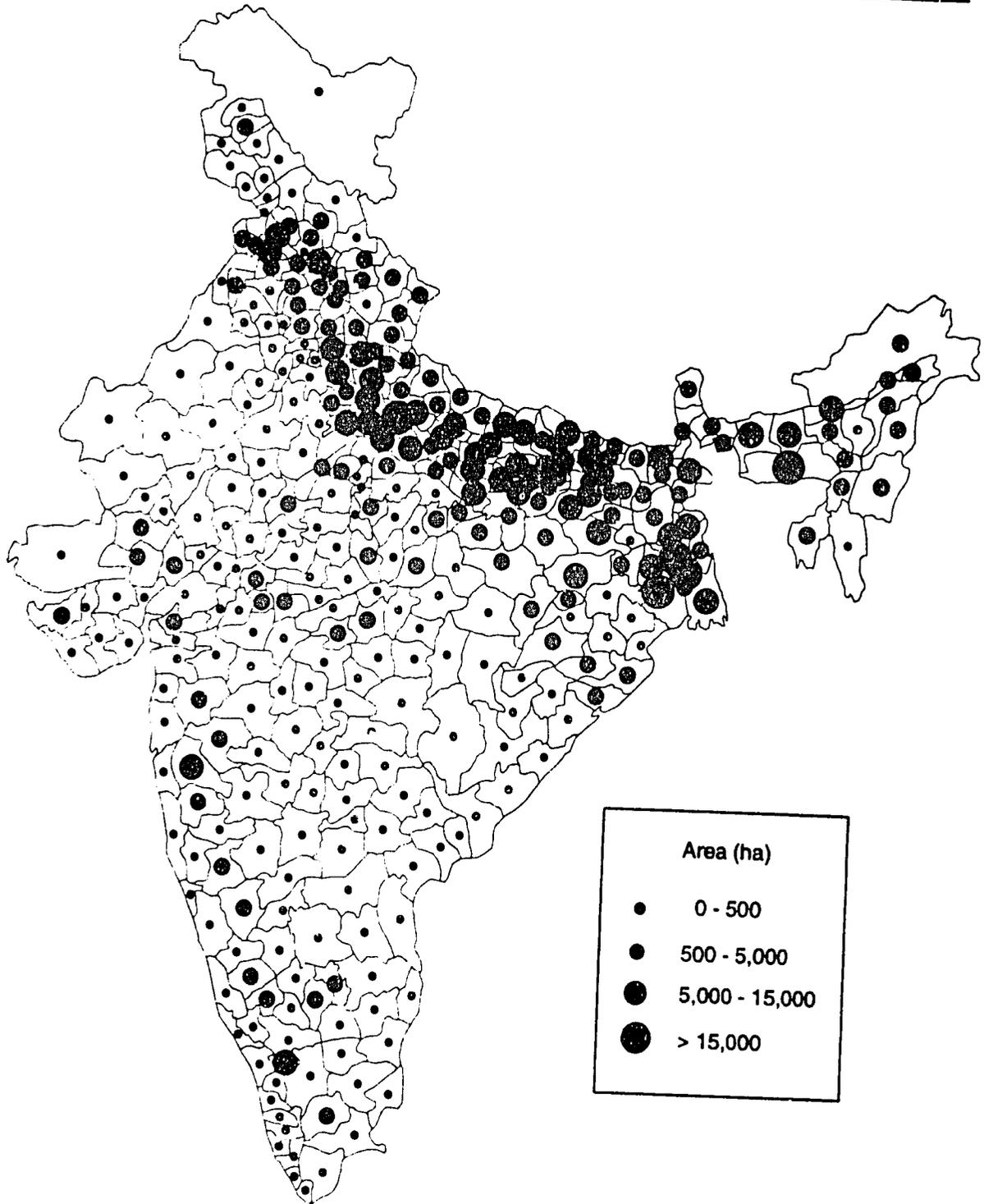
APC	Agricultural Prices Commission
CPRI	Central Potato Research Institute, Shimla
DES	Directorate of Economics and Statistics, Ministry of Agriculture
DMI	Directorate of Marketing and Inspection, Ministry of Rural Development
ha	hectares
HP	Himachal Pradesh
km	kilometer
NAFED	National Agricultural Co-operative Marketing Federation of India Limited
NSSO	National Sample Survey Organization
rupees	conversion rate: \$US1 = Rs 31.85 (Jan. - Apr. 1994); Rs 31.90 (May 1994)
tons or t	tonnes & metric tonnes
UP	Uttar Pradesh
100 kg	1 quintal
10 million	1 crore
100,000	1 lakh

Potato Marketing in India: Status, Issues, and Outlook

Abstract

Potato figures among the principal cash crops in India and its marketing plays an important role in the farm economies of growers of all scales. This paper describes the current status of potato marketing in India including infrastructure, market structure, price analysis, use, imports and exports, and price support policy. Marketing and research conducted at the Central Potato Research Institute, Shimla, and experiences gained are also presented. These include a comprehensive farm-level study of Farrukhabad District, Uttar Pradesh; the dynamics of seed potato marketing in Himachal Pradesh; price forecasting; a study of cold storage in Meerut District, Uttar Pradesh; and outlook surveys. Issues that merit future attention are: improvement of crop statistics; studies on consumer behavior, including the estimation of income elasticities of demand; assessment of marketing of seed potatoes and processed products; and techno-economic feasibility of potato exports.

Map 1. Area planted in potato in India by district, 1988-89.



Source: Agricultural Situation in India.

Introduction

Potato is one of the main commercial crops in India. Although in 1980-81 potato was only 0.4% (.73 million ha) of the total cropped area, it contributed a handsome Rs. 7,870 million to the national economy in that year. In 1989-90, at current prices, its monetary contribution increased to Rs. 19,140 million (Govt. of India statistics 1992a). By 1992-93, area planted in potato had risen to over 1 million ha and 0.6% of total cropped area.

Potato is cultivated in 23 Indian States. Uttar Pradesh (UP) accounts for over 36% of aggregate output (15.25 million t in 1990-91), followed by West Bengal (29%), and Bihar (10%). The Indo-Gangetic region—Uttar Pradesh, West Bengal, Bihar, Punjab, and Haryana—accounted for 78% of area and 86% of production in 1990-91. The map on the facing page gives an overview of area planted to potato throughout India.

Nearly 82% of potato is grown on the plains under irrigation during the winter, with 10% in the hills during summer, and 8% on the plateaus of southeastern, central, and peninsular India, generally as a rainfed crop during the rainy season and as an irrigated crop in winter (Shekhawat, Grewal, and Verma 1992).

This paper discusses the status of potato marketing in India including infrastructure, market structure, and price analysis; price spread and marketing channels; use; imports and exports; and price support policy. Marketing research conducted at the Central Potato Research Institute (CPRI), Shimla, including methods, results, and experiences, is presented. The emerging issues and outlook complete this paper.

