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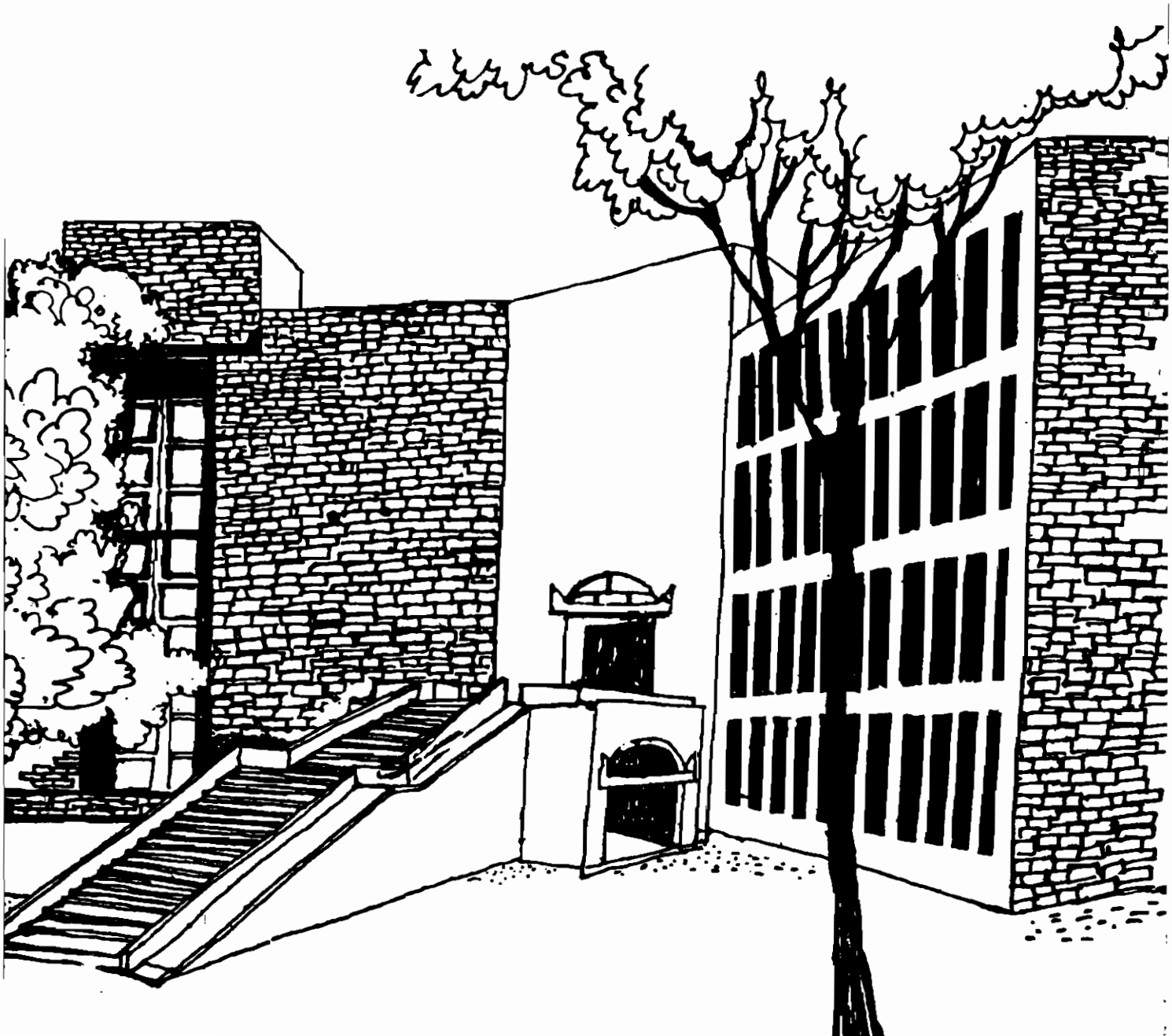

WHEAT ECONOMY OF INDIA: A STUDY OF THE GROWTH, DEVELOPMENT AND INTERNATIONAL TRADE PROSPECTS

By

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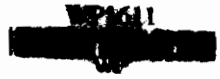

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June 2000

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ABSTRACT

India is now the second largest producer of wheat in the world even though it is only the seventh largest in land area. It produces about 70 million tons of wheat per year or about 12 percent of the world production. Being second largest in population, it is also second largest in wheat consumption, after China, with a huge and growing wheat demand. What is the nature of the wheat economy of India? How has wheat production increased in India? Will it be able to keep pace with consumption growth? What are the prospects and the market environment for international trade? This paper seeks to explore and examine these issues. Analysis indicates that depending on the rate and nature of economic growth, a 4 to 5 percent annual rate of growth in the demand for wheat is likely in the near future, given the population growth and the income elasticity of demand. Wheat production may be expected to grow at about 2 to 3 percent per year considering the various constraints. The outcome will depend substantially on the rate and nature of economic development in India. Good performance in economic development will lead to a deficit whereas slow economic development will lead to a surplus. Promoting rapid economic development which includes the poor and particularly the rural poor will lead to significant growth in demand.

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1. Introduction

India is now the second largest producer of wheat in the world even though it is only the seventh largest in land area. It produces about 70 million tons of wheat per year or about 12 percent of the world production. Being second largest in population, it is also second largest in wheat consumption, after China, with a huge and growing wheat demand.

Even though there have been regional studies on wheat in India, such as Sidhu DS and Byerlee Derek (1991), Sidhu DS and Byerlee Derek (1991), Sims, Holly (1988) and Gandhi Vasant (1997), and overall studies on foodgrains in India, such as Sarma & Gandhi (1990) and Bhalla and Hazell (1999), there do not appear to be any recent studies on the wheat economy of India as a whole.

What is the nature of the wheat economy of India? How has wheat production increased in India? Will it be able to keep pace with consumption growth? What are the prospects and the market environment for international trade? This paper seeks to explore and examine these issues.

2. Food grain Production in India: The Place of Wheat

Food grain production occupies the dominant position in India's agriculture. India has shown an impressive growth in the production of food grains since the advent of the green revolution in the mid-sixties (Sarma and Gandhi 1990). Chronic food deficits and a hovering Malthusian crisis have given way to self-sufficiency and marginal surpluses from time to time in the 80s and 90s. However, with the population growing at nearly 2 per cent per year (nearly 18 to 20 million people being added every year) and the income growth rates accelerating, the demand for food grains continues to grow at a rapid pace.

In the 1950s, the decade after independence, there was scope for increasing production of food grains through expansions of cultivated area, but this was exhausted by the end of the sixties. Table 2.1 shows that there has been almost no expansion in the cropped area from 1970/71 onwards and on the contrary, a slight tendency of decline as area is diverted to non-food grain crops.