The Changing Research and Development Scene

Since 1958, 26 high-yielding varieties have been released for different Indian agro-climatic regions. Three additional changes have led to an increased supply of quality seed to growers: a national seed potato production program streamlined in 1966, development of the Seed Plot Technique in the 1960s for raising disease-free, healthy seed potato in the subtropical areas of the Indo-Gangetic region, and steady growth in the cold storage network.

The growth rate of potato over the last four decades surpassed the principal cereals—rice and wheat—for all years, except from 1967-68 to 1988-89 when wheat yield recorded a slightly higher growth rate. Area planted in potato nearly doubled from 500,000 ha in 1967-68 to 940,000 ha in 1990-91. Production surged from 4.23 million t to 15.25 million t, a 260% increase during the same period. This reflects a yield increase of from 8.44 t/ha (1967-68) to 16.23 t/ha (1990-91), and a production increase of 92%. Overcoming this major production constraint has focused attention on problems in marketing and use of potato (Dahiya and Sharma 1980).

Farmers cultivating potatoes belong to all sizes and classes of farms (Gupta et al 1989). A recent survey in Farrukhabad District found that the sample of potato growers consisted of 46% marginal farmers (holdings of less than 1 ha), 25% small farmers (holdings of between 1-2 ha), 28% medium farmers (holdings of 2-10 ha), and less than 1% large farmers (holdings more than 10 ha). Dahiya (1990) reported that there were 60,881 potato-growing holdings in Himachal Pradesh in 1980-81, of which the marginal and small holdings shared 62%, medium 36%, and large 2%.

National Agricultural Marketing Framework

In India, the agricultural marketing system largely operates under the forces of supply and demand. Trade is mainly in the hands of private enterprise, with governmental intervention mainly limited to protecting the interests of producers and consumers and to promoting organized marketing of agricultural commodities (Govt. of India, 1992b).

The Directorate of Economics and Statistics, Ministry of Agriculture, reports annual crop area and production estimates, as well as reporting market arrivals, prices, etc. The Directorate of Marketing and Inspection (DMI), Ministry of Rural Development, conducts research on the marketing system of the principal farm commodities and enforces the Cold Storage Order of 1980. It published reports on potato marketing in India in 1941, 1956, 1967, and 1984; and one report on price spread and marketing channels in 1984. The National Horticulture Board, under the Ministry of Agriculture, reviews research and development in horticultural crops, including potato, and also collects market information for these crops at the national level. The National Agricultural Co-operative Marketing Federation of India Limited (NAFED) is the central body dealing with procurement, distribution, and export and import of selected agricultural commodities. For potato, it is the nodal agency, in cooperation with state agencies, for implementing market intervention schemes.

At the state level, State Agricultural Marketing Boards and Directorates of Agricultural Marketing develop and regulate markets in the organized sector, and collect and disseminate market information under the Agricultural Produce Markets (Regulation) Acts. State Cooperative Marketing Federations implement market intervention schemes, while seed certification agencies certify potato in Bihar, Haryana, Himachal Pradesh, Karnataka, Punjab, Tamil Nadu, Uttar Pradesh, and West Bengal (Shekhawat et al 1992).

Cooperative marketing societies and commission agents play important roles in potato marketing in India. Cold storage owners associations have been set up in Haryana, Uttar Pradesh, Bihar, West Bengal, Gujarat, and elsewhere, and this cold storage network plays a pivotal role in potato marketing. A few processing plants set up near urban centers, such as Delhi and Ludhiana, promote marketing of value-added potato products. Finally, retailers complete most marketing channels and sell both fresh and stored potatoes.

Storage and Transport

Potatoes are mostly produced during the winter season from November to March, but are consumed year round. Therefore, storage plays an important role in the creation of time and place utilities. Traditional storage methods include the sand method, pit storage, platform (*machan*) storage, and storage on bamboo chips or wooden planks. With a view to regulating the development of the cold storage industry, the Indian government promulgated the Cold Storage Order in 1964 (replaced by the Order of 1980) under Section 3 of the Essential Commodities Act of 1955. West Bengal and Uttar Pradesh States enacted their own legislation in 1966 and 1976, and Punjab and Haryana announced their legislation in 1979.

Until the late 1950s the growth of cold storage capacity was slow, therefore, the Third Five Year Plan (1961-62 to 1965-66) provided an incentives package for industry development. As a result, cold stores increased to 1,091 with a capacity of about 1.5 million t by the end of 1969. By the end of 1989, this had increased to 2,797 stores with a capacity of more than 6.8 million t. Nearly 85% of the cold stores with 92% of the total capacity are located in potato-growing states. The private sector owns 85% of the cold stores with a capacity of

88%, the remainder are in the public and cooperative sectors. Currently, the cold storage capacity of 6.8 million t—of which 6.1 million t is exclusively for potatoes—is inadequate. An additional 1.8 million t capacity is scheduled for completion by the end of the Eighth Five Year Plan in 1997. The cost is estimated at Rs. 4.32 billion (432 crores) (Bhatnagar 1990). Presently, only about 41% of potatoes produced in India have access to cold storage. Singh (1974) estimated that about 50-60% of aggregate potato production needs cold storage, therefore, the country is 20% below optimum capacity.

Cold storage available for total potato output in the Indo-Gangetic region has increased from 37% in 1979-80 to 42% in 1989-90 (Table 1). The West Bengal situation has remained static. Bihar reported a drop in storage capacity for potatoes from 31% to 25% during the study period. Punjab and Haryana have more than optimum storage capacity, probably because the aggregate potato output has gone down over the last decade.

Studies have been made of cold storage use patterns. Rangaswamy et al. (1981) showed that all categories of farmers in Hoshiarpur District (Punjab) used cold storage facilities. However, the proportion of use decreased as farm size increased: large holders' share was 73%, medium 19%, and small 8%. Chatha and Sidhu (1980) estimated that only 32.5% of farmers in the Punjab used cold storage facilities and most were accessed by farmers with large holdings. Cold storing potatoes resulted in net profits of Rs 0.79 (1978) to Rs. 15 (1973) per 100 kg, except 1974 when a loss of Rs. 2.12 per 100 kg was recorded.

A recent study (Kainth 1989) in Amritsar District (Punjab) revealed that potato storage netted a gain of Rs. 24 per 100 kg. Though 15% of farmers in Amritsar and 30% elsewhere could store potatoes, the majority of farmers could not use cold storage facilities because of their weak financial position, price uncertainty, and the risk of damage to potatoes in stores.

In Uttar Pradesh, Singh and Verma (1979) reported that about 80% of the cold storage capacity is used by either traders or farmers of large holdings. Small holders are hardly able

Table 1. Production, storage available, and capacity (%) for storing potatoes during 1979-80 and 1989-90 by state.