Despite this, the food grain production has been doubled from 50.82 million tons in 1950/51 to 108.42 million ton by 1970/71 and doubled once again to 203.04 million tons by 1998/99. This has been achieved almost entirely through yield growth: yields have been tripled from 522 kg/ha in 1950/51 to 1620 kg/ha in 1998/99.

Table 2.1: India: Foodgrains: Area, Production and Yield

Year	Area Million Hectares	Production Million tons	Yield Kilograms per Hectare
1950/51	97.32	50.82	522
1960/61	115.58	82.02	710
1970/71	124.32	108.42	872
1980/81	126.67	129.59	1023
1990/91	127.84	176.39	1380
1997/98	123.85	192.26	1552
1998/99	125.36	203.04	1620
1999/00	123.31	199.06	1614

Source: India, Directorate of Economics & Statistics, and India, Ministry of Finance.

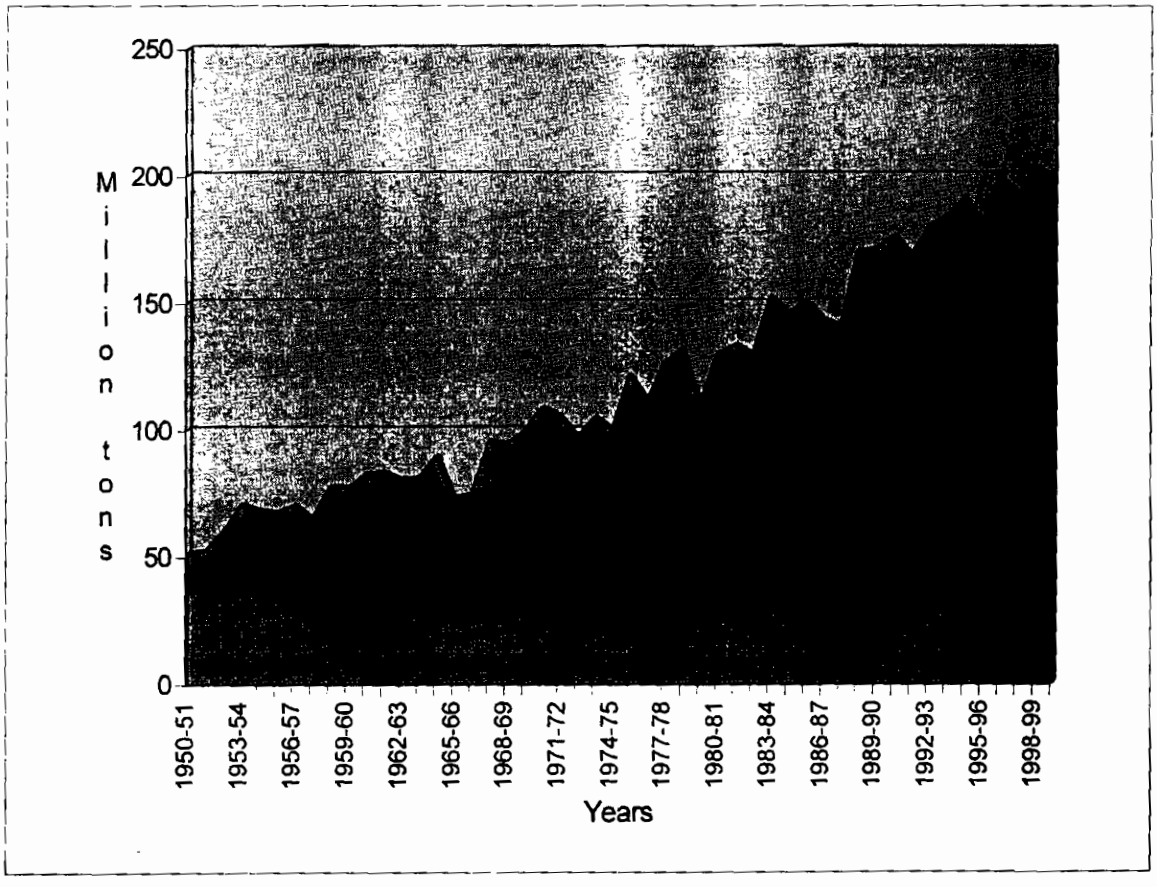
The yield growth has been achieved principally through the green revolution technology of high yielding varieties, fertilizers and irrigation. Figure 2.1 shows the growth has been punctuated by periodic declines as the production is dependent to a significant extent on a fluctuating rainfall, and because of the challenges in overcoming various constraints for achieving technological change on millions of small farms spread across the country.

Figure 2.2 shows that about 65 percent of the gross cropped area in the country is devoted to food grains, but the percentage varies substantially across the regions of the country, ranging from 76.5 per cent in the northern region to 51.2 percent in the south. This is related to resources, agroecology and crop diversification.

Figure 2.3 shows that rice is the largest in the foodgrains with a 42 percent share, followed by wheat with 35 percent share, which is increasing. Coarse cereals and pulses hold much smaller shares of 16 per cent and 7 percent respectively. Figure 2.4 shows that the shares vary substantially across the regions. In the north, wheat dominates by far and the region produces 47.20 million tons of the wheat. Wheat is almost non-existent in the south, and very limited in the east, and the only other significant region is the west, which produces 18.24 million tons. Rice, on the other