State	1979-80			1989-90		
	Potato Production (000 t)	Cold storage available (000 t) for potatoes	Output stored in a year (%)	Potato Production (000 t)	Cold storage available (000 t) for potatoes	Output stored in the year (%)
Uttar Pradesh	3,163	1,080	34.1	6,228	2,724	43.7
West Bengal	1,995	743	37.3	4,532	1,708	37.7
Bihar	1,032	319	30.9	1,458	367	25.2
Punjab	679	341	50.2	363 ¹	391	107.8 ¹
Haryana	187	131	70.3	142 ¹	170	119.8 ¹
Indo-Gangetic Region	7,056	2,615	37.1	12,723	5,360	42.1
All India ²	8,327	3,013	36.2	14,771	6,114	41.4

90% of the cold storage capacity is taken to be available for storing potatoes. Ideally 60% of potato production should have facilities for cold storage.

¹Probably more than 10% of the cold storage capacity is used for storing other semi-perishable products in these states. The area under potato in the Punjab was reduced from 37.6 to 18.5 thousand ha from 1979-80 to 1989-90. During the same period, potato area in Haryana decreased from 11.4 to 8.7 thousand ha.

to put potatoes in cold storage because of their limited capacity to bear the costs and risks associated with storing potatoes. In West Bengal, Sen (1984) found that cold stores benefitted middlemen and traders in manipulating prices in the lean months of the year, which resulted in intermediaries generally getting higher returns per 100 kg than producers. The National Commission on Agriculture (1976) pointed out malpractices: charging exorbitant storage rates and fictitiously booking space to create the impression of an artificial glut, thus forcing growers to part with their produce at an unremunerative price. Later in this paper, interstate variations in cold storage rates are discussed.

Different types of transport move potato in India. Manual labor and pack animals are the principal modes of transport in the hilly areas of West Bengal and in Himachal Pradesh. People there carry potatoes in *Kiltas* (a typical bamboo basket) on their backs, while in the plains bullock carts are the principal mode of potato transport from the village to the primary market center. In coastal areas, large quantities of potato are transported by steamer or country boat. Inland waterways handle a fair share of the potato trade in West Bengal and Assam.

Railways haul potato over long distances and trucks are a common mode of transport. DMI (1984) reported that though trucks on roadways are used, railroads continue to be important to transport potato from producing to consuming areas. A study by Bhaskar Neel (1980) showed that 12,500 railway cars (wagons) should have been replaced annually. However, he reported that an average of only 10,400 cars (wagons) were replaced annually between 1974 and 1979. Because many commodities including potatoes are transported by railways, this declining freight capacity is disturbing. Also, potato transport is accorded the low "C class" priority which impedes the speedy movement of potato. Air-cooled or refrigerated cars are simply not available.

Market Structure and Price Analysis

Chatha and Sidhu (1980) found that potato farmers in the Punjab sold some 73% of what they harvested, although Singh and Sidhu (1973) had earlier found that in 1970-71 it was as high as 95%. This decrease may have been due to the shift in acreage from spring to autumn crops. Spring crops may allow a larger percentage of potato sales because seed needs for the spring crop are able to be met from the hilly areas, mainly in Himachal Pradesh. From 1972-73 to 1978-79, the seasonal price index dropped to its lowest point in January, stabilized by June, and reached its peak of 129.70 in October. The index remained below average from June to November. Arrivals and prices were negatively correlated ($r = -0.7655$).

In the case of Himachal Pradesh, the major share of seed potato marketing is handled by traders. Mathur (1977) observed that the cooperatives handled only 20-30% of the trade. Raghuvanshi and Tiwari (1974) had observed a similar situation earlier, when they found that the price spread was about 40-50% with no corresponding economic contribution made by the traders. Later research by Dahiya et al (1990) found that the Manali market was competitive. The cooperative organization (L.P.S.) accounted for 75% of the market share; but the Shimla market was oligopolistic, since the nine commission agents (having formed the Shimla Potato Merchants Association) accounted for 82% of arrivals and sales in the market. The Shimla and Theog markets (only 30 km away) were not integrated and competitive both for KJ₁ and KJ₂ grades of Kufri Joyti of truthfully labelled seed potato over the entire marketing season. The lack of market integration could be attributed to lack of market intelligence, indebtedness of the producers to local traders, disposal of small quantities of produce by small and marginal farmers, infrastructure bottlenecks, etc.

Deen (1977) found that 95% of the produce was sold in the market and only small holders sold in the villages in Farrukhabad, UP. Over 75% of produce was sold between December and March. Diwakar and Murlidharan (1980) studied the spatial and temporal pricing efficiency of Farrukhabad, Meerut, Kanpur, and Mettupalayam markets for the period of 1958-73. These markets were integrated within the region, but no integration of the Mettupalayam market with the selected producing markets was found. On the basis of Bain's classification of the market structure (Bain 1956), Farrukhabad market came under slightly concentrated oligopoly in all the years, because the top four commission agents handled 32%, 35%, 35%, and 29% of the total sales for 1973 through 1976. Diwakar (1990) found the potato market to be far from perfectly competitive.

Price Spread and Marketing Channels

In the Varanasi market in Uttar Pradesh, Shukla (1968) reported that the producer's share was 77% and that the price spread could be further reduced by linking farmers' cooperatives with marketing cooperatives. Pandey and Prasad (1972) observed that the price spread was high due to the following factors.

- poor transport facilities in rural areas
- no grading of agricultural produce
- lack of adequate storage facilities
- many middlemen
- high assembling charges
- marketing malpractices

Singh and Verma (1979) observed that in Unnao, UP, the farmer's share in the consumer rupee was lower than in the Varanasi market, with the producer receiving 65% of the consumer price. They suggest that inadequate cold storage, an acute shortage of wagons and trucks, and an unhelpful attitude of the Uttar Pradesh Cooperative Marketing Federation were the major factors contributing to the higher price spread. Diwakar and Murlidharan (1981) identified 11 marketing channels in the Farrukhabad District. The producer's share ranged from 51% to 75% depending upon the channel. Producer's profits were highest when the potatoes were sold directly to the secondary market from cold storage, and lowest when sold to the village trader (*bania*). The marketing costs of the farmers and intermediaries varied between 1.5% and 18% of the consumer price in the various channels. Farmers bore higher per 100 kg marketing costs than intermediaries, with small holders receiving a relatively smaller share compared to medium and large holders. In Burdwan District, West Bengal, two potato marketing channels were predominant in the 1980s: (1) producer-wholesaler-retailer-consumer and (2) producer-cold storage-wholesaler-retailer-consumer. This system was considered inefficient in view of "excessive profits for middlemen". Traders used the cold storage facilities which further reduced the producer's share from 80% to 50% (Baksi and Banerjee 1983). DMI (1984) also studied the price spread in three marketing channels in West Bengal. These were (1) producer-commission agent-retailer-consumer, (2) producer-cold storage-commission agent-wholesaler-retailer-consumer, and (3) producer-commission agent-wholesaler-retailer-consumer. The producer received the highest share of 80% and 81% in the first two market situations in the first channel versus only 44% in Darjeeling District and 63% in Calcutta in the other two market situations in the third channel. This indicates that the producer is benefitted only when the price spread is narrowed down.