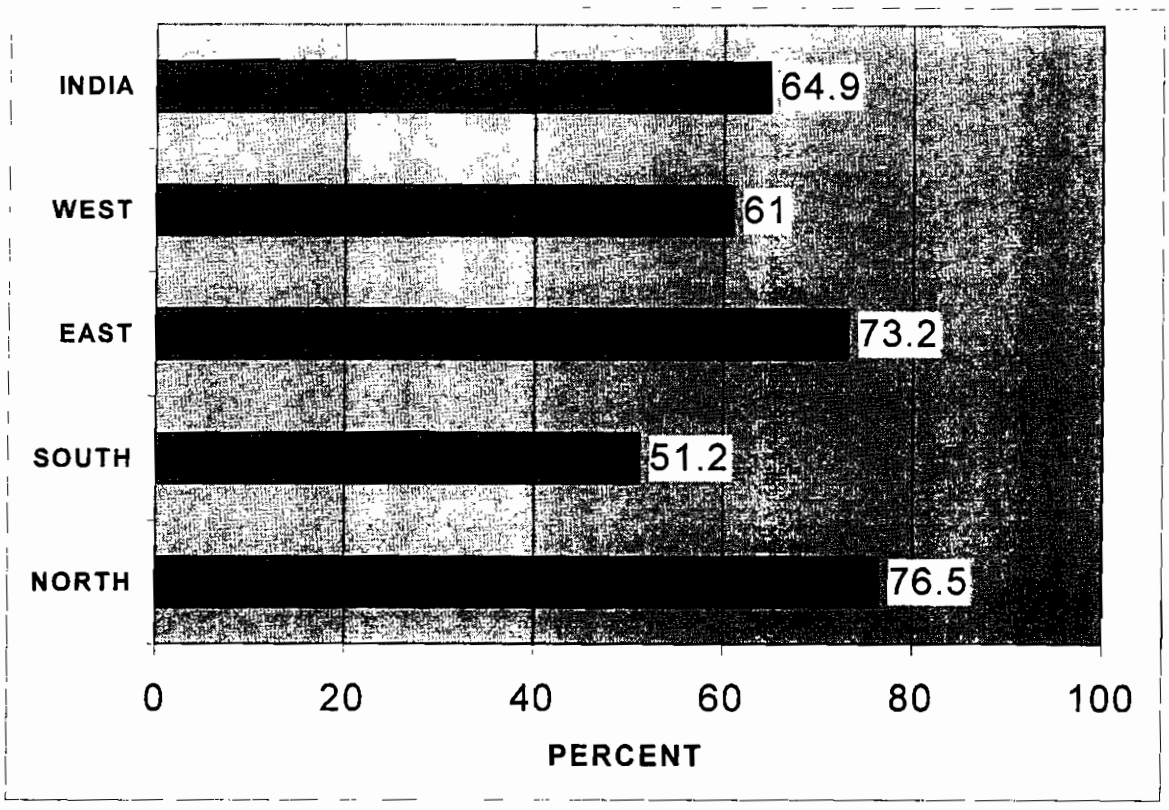
hand, is found in every region but is the largest in the eastern region with a production of 29.18 million tons, followed by the south at 23.91, and the north at 22.69 million tons. Coarse cereals and pulses have the highest production in the western region.

Figure 2.1 India's Foodgrain Production



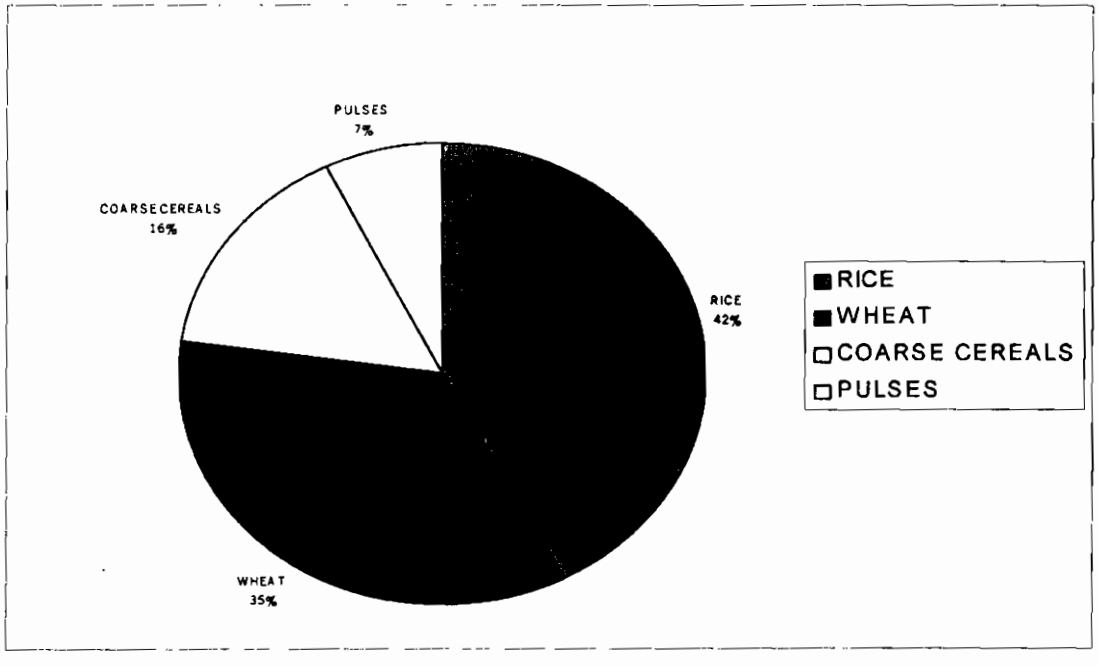
Source: India, Directorate of Economics & Statistics, and India, Ministry of Finance.

Figure 2.2 Percent Area Under Foodgrains



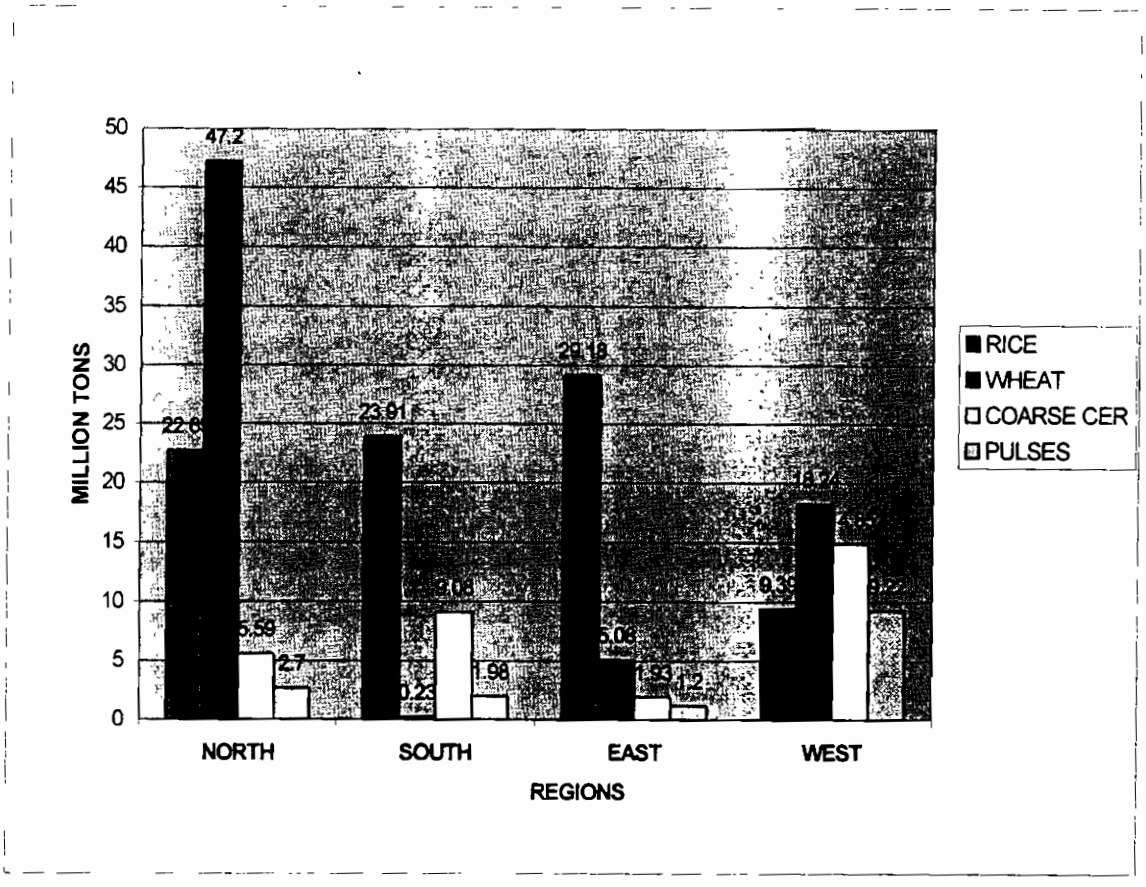
Source: India, Directorate of Economics & Statistics, and Fertilizer Association of India.

Figure 2.3 Grain Production:Distribution of Crops



Source: India, Directorate of Economics & Statistics, and Fertilizer Association of India.

Figure 2.4 Production Across Regions



Source: India, Directorate of Economics & Statistics, and Fertilizer Association of India.

Table 2.2 and Figure 2.5 show that wheat has made an enormous contribution to the growth in foodgrain production in India. Whereas rice production has doubled between 1950/51 and 1970/71 and doubled once again from 1970/71 to 1999/2000, wheat production has increased four times from 6.46 million tons to 23.83 million tons between 1950/51 and 1970/71, and has increased nearly three times again to 68.70 million tons from 1970/71 to 1999/2000. Whereas wheat production was below that of rice, coarse cereals and pulses in 1950/51, it is far higher than coarse cereals and pulses by 1999/2000 and is approaching the rice production. The coarse cereal and pulse production have stagnated, on the other hand, between 1970/71 and 1999/2000.

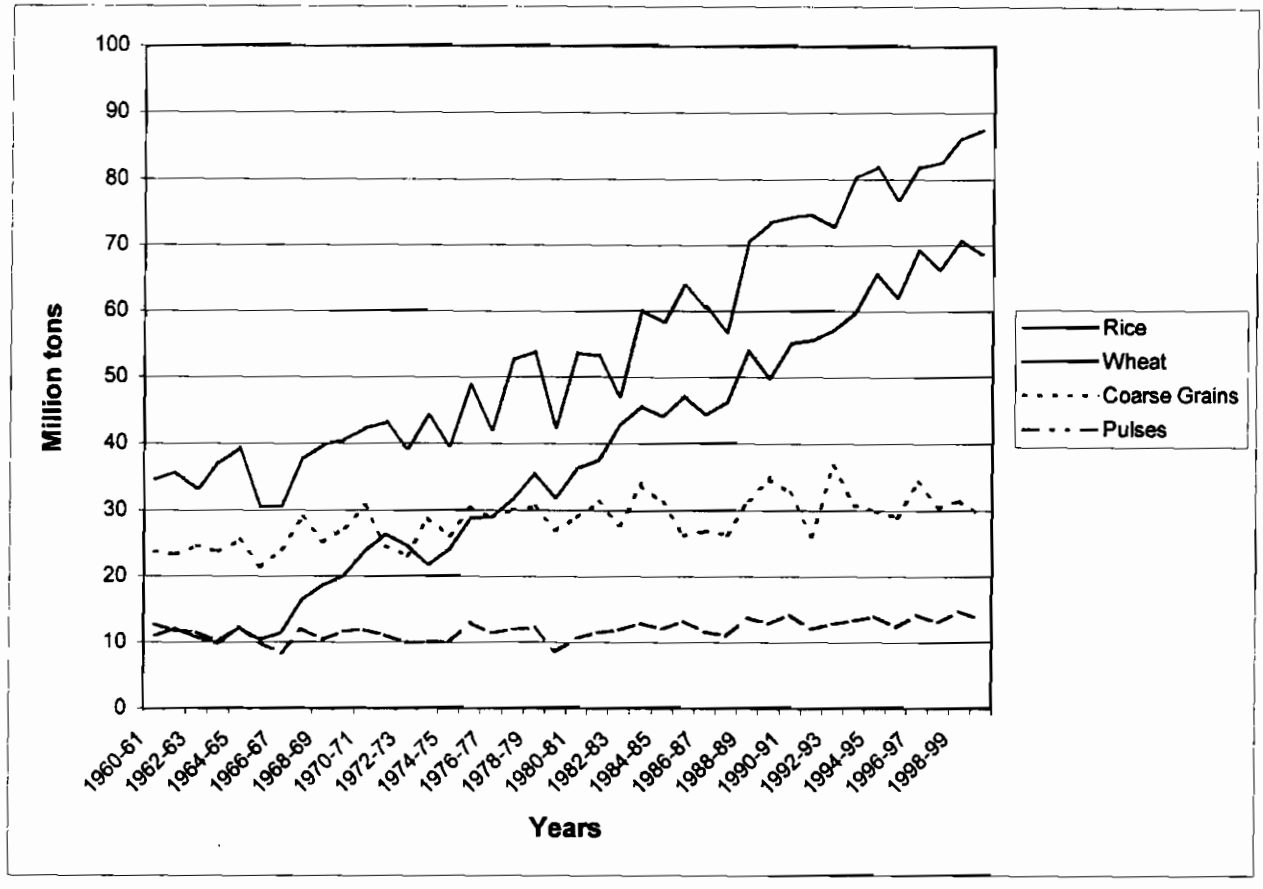
Table 2.2: Growth and Composition of Foodgrain Production in India (Million tons)					
Years	Rice	Wheat	Coarse Cereals	Pulses	Foodgrains Total
1950/51	20.58	6.46	15.38	8.41	50.82
1970/71	42.22	23.83	30.38	11.82	108.42
1980/81	53.63	36.83	29.02	10.63	129.59
1990/91	74.29	55.14	32.70	14.26	176.39
1997/98	82.50	66.30	30.40	13.00	192.30
1998/99	86.00	70.30	31.50	14.80	203.00
1999/2000	87.50	68.70	29.20	13.50	199.10
Source: India, Directorate of Economics & Statistics, and India, Ministry of Finance.					

Figure 2.6 shows that in the last decade, between 1989/90 and 1998/99, the wheat production has grown at about 3.6 percent per annum whereas rice has grown at only about 1.6 percent, coarse cereals have declined and pulses have grown at 1.2 percent. These growth rates bringing out the increasing importance of wheat in the food grain economy of India.