In Himachal Pradesh although there are six marketing channels for potatoes, 80% of the marketed surplus sold in Shimla is marketed through the producer-depot holder-commission

agent (local market)-commission agent (consuming market)-consumer channel (Agro-Economic Centre, Himachal Pradesh 1981).

For Lahaul growers, the producer-cooperative society-commission agent (consuming market)-consumer channel is popular. In Manali, producers received 65% of the consumer price, when potatoes were marketed through the cooperative society, and 64% when the sale was through private traders. In Shimla, the producer received only 54% of the price consumers paid in the Shimla market.

At the All India level, the DMI study (1984) showed that producer's net average share was 59% of the consumer price. Marketing costs averaged about 19% and the marketing margin 22% of the consumer price. In Bihar and Gujarat, costs and margins had gone up considerably, thus reducing the producer's share. In the case of Bihar, the average share of producer's net return was only 42% in 1980 compared to 74% in 1967; while in the case of Gujarat, the respective producer's shares were 55% and 70% in these years. This is partly attributed to an increase in cold storage charges. Several measures suggested to increase the farmer's share are strict market regulation, better rail transportation, an increasing role of cooperatives, exports, and potato processing.

The price spread consists of costs and margins. Costs are divided between producers, intermediaries, and retailers. Producers bear the cost of transport from farm or village to market, packing charges, toll tax (if any), labor for loading and unloading, commission (sometimes deducted illegally), and any other unauthorized charges deducted by wholesalers and commission agents. Wholesalers bear the cost of packing (sacks, sewing, etc.), labor for loading and unloading, commissions paid to agents, charities and incidentals, and warehousing. Retailers bear the cost of commissions, transport from the wholesaler to the shop, loading and unloading, and wastage/retailing losses.

The producer's share is shown as net share in the price paid by the consumer (Table 2). But this is not pure profit as such. In order to work out the "pure profit or net returns" for the producer, we have to subtract the cost of production incurred by him in producing the commodity.

Table 2. Price spreads in potato in Uttar Pradesh, West Bengal, and all India (1968-84).

Area/Reference	Producer		Wholesaler		Retailer	
	share %	cost %	share % ¹	cost %	share %	cost %
Uttar Pradesh						
- Shukla (1968)	77.4	8.5	4.9	.5	5.6	3.1
- Pandey & Prasad (1972)	77.9	8.8	4.3	-	9.0	-
- Singh & Verma (1979)	65.0	12.8	4.4	6.7	6.1	5.0
West Bengal						
- Baksi & Banerjee (1983)						
Channel 1	80.0	5.8	10.7	3.5	-	-
Channel 2	50.0	3.6	24.5	21.9	-	-
All India						
- DMI (1984)	59.3	-	22.2	18.6 ²	-	-

¹ = not reported.

² Average marketing margin for all intermediaries in the channel.

² Average marketing cost for all intermediaries in the channel.

For the wholesaler also, the margin and costs have been shown separately and for the wholesaler it is his "net or pure profit". The items of cost for producers, wholesalers, and retailers have been explained in detail above.

Use Patterns and Trends

Potato is used for fresh food, processed products for human consumption, starch and alcohol production, seed, and animal feed. In India, however, potato is exclusively used for human consumption, Singh (1972).

The National Sample Survey Organization (NSSO) in its 17th Round (1961-62) estimated that the per capita annual consumption of potatoes was 9 kg in urban areas and 7.7 kg in rural areas. In its 1967 research report, DMI reported that production could be divided as: food 77%, seed 14%, wastage 8%, exports 0.3%, and processing 0.1%. The Indian Institute of Foreign Trade investigated potato disposal and export in 1968. It reported that potatoes were mainly processed to meet the defense requirements and that 4.5 million cans were produced. In NSSO's 28th Round in 1973-74, they found that urban per capita consumption had risen from 9 to 10.2 kg and rural consumption from 7.7 to 8.4 kg.

Srivastava and Kishore (1979) found that the per capita monthly consumption of potatoes in working class families had increased 25% from 0.77 kg (1958-59) to 0.96 kg (1970-71). However, the number of families consuming potatoes remained static at 87%. Dahiya and Sharma (1980) reported that per capita consumption had gone up from 2.7 kg (1952-53) to 9.9 kg (1978-79) with a compounded growth rate of 5% annually. Tewari (1977) reported that annual consumption of potato would go up to 26 kg by the year 2000.

Compared with its 1967 report, DMI reported in 1984 that use patterns had changed (DMI 1984). The bulk of potato was for food at 63% down from 77%, seed was up 6% to 20%, and wastage more than doubled to 17%, the same 0.3% were exported, and processing was lower at 0.03%, as a percentage of increased potato production in the country.

Potato processing has gained momentum, Verma (1991) cited several studies showing this progress. The capacity for processing potatoes in the organized sector is 25,000 t/year (Kankan 1986). Naik-Kurade (1986) reported that 2,000 t/year of potatoes are canned or dehydrated for the armed forces, and six potato chip production plants and two french fry plants have been set up. Goenka (1990) reported the capacity for potato chip production in the organized sector to be 6,000 t/yr. He found five potato chip brands in the market, including one multinational: Uncle Chipps, Binnies, Ruffles, Aloo, and Wonder, plus potato wafers and Frenz (potato fingers). These are commonly sold in urban areas, but can also be found in rural areas. Although these products are demanded by the urban middle class—now estimated to be some 50 million consumers—they continue to be beyond the reach of most. However, according to Verma (1991), the prospects for using potato as an industrial raw material appear to be limited at present as cheaper alternative raw materials for the production of starch, such as maize and tapioca, are available.

Imports and Exports

Prior to World War II, potato was imported, mainly as seed, from Burma, Italy, the Netherlands, and the United Kingdom (Shekhawat et al. 1992). DMI (1956) also reported that potato was imported from Kenya. And in their 1967 report, DMI attributed 99% of the

total imports from 1956-57 to 1960-61 to be seed potato from Burma. This was almost a total shift away from European imports.

NAFED (1983) reported that up to 1973-74 potato exports were insignificant. In those years, 80-98% of exports were to Nepal. Other export markets for Indian potato were the Bahrain Islands, Dubai, Iran, Kuwait, the Maldiv Islands, and Seychelles. Dahiya and Sharma (1980) observed that in 1974 only 1.3% of the world's total potato production was exported and this trade was mainly confined to Europe. From 1962-76, India's share in world potato exports had been equal to or less than .1%, except for four years: 1962, .34%; 1963, .60%; 1975, .32%, and 1976, .92%. It is clear that potato exports as a percent of total potato production in India have been marginal and highly variable ranging from .01% in 1967-68 and 1970-71 to .44% in 1962-63 and .49% in 1963-64 (see Table 3). This also holds true if we consider the percentage of all of India's exports in relation to world exports. Exports were highly variable from year to year.

NAFED entered export trade in 1974-75. The next year, India had a bumper crop and prices crashed. That same year, the European crop was devastated by a severe late blight attack. NAFED and other exporters succeeded in exporting 29,828 t valued at Rs. 348 million (3.48 crores) to continental Europe and the United Kingdom. In the following year, 1976-77, potato exports peaked to a record 44,671 t valued at Rs. 585 million (5.85 crores). Exports

Table 3. Trends in potato production and exports from India for selected years from 1961-62 to 1989-90.

Year	Production (million t)	Exports (t)	Exports as % of total production	Value of Exports (100,000 Rs.)	Average export price (Rs./t)
1961-62	2.4	7,052	.29	-	-
1962-63	3.4	14,719	.44	-	-
1963-64	2.6	12,552	.49	-	-
1964-65	3.6	775	.02	-	-
1965-66	4.1	2,173	.05	-	-
1966-67	3.5	988	.03	-	-
1967-68	4.2	547	.01	-	-
1968-69	4.7	2,043	.04	-	-
1969-70	3.9	2,515	.06	-	-
1970-71	4.8	710	.01	-	-
1971-72	4.8	2,977	.06	17.9	602
1976-77	7.2	44,671	.62	585.2	1310
1981-82	9.9	4,547	.05	52.1	1145
1982-83	10.0	6,824	.07	132.4	1941
1983-84	12.2	2,594	.02	51.1	1971
1984-85	12.6	1,262	.03	72.2	1695
1985-86	10.4	1,970	.02	37.3	1,888
1986-87	12.7	2,041	.02	49.5	2,423
1987-88	14.0	3,166	.02	71.8	2,268
1988-89	14.9	2,983	.02	51.5	1,728
1989-90	14.8	3,512	.02	94.6	2,694

- = No data available.

Sources: Production: Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India, New Delhi; Export & Value: Directorate of Commercial Intelligence and Statistics, Calcutta.

were banned in 1977 because in-country potato prices were soaring, but this ban was relaxed in October 1978. In February, 1979, potato exports were placed under Open General Licence. Dattatreya (1985) reported that at that time about 2% of potatoes produced worldwide entered world trade. More recent estimates suggest this figure to be over 4% and that is only considering table potato and seed (Scott 1994). India exported .07% and .05% of potato production during 1980-81 and 1981-82. Though exports were made to as many as 15 countries in these years, 40% of the exports were made to Nepal in 1980-81. The Import-Export Policy of 1984-85 allowed exports on merit, from time to time, subject to ceilings or other conditions. During 1985-90, exports have not risen above 0.2% of output. Potato export trends compared with potato production for selected years between 1976 and 1990 are summarized in Table 3.

Upadhyaya and Nandpuri (1978) reported that Kuwait and Iran imported potatoes from France and Holland at much higher than Indian prices. Dahiya and Bhati (1992) found that promoting Indian exports was highly feasible economically, because varieties such as Kufri Chandramukhi costs Rs. 601 t, and Kufri Sindhuri Rs. 504 t in the Punjab and Rs. 479 t in Farrukhabad, UP, and the average export price in 1983-84 was Rs. 1971. The authors stressed the need for a long-term export policy, development of appropriate infrastructure, and setting up a Potato Marketing Board.

Price Support Policy

Agricultural commodity price supports have been part of India's economic policy since the 1960s. The Government of Himachal Pradesh initiated the practice with support prices for different grades and varieties of potato. This, however, was an ad hoc measure and support prices were fixed based on an assumed reasonable return to growers and not on a realistic cost basis. Dahiya (1990) contends that the price support policy for potato, in general, has been marked by ad hocism. In 1972-73, support was Rs. 60 for an 80-kg bag of Kufri Chandramukhi and Rs. 65 for Kufri Jyoti. Support prices witnessed a downward trend during 1979-80 to Rs. 50 per 80 kg bag. These prices remained stable through 1984-85. In Himachal Pradesh, prices rose by 1989-90 to Rs. 160 per 80-kg bag of certified seed and Rs. 100 for truthfully-labelled seed.

Kahlon and Chandra (1982) reported that until 1974-75, support to potato prices was provided only indirectly by influencing the market prices through announcing or withdrawing export quotas. In their 1975-76 report, the Agricultural Prices Commission (APC) (now designated as Commission for Agricultural Costs and Prices) considered it inadvisable to introduce any price support scheme, in view of the inadequacy of cold storage capacity and the potential of heavy financial losses (APC 1975). Their recommendation was an open market intervention scheme. In their 1976-77 report, the APC again did not favor national price support for potato and expressed the view that the feasibility of setting up processing plants in the public sector should be explored (APC 1976).

A market intervention scheme continues to be the public policy for averting a crash in potato prices. The NAFED and other state cooperative marketing federations such as Markfed, Hafed, etc., are the agencies for implementing market intervention schemes for potato.

In a study on evaluation of the potato price policy in Orissa, Naik and Patnaik (1986) conclude that unless prices are fixed above production costs, it may not be possible to meaningfully improve potato production. Sikka et al. (1981) suggested that potato price supports be based on production costs, prevailing price, and parity price.

Marketing Research at CPRI, Shimla

The discussion below of marketing research at CPRI, Shimla, includes a farm level study in Farrukhabad District, investigation of seed potato marketing in Himachal Pradesh, analysis and forecasting of prices, a study of cold storage facilities in Meerut District, UP, and outlook surveys.

Farm-level study in Farrukhabad District

During 1983 and 1984, CPRI, Shimla, and the Indian Agricultural Statistics Research Institute, New Delhi, undertook a study in Farrukhabad District, UP. The study estimated cultivation costs, area, and yield rates, and analyzed adoption of improved agronomic practices and disposal of potato by growers.

Farrukhabad contributed 14% of the area under potato cultivation and 18% of production of Uttar Pradesh in 1983-84. The district consists of four subdivisions (*tehsils*) containing 14 community development blocks. Of the 1,780 villages in Farrukhabad, 91.5% were reported to be growing potatoes.

The survey area was divided into eight groups by combining the 14 community development blocks, while taking into consideration the area under potato cultivation and soil and agroclimatic conditions. The sample size was 64 villages, including 16 taken for a cost of cultivation inquiry. For each sampled village, ten potato farmers were selected with equal probability without replacement. For the agro-economic inquiry, the sample consisted of 640 farmers; for the cost of cultivation survey, 160 farmers were interviewed.