3. Wheat: Production and Growth Profile

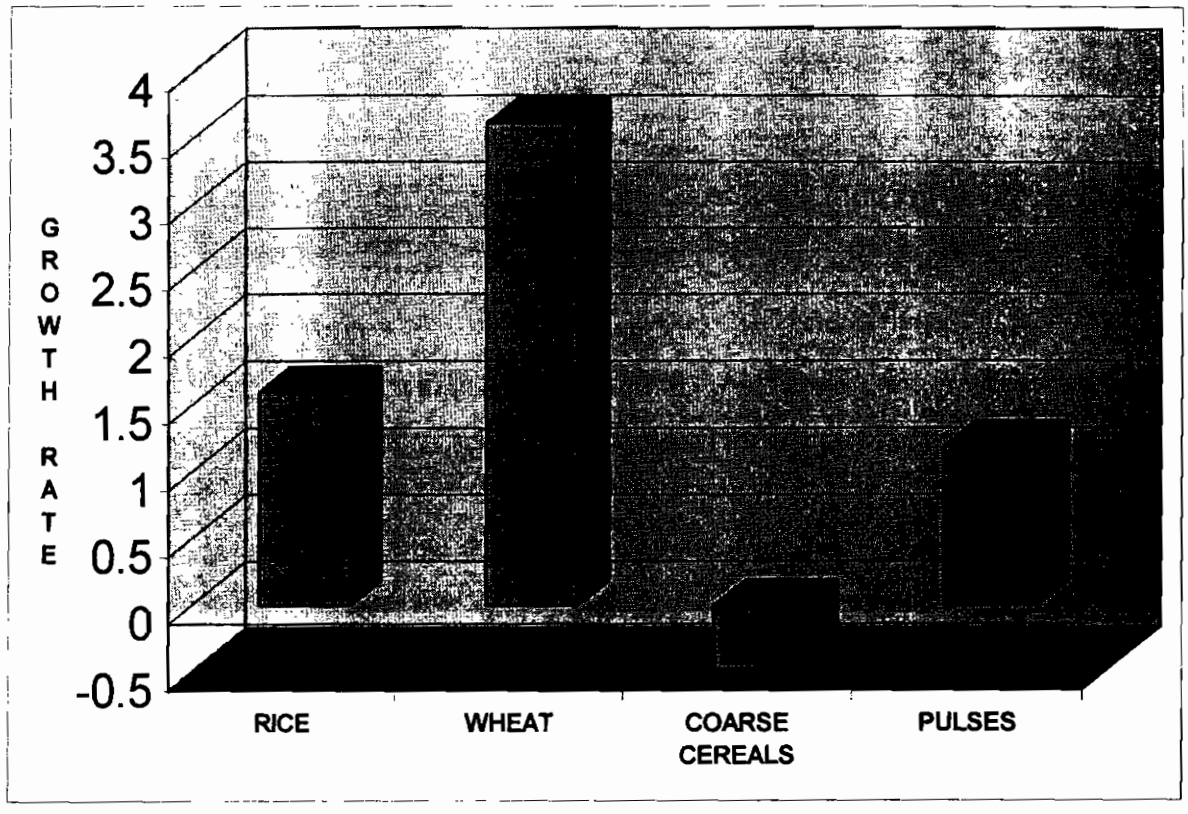
Table 3.1 shows that the production of wheat has increased over ten fold from 9.75 million tons to 68.70 million tons between 1950/51 and 1999/2000. This growth has come both from the expansion of area as well as increase in yield. The area has

Figure 2.5 Production of Different Foodgrains



Source: India, Directorate of Economics & Statistics, and India, Ministry of Finance.

Figure 2.6 Growth Rates: 1989-90 to 1998-99



Source: India, Directorate of Economics & Statistics, and India, Ministry of Finance.

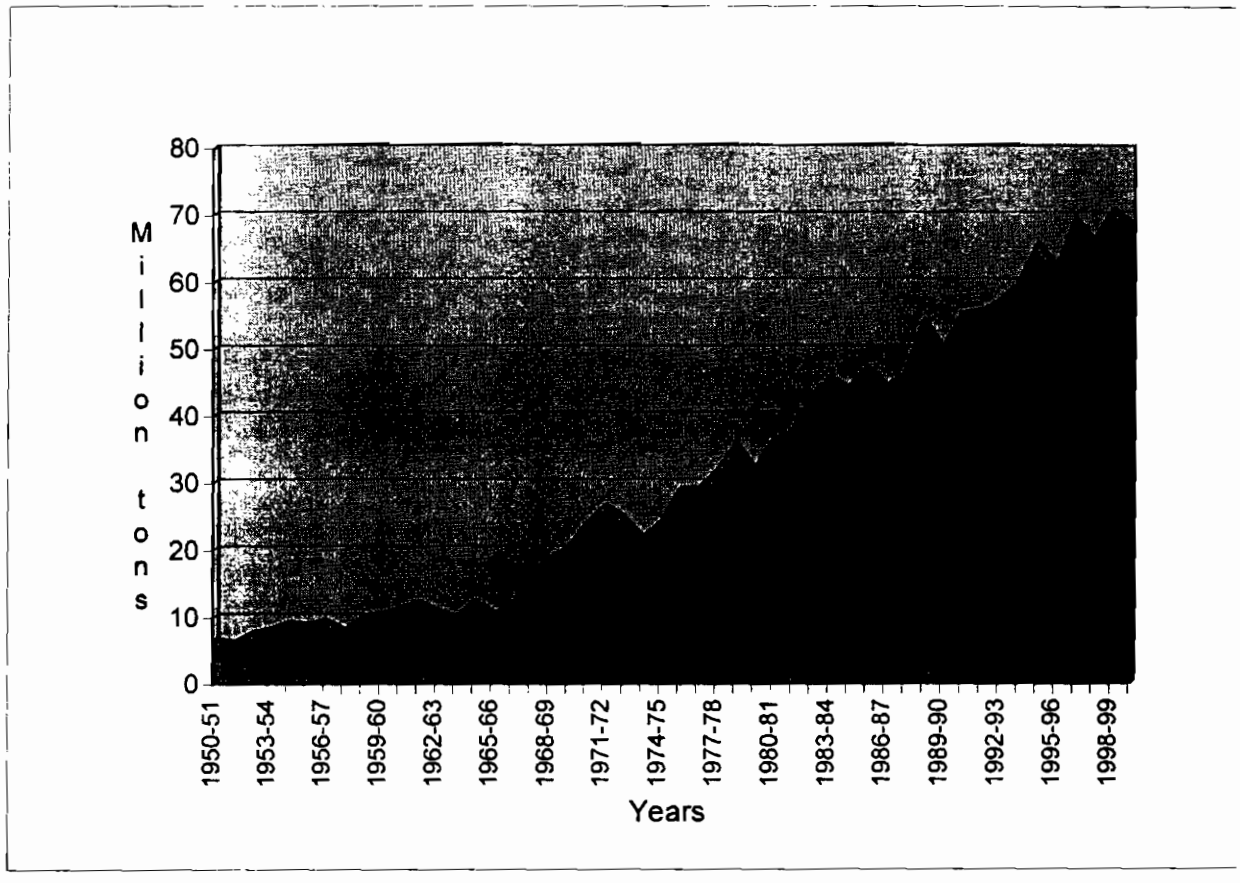
Table 3.1: Wheat: Area, Production and Yield			
Year	Area Million Hectares	Production Million Tons	Yield Kg/ha
1950/51	9.75	6.46	663
1960/61	12.93	11.00	851
1970/71	18.24	23.83	1307
1980/81	22.28	36.31	1603
1990/91	24.17	55.14	2281
1997/98	26.69	66.30	2485
1998/99	27.40	70.80	2583
1999/2000		68.70	
Source: India, Directorate of Economics & Statistics, and India, Ministry of Finance.			