Research on the economics of potato production and use focused on marketing. The disposal pattern indicates that nearly one-third of the potato output was sold on-farm (Table 4). However, medium holder (4-10 ha) farmers sold more than 41% on the farm and only 7% in the market, while semi-medium holder (2-4 ha) farmers sold 32.7% of their output in the market.

Slightly more than 50% of all respondents' produce was kept in cold storage for later disposal during the season when prices were high. Only 2-4% was consumed in the home. The study found the cost of cultivation to be Rs. 11,804 per ha, and of production to be Rs. 50 per 100 kgs. The average net return was Rs. 4,676 per ha and the output-input ratio (i.e., the ratio of gross value of output (per hectare) to value (cost) of inputs (both variable and fixed) per hectare) was 1.4 (Gupta et al. 1989).

Table 4. How sampled potato farmers in Farrukhabad District disposed of their produce in 1983-84.

Holding size group ¹	Farmers sampled	production (100 kg)	Disposal pattern (%)			
			Home consumption	Sold on-farm	Sold in the market	Kept in cold storage
Marginal	90	82.3	3.8	31.4	12.7	52.1
Small	43	103.7	4.0	32.3	11.8	51.9
Semi-medium	18	190.0	2.2	16.2	32.7	48.9
Medium	6	104.8	3.8	41.8	7.0	47.4
Overall	157	101.4	3.5	28.8	16.5	51.2

¹Marginal = less than 1 ha; small = 1-2 ha; semi-medium = 3-4 ha; medium = between 4-10 ha

Marketing seed potato in Himachal Pradesh

More than two-thirds of the potatoes produced in Himachal Pradesh are exported as seed, therefore, this state appears prominently on the potato map of India (Nayar 1986). Studies by Raghuvanshi and Tiwari (1974), Agro-Economic Research Centre, HP (1981), Sikka and Swarup (1985), and Thakur and Moorti (1991) mainly focused on price spread, marketing channels, transport problems, and related issues. Little information was available on such important aspects of marketing as the dynamics of price determination of seed potatoes, consumer preferences for various grades and varieties, arrival and disposal patterns, market information, market integration, and problems experienced by farmers and traders in importing potatoes. Dahiya, Pandey, and Nand (1990) conducted a study in Himachal Pradesh to gather this information during 1987-88.

Shimla and Manali are the two terminal markets for seed potato in the state. The main export outlets are Kiratpur Sahib railway station (Punjab) by rail and Swarghat checkpost by road for Lahaul-Spiti, Kangra, Mandi, and Kullu Districts, while Shimla railway station and Parwanoo checkpost serve Shimla and its adjoining districts. The authors collected arrival and disposal data from these outlets, from commission agents of the two terminal markets, and from cooperative agencies. Wholesale prices for certified seed were collected from the HIMFED cooperative agency, and for truthfully-labelled seed potato from commission agents. The surveyors used forms to record the views of commission agents and officials about market regulations, marketing problems, grading, and health standards of potatoes. Similar data were also collected from visiting traders and farmers. Secondary data in area, production, export, and value added were recorded from appropriate state government directorates.

The study revealed that official estimates of potato production by the Directorate of Land Records (HP) at 25,000 t was much less than the export figures recorded at 66,505 t, indicating unreliability in official crop estimates. In the Shimla market, as many as 18 exporters were registered with the Goods Office, Commercial Department of Railways. Only nine commission agents accounted for 82% of the total exports from the Shimla market, while the two cooperatives together had a share at 18% of the total exports. But the LPS cooperative agency claimed the lion's share of 75% in exports from the Manali market and only 25% of the remaining exports were accounted for by the four other private agencies. The Manali market was found to be competitive and the Shimla oligopolistic. All traders rated market information poor and 50% of the officials agreed. Respondents said that enforcement of the HP Seed Potato (control) Order of 1976 was unsatisfactory.

Price determination for Himachal Pradesh seed potatoes is complex because of segmented demand across the country and other compounding factors (see Table 5). Out of the 11 potential factors affecting prices, as many as eight played a determinant role in fixing prices. The key factors found to determine prices were the quantity of seed potato stored in cold stores, current prices for table potatoes in importing states, current prices of table potato in important markets, and the supply and demand position as judged by commission agents and cooperatives. Competition from other producing areas also had an important effect, while the previous year's seed potato price and crop situation in HP had no effect.

Table 5. Factors affecting price determination of seed potato in Himachal Pradesh during the marketing season, 1987-88.

Price determining factor	Respondents' perception ¹			
	Traders		Officials	
	Number	(% of total)	Number	(% of total)
Price of seed potato for the preceding year	1	16	2	34
Support price fixed by the state government	3	50	4	66
Price of table potato prevailing before the beginning of the marketing season in importing markets	6	100	5	84
Demand received from agencies of importing states	6	100	5	84
Demand and supply as judged by commission agents and cooperatives	6	100	5	84
Advice received from dealers of importing states	6	100	4	66
Competition from other areas, e.g., Punjab	6	100	3	50
Quantity of seed potato reportedly available in cold stores	6	100	6	100
Crop situation in HP	1	16	0	0
Weather conditions in importing states	3	50	1	16
On-the-spot bargaining	6	100	4	66

¹Six of 11 traders were interviewed in the Shimla market; and all six state officials were interviewed.

Economic analysis of cold storage in Meerut

Meerut is an important potato producing and marketing area in western Uttar Pradesh. Because of the relative importance of the cold storage industry in potato marketing in this area, a 1991 study investigated farmers' problems in storing potatoes and the economics of storage.

In 1991, Meerut District had 7,292 ha in potato and 45 cold storage units. The District comprises four subdivisions: Baghpat, Mawana, Meerut, and Sardhana. Meerut Subdivision, which grows the most potato, accounts for 62.5% of the total area under potato and has 32 cold storage units. Therefore, Meerut Subdivision was selected for the study. Two villages having an area of 20 ha or more were randomly selected from each of the three development blocks. In all, 97 potato growers were interviewed from the six villages. Data on installation costs, storage costs, and cold storage problems were collected. These data were also collected from 25 cold storage units in Meerut Subdivision and 10 units in the three other subdivisions. These are the results.

Farmers' problems in storage and economics of storage. Cold storage units are regulated by the Uttar Pradesh Cold Storage Regulation Act of 1976. An overwhelming majority of 84% of farmers held the view that no compensation was paid for loss or damage to stored potatoes. Only 3% had received compensation from the cold storage owners. About 60% of the farmers said that the cold storage owners charged higher than fixed rates. Only 12.5% of marginal, 25% of small, and 28.6% of medium holder farmers could raise loans against stored potatoes and this at an interest rate of 24% per annum.

Potato storage was found to be profitable by all categories of farmers. Per 100 kg net returns ranged from Rs. 8.13 for medium holder farmers to Rs. 24.62 for marginal farmers, averaging Rs. 11.93 per 100 kg (Table 6). The higher profit obtained by marginal farmers could be attributed to the higher unit prices they received (Dahiya et al. 1994).

By way of comparison, cold storage charges in Bihar State ranged from Rs. 29 per 100 kg to Rs. 55.60, with reports from Ranchi, Bihar, that charges were Rs. 50-80 per 100 kg. We therefore question the economic rationality of fixed cold storage charges, and the effectiveness of control over the cold storage industry. It is possible, however, that the higher charges in Bihar could be attributable to the woefully inadequate capacity of cold storage and chronic power deficiencies in that State.

Table 6. Economics of cold storing potatoes in Meerut District, Uttar Pradesh, 1990-91.

Size of holding ¹ (ha)	Ruling price at storage time ²	Total storage cost ²	Ruling price at time of sale ²	Average stored (100 kg)	Net return after storage ²
Marginal	80.0	53.3	158.00	51.5	24.6
Small	76.1	51.0	145.78	265.4	18.6
Medium	71.3	51.3	130.73	288.5	8.1
Large	70.8	51.9	140.25	748.0	17.5
Overall	72.4	51.5	135.80	342.7	11.9

¹Marginal = below 1 ha; small = 1-2 ha; medium = between 2-10; large = more than 10 ha.

²Rs. per 100 kg.

Price analysis and forecasting

CPRI's first analysis of potato prices was done in 1980 following the serious production glut and price crash of 1979-80. In this study, wholesale potato prices from 1972 to 1977 were collected for principal producing markets, such as Delhi, Farrukhabad, Jalandhar, Karnal, and Mettupalayan, and for the consumer markets of Bombay and Calcutta. This study investigated market competitiveness and analyzed variations in average wholesale prices between the peak period (January to April), lean period (May to October), and the mid-period (November and December).

In 1987, the second study analyzed seasonal indices, market integration during price crash years, price hike years, and normal years. It focused on the causes for price fluctuations. Also, monthly wholesale prices were forecast for the Calcutta, Delhi, Farrukhabad, Kanpur, Karnal, and Meerut markets from March to October 1987, using wholesale price data for these markets from 1969-70 to 1985-86. A time series analysis of the prices was made, adopting the multiplicative model, i.e., $P=T.S.C.I$. A number of regression equations were fitted to study the relationship between potato prices and possible explanatory variables, such as potato production at the national and state levels, national population, per capita income, indices of wholesale prices for all foods, and both linear and exponential trends over the 17-year period.

A third study done in 1991-92 examined the extent of interdependence of the prices of potatoes, vegetables, and pulses, while taking into account potato production variations. Prices for principal vegetables were not available on a time series basis. The analysis was done considering the retail prices of potato and pulses.

Dahiya and Sharma (1980) found that prices were consistently very low during January to April in the producing markets. A comparative analysis between the market prices in potato growing areas and those in the main consuming centers showed that prices in Bombay, Calcutta, and Mettupalayam were more than 50% higher during the same period, as well as during the lean period (May to Oct.). During the mid-period (Nov. to Dec.) price differentials shot up to 80%. The authors concluded that markets were not integrated due to inadequate transport facilities.

Sharma et al. (1987) studied the trends and outlook for potato prices over the 17 years from 1969-70 to 1985-86 in six major potato markets in the Indo-Gangetic plains: Calcutta, West Bengal; Karnal, Haryana; Meerut, Farrukhabad, and Kanpur, UP; and Delhi.

Seasonal components, measured in terms of seasonal indices (Table 7), accounted for more than 96% of the "within year" fluctuations in prices in all six markets. The exponential trend was slightly better than the linear trend. It accounted for 38-40% of the yearly price fluctuations in Meerut and Farrukhabad markets and 55-65% in the others. Three to four year cycles were observed in all markets. Seasonal indices remained low during December to April and generally reached their peak during October. The four producing markets and the Delhi market were not integrated with the major consuming market in Calcutta, when taking into consideration the differentials of transportation and handling charges between these market combinations.

Sharma et al. (1992) analyzed the influence of vegetable, pulse, and potato production on the retail price of potatoes. Annual potato production, availability of seasonal vegetables and pulses, general price levels, and other factors accounted for a 64% fluctuation in retail prices, while monthly price differences accounted for 19%. The seasonal index could explain 53% of the monthly differences. Potato production together with vegetable and pulse prices could account for 82-89% of the behavior of retail potato prices in all the markets. In general, the cost of vegetables contributed 42%, pulses 22%, and potato 36% toward fluctuations in potato prices. This supports their influence on the determination of potato prices. The contribution of potato production in price determination was, however, more (about 42%), relative to other variables in Jamshedpur, Calcutta, and Delhi, while that of vegetables was more in the other three markets.

Table 7. Seasonal indices of wholesale prices of potato in the six markets of the Indo-Gangetic Region, based on average prices from Dec., 1969, to Nov., 1986.

Market	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	R ² *
Calcutta	101.9	61.5	65.9	74.2	85.4	106.5	112.0	111.9	113.6	116.2	126.9	124.0	98.5
Delhi	75.5	70.3	70.3	76.2	90.3	100.0	116.5	123.0	116.5	119.7	128.6	113.0	98.3
Farrukhabad	82.5	61.3	64.0	68.5	72.8	86.5	109.1	124.3	126.8	135.8	138.3	130.2	96.8
Kanpur	73.0	64.2	63.9	72.7	79.7	87.7	111.5	129.2	127.1	126.1	135.6	129.4	97.2
Karnal	74.7	60.3	63.0	75.6	91.4	107.5	116.3	132.9	119.3	119.3	119.6	120.0	97.4
Meerut	76.4	66.5	66.8	75.1	88.0	100.0	113.4	127.6	123.3	124.0	127.4	111.2	98.1

*R² is the multiple correlation coefficient expressed in %.

Price forecasting for potato. Forecasting prices for commodities is a risky venture and even more so for a semi-perishable commodity like potato. Any forecasting model, however, can work satisfactorily under normal conditions when using accurate production estimates and reliable price data. Price data are collected as minimum and maximum potato prices by Agricultural Produce Market Committees, and in some cases, modal prices are also collected.

Nayer et al. (1987) found that, based on data for 1979-80 to 1984-85, lean period prices were strongly related to commodity market arrivals in Delhi, while peak arrival period prices behaved randomly when related with arrivals. The authors used yearly trend and potato production figures (both from predominantly potato producing areas and nationally) in developing the forecasting models for the Farrukhabad and Delhi markets.

Using the multiple linear regression model, seasonal index, national potato production, and population figures, the authors could satisfactorily describe the price phenomenon over the 17-year period from Dec. 1969 to Nov. 1986. The multiple correlation coefficient ranged from 80.1% to 88.9% in the six markets of Calcutta, Delhi, Farrukhabad, Kanpur, Karnal, and Meerut (Sharma et al. 1987).