expanded about 3 times from 9.75 million hectares to 27.40 million hectares and the growth is continuing, though at a slower pace, even in the 90's. Given that wheat and rice are grown in separate seasons and do not compete for area, it appears that this growth has come partly from shift in area towards wheat and away from coarse cereals and pulses, and partly from increase in cropping intensity through multiple cropping.

The yields have increased 4 fold from 663 kg/ha to 2583 kg/ha between 1950/51 and 1998/99. There has not been much growth in yield between 1950/51 and 1960/61, but there has been substantial growth after that. Figure 3.1 shows that there has been a significant acceleration in production growth after 1966/67 with the advent of the green revolution. The growth can be largely attributed to productivity coming from the introduction of the new dwarf high yielding varieties from CIMMYT, Mexico, as well as the use of the associated complementary modern inputs, particularly fertilizers and irrigation. The national research system also played a major role in adapting this technology to suit the local conditions and market preference in India.

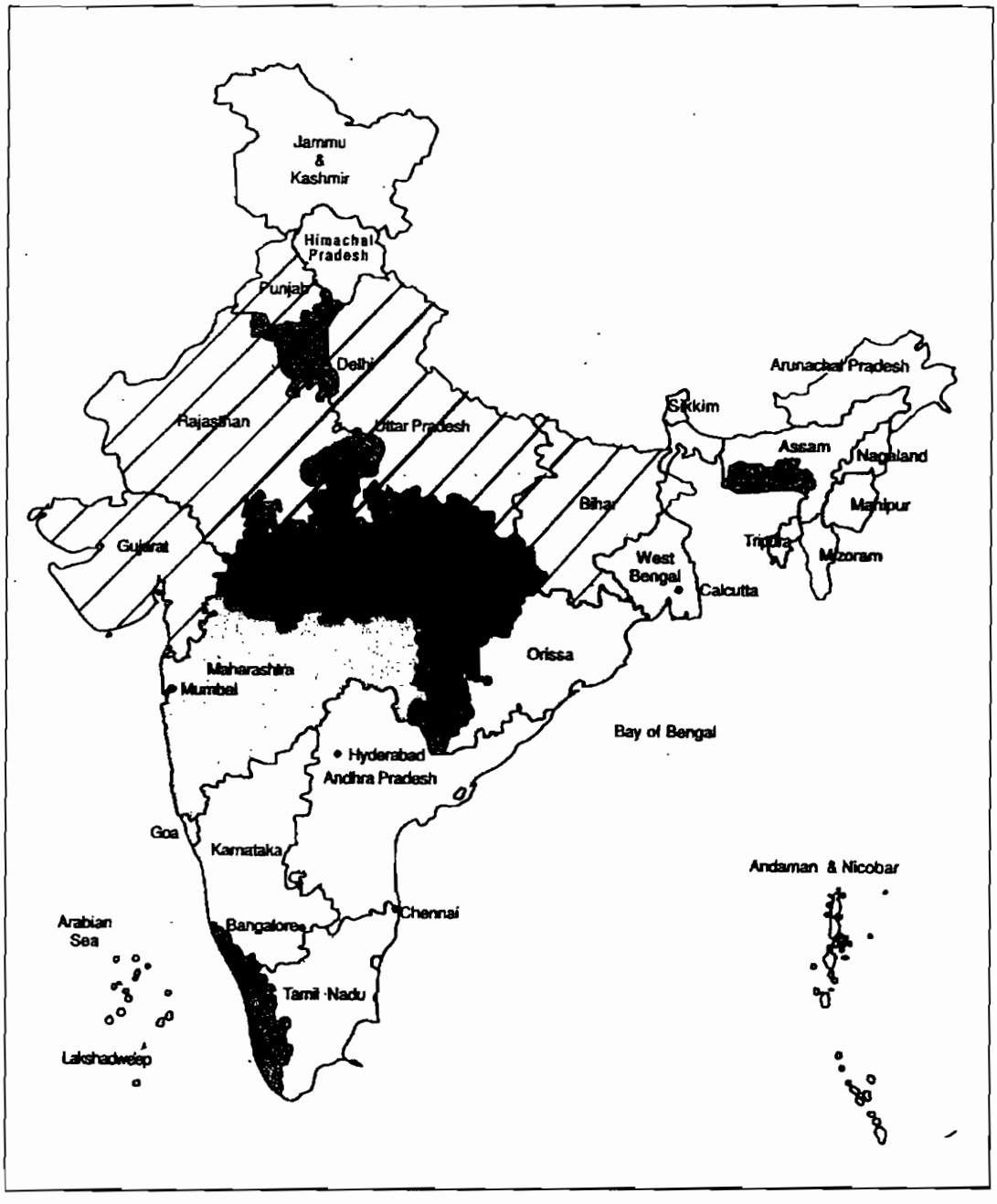
Figure 3.2 shows the major wheat growing states in India, and these are primarily Uttar Pradesh, Punjab, Haryana, Rajasthan and Madhya Pradesh. Wheat is also grown in Gujarat and Bihar. It may be noted that the major wheat growing areas are all in the north, and therefore unlike rice, wheat has a relatively narrow geographic land base of production. Wheat is a temperate crop requiring low temperatures, and

Figure 3.1 India's Wheat Production



Source: India, Directorate of Economics & Statistics, and India, Ministry of Finance.

Figure 3.2: Map of India Showing the Major Wheat Growing States



Source: India, Ministry of External Affairs.

most of the country is tropical. Even within many of these states the wheat areas are limited and overall only about 18 percent of the net cropped area is planted to wheat.

Figure 3.3 gives the shares of the different states in the national production. It shows that Uttar Pradesh (U.P.) contributes the largest share with 36 percent of the production, followed by Punjab with 19 percent and Haryana with 11 percent. These 3 northern states together contribute two-third of the production of wheat. These are followed by Madhya Pradesh (M.P.) 11 percent, Rajasthan 10 percent, Bihar 6 percent and Gujarat 3 percent. All the rest contribute only 4 percent.

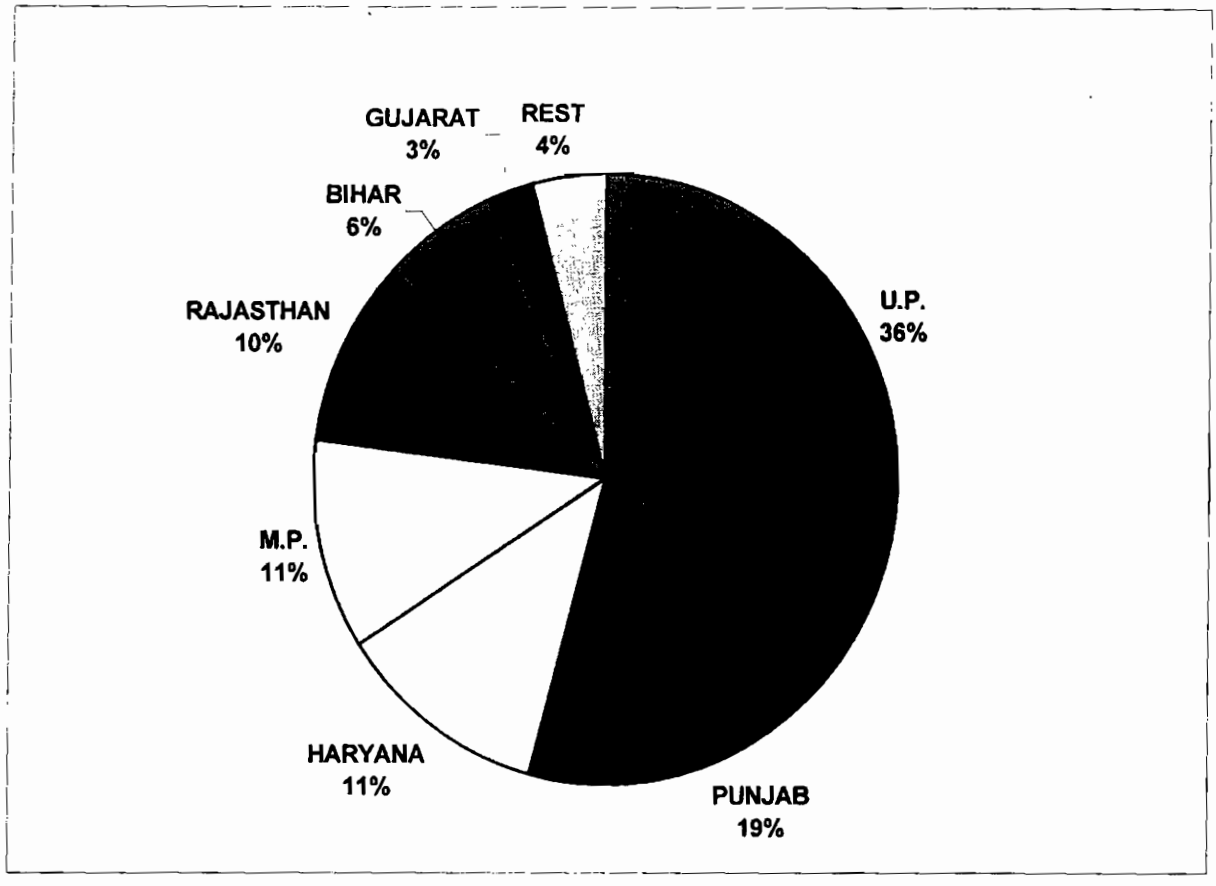
The per hectare yields vary substantially across the states as shown by Figure 3.4. Punjab and Haryana show the highest yield of 3853 and 3660 kg/ha respectively. This is followed after a significant gap by Rajasthan, U.P. and Gujarat with 2500, 2498 and 2373 kg/ha respectively – which are close to the national average of 2583 kg/ha. Bihar and M.P. follow with much lower yields of 1999 and 1625 kg/ha respectively. These yields (kg/ha) can be compared with 2907 in USA, 1907 in Australia, 1029 in Russia, 3667 in China and 7603 in France (1998:FAO).

What has made the yield growth possible in India? Table 3.2 shows the trends in the major inputs and resources used in wheat production. Fertilizers, High Yielding Varieties (HYV) and irrigation all show substantial change. Estimated fertilizer use on wheat has increased from 1.80 to 137.40 kg/ha between 1950/51 and 1998/99. HYV's were non-existent in 1950/51 and 1960/61 but now cover 87.6 percent of the area. Irrigation has risen from 34 percent to 89.3 percent. Thus, clearly, substantial technological change has taken place in wheat production.

4. Production Behaviour

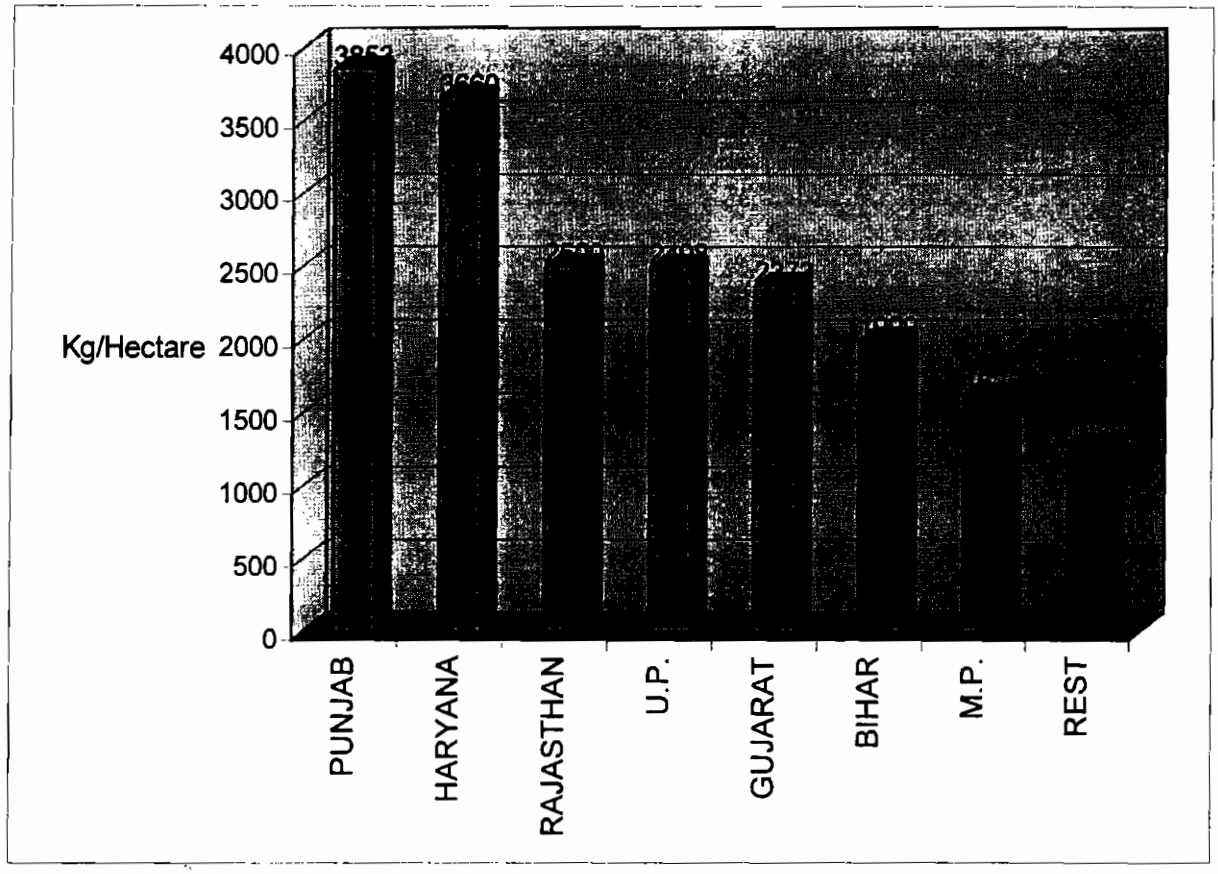
This section examines the role of different major inputs and factors in determining the wheat production in India, at the aggregate level. As per standard practice, (see Fuss, McFadden and Mundlak 1978, and Sarma and Gandhi 1990) area and yield are separated as determinants of production and only the yield function is estimated. It is yield, in any case that is more important since area growth has reached