Although the demand for potatoes is relatively inelastic, forecast prices for 1987 showed high correlation with the actuals ($r = 0.98$) despite a bumper potato crop of 13 million t during 1986-87 (production in 1985-86 was only 10.7 million t). This was because a widespread drought caused a severe shortage of vegetables; and potatoes were consumed in their place. This, however, does not reduce the utility—under normal conditions—of the forecasting model developed by Sharma et al. (1987).

Another technique for forecasting potato prices was followed in subsequent outlook surveys conducted at CPRI, Shimla. This technique consists of estimating the peak period prices through a quick potato outlook survey, and then calculating the monthly forecast prices with the help of seasonal indices worked out over the past 17 years (Sharma et al. 1987). This method is simple to adopt and, since it is based on prevailing market prices which take into account production influences and other factors, forecast prices are likely to be closer to actual prices. Peak period prices, however, are likely to contain the influence of speculative factors, which is a drawback of this technique. This price forecasting model could be improved by giving suitable weight to survey estimates (production data for the current year), actual production data for previous years, and peak current year prices. Collection of reliable wholesale price data, and more importantly, of modal prices on a variety-wise and grade-wise basis, should be accorded priority to ensure useful forecast prices.

Quick potato outlook surveys

CPRI, Shimla, has conducted an annual quick survey on potato outlook since its initiation in 1985-86. These surveys in the Indo-Gangetic Region quickly monitor potato production, market arrivals, wholesale and retail prices, cold storage capacity available for potato, disease incidence, and marketing constraints during the current year, relative to the previous year at the peak arrival time so that appropriate authorities can take concerted policy measures. This survey also provides important crop estimates, which are not immediately available from the Directorate of Economics and Statistics (DES), Ministry of Agriculture, Govt. of India.

CPRI adopted a simple survey methodology. Requisite data have been accessed from Bihar, Haryana, Punjab, Uttar Pradesh, and West Bengal States, and from two union territories, Chandigarh and Delhi. Data are also collected from selected major potato growing districts in these states: Jalandhar, Karnal, Meerut, Farrukhabad, Lucknow, Varanasi, Patna, Ranchi, and Burdwan; Hooghly was more recently added. Personal rapport was established early through visits by three senior scientists to the senior officers of the Departments of Agriculture/Agricultural Marketing, Horticulture, and Agricultural Produce Market Committees. CPRI scientists made personal visits for the first three years, and now the required data and information are collected through mailed questionnaires. The market situation was assessed in the early years through visits to the important producing markets, but recently

the situation has been monitored through a watch on the national press and other bulletins on prices.

Results and experiences. DES estimates of potato area, production, and yield and the survey estimates for 1985-86 to 1991-92 have been taken into account for this report. The difference between the DES and the CPRI survey estimates is less than 20% at the aggregate level. However, in Bihar, the survey estimates of area (according to Dept. of Agriculture, Bihar) are about 130,000-160,000 ha higher than the DES estimates. The latter estimates, however, are taken as the official figures in India. In the Punjab, area, production, and yield estimates from the two data sets have differed widely.² But the two estimates (DES and CPRI survey) have been fairly close in Uttar Pradesh, West Bengal, and Haryana, except in 1985-86, the year of the serious late blight infection.

During the peak arrival period in selected markets, market arrivals did not have a strong relationship with the wholesale prices, contrary to the effect of interplay of demand and supply factors. Markets in the producing areas in the Indo-Gangetic Region were integrated with one another, but were not integrated with the Ahmedabad and Mettupalayam markets. The retailers' share was 13-30% in the surveyed markets, except the Karnal market where it was exceptionally high, 48-57%.

During the early part of the peak arrival period, it was particularly profitable to move potato from the northwest part of India to the markets in Calcutta and the south. But, margins tend to stabilize at a reasonable level when potato movement takes place. Thus, the marketing system was competitive in the Indo-Gangetic Region, but not so in distant southern markets (Nayar et al. 1987; Sharma et al. 1988; Sharma et al. 1989; Sharma, Dahiya, and Grewal, 1990; Sharma, Dahiya, and Grewal, 1991, 1992).

Findings from the quick outlook surveys call for remedial steps toward accurate crop estimates in Bihar and Punjab States. Price data are, more often than not, reported as minimum-maximum prices by the Agricultural Produce Market Committees. Moreover, through quicker dissemination of market information and faster transportation, integration of markets in the north and south of India would benefit both producers and consumers.

Emerging Issues for Marketing Research

The critical review of the potato marketing system in India presented here brings up the emerging issues discussed below.

Crop estimates for potato need to be improved, particularly in the case of Bihar, Punjab, and Himachal Pradesh. This is necessary for developing proper marketing strategies. One possibility is adopting the crop cutting experiments method.

2 Crop estimates for area and production are formulated by the Directorate of Land Records (DLR) at each state level, then this information is supplied to DES at the state level. DES at the national level consolidates these estimates. This is the channel for "official" estimates. "Unofficial" crop estimate data are also available from state Departments of Agriculture. CPRI used both estimates for their Quick Surveys, since both bodies of data originated from government departments.

Income elasticities of demand are known to be helpful for projection of demand for commodities. In India, not much work has been done in this area for potato and only scanty data on household consumption patterns are available from studies by NSSO. Studies have not been made of potato consumption levels and patterns, household purchasing patterns, status, attitude, or knowledge about the food value of potatoes, etc. An All-India consumption study of potato is also important for the integrated development of the cold storage industry. What Horton (1980) says about prejudices against potato being embedded in the minds of people in Europe appears to hold true in India. A strategy for enlightenment on potato's food value and potato marketing also could be designed.

The dynamics of seed potato marketing at the country level have not been studied. Considering, from the viewpoint of its predominant share in production cost and effect on productivity, the importance of seed input in potato cultivation should be high on the agenda for future marketing research.

Promotion of agricultural exports is critical at this time for India. The country does have the production technology and economic advantage, but a techno-economic feasibility study is an important issue for marketing research, so that an action plan could be assessed for: the investment requirement for infrastructural development; identification of export markets; need for changes in research and development policy on potato; and other related aspects.

Outlook for the Potato Marketing System

The outlook for an efficient 1) table potato marketing system, 2) seed potato marketing system, and 3) processed potato marketing system depends on many, diverse factors. Among these are the availability of reliable crop estimates; market information, i.e., variety and grade prices; strict market regulation; quick and modern transport facilities; adequate cold storage facilities in producing areas, consuming areas, and export centers; a campaign to educate on the food value of potato; and a long-range export strategy. While public policy should plan an increasing role in facilitating change, initiating farmers' cooperative societies and research on the emerging issues of marketing would go a long way in shaping things to come.

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