Figure 3.3 Distribution of Wheat Production Across States



Source: India, Directorate of Economics & Statistics, and India, Ministry of Finance.

Figure 3.4 Wheat Yields Across States



Source: India, Directorate of Economics & Statistics, and Fertilizer Association of India.

Table 3.2: Trends in Major Resources and Inputs Used in Wheat Production					
Years	Area Mill.Hectare	Fertilizers* Kg/ha Nutrients	Percent Area under High Yielding Varieties	Percent Area Irrigated	Rainfall Index (Normal=100)
1950/51	9.75	1.80	0.00	34.00	104
1960/61	12.93	5.73	0.00	32.70	99
1970/71	18.24	31.18	35.50	54.30	113
1980/81	22.28	63.67	72.28	76.50	104
1990/91	24.17	118.25	86.75	81.10	119
1997/98	26.69	127.39	86.17	87.40	102
1998/99	27.40	137.40	87.59	89.30	106
1999/2000					
* Fertilizer use on wheat is estimated by the authors based on available data. *Source*: India, Directorate of Economics & Statistics, and Fertilizer Association of India.					

limits and it is yield growth which is driving and will drive, in the future, the production growth.

In the Indian setting, high yielding varieties, fertilizer use, irrigation and rainfall are known to be the most important determinants of yield. These are assumed to be the independent variables explaining the yield as the dependent variable. The following two functional forms, based on past literature (each has its own theoretical limitations) were tried:

Linear:

$$YIELD = A + B1*FERT + B2 * HYV + B3*IRRG + B4*RAIN + e$$

Cobb-Douglas:

$$YIELD = a * FERT^{b1} * HYV^{b2} * IRRG^{b3} * RAIN^{b4} * u$$

(This is linearised by taking logs.)

Where:

YIELD = Wheat yield in kilograms per hectare
FERT = Fertilizer use on wheat (estimated) in nutrients, kilograms/hectare
HYV = Percentage of wheat gross cropped area under high yielding varieties
IRRG = Percentage of wheat gross cropped area which is irrigated
RAIN = Index of rainfall based on rainfall received during the main monsoon season of June to September (85 percent of the rainfall).

A, B1, B2, B3, B4, a, b1, b2, b3, b4 are parameters to be estimated.
e and u are error terms.

Production function estimation is frequently affected by multicollinearity which depends on the correlation between explanatory variables. A correlation matrix of the explanatory variables is given in Table 4.1. A look at the correlations shows that the correlation between explanatory variables is very high and therefore the regression estimation of the above production functions will be influenced by multicollinearity. The correlation between fertilizer and irrigation is 0.9607 and this is because the rise in irrigation and fertilizer use go together. Similarly the correlation between fertilizer and HYV is also high at 0.8499 since fertilizer use increases substantially with HYV use. Correlation between irrigation and HYV is also high at 0.9327 since irrigation helps HYV adoption. It appears from these results that the regression procedure will find it difficult to separate the effects of these three inputs on yields and therefore their coefficient magnitudes may vary considerably and will reflect the effects of each other. It may also be noted that rain does not have a high correlation with any of these inputs.

Table 4.1: Correlation between Explanatory Variable (1966/67 - 1998/99)

	FERT	HYV	IRRG	RAIN
FERT	1.0000			
HYV	0.8499	1.0000		
IRRG	0.9607	0.9327	1.0000	
RAIN	0.1748	0.1595	0.1450	1.000

The production functions were estimated by OLS regression procedure. Three time periods used were 1966/67 to 1998/99 which is the entire period after the green revolution technology arrived. The earlier period of 1950/51 to 1965/66 is separated and not used since this represented a different technology environment, different from the present scenario. Two other sub-periods 1980/81 to 1998/99 and 1990/91 to 1998/99 were also used to capture the more recent environments.

The regression estimates are given in Table 4.2. The results are affected by multicollinearity between fertilizer, HYV and irrigation. However, all these variables emerge as important determinants for one or the other of these equations, each having a positive impact. Fertilizer emerges with a large and highly significant coefficient in the equations for the whole period. Its coefficient of 11.3 indicated 11.3 kg increase in yield for every kg of fertilizer nutrient applied, and this is high but acceptable.

However, this drops considerably to 3.6 and 4.6 in the more recent periods indicating that its incremental grain output has declined and less can be achieved from it now. On the other hand the coefficient of HYV has increased substantially indicating that recent increases in yield/production depend substantially on the spread of HYV's. The coefficient of irrigation too shows a substantial increase over the periods indicating that recent increases in yield/production depend substantially on expansion of irrigated area. What is concerning though is that both HYV and irrigation are already at near 90 percent level and there is not much further scope of expansion.

It is interesting that the rain coefficient is never significant for wheat indicating that wheat production with its substantial coverage with irrigation is not affected much by the performance of the monsoon. It provides stability to the grain production in India. Both the functional forms, though they have their theoretical limitations, perform reasonably well on their R-square and F-statistic. The estimates of the last period of 1990/91 to 1998/99 are influenced by limited number of observations/degrees of freedom.

5. Markets and Prices

The Government of India has developed, since the food grain crisis situation of the mid-sixties, an elaborate institutional system for the support, control and stabilisation of food grain prices in India, and making available basic minimum supplies at reasonable prices to the people. The system includes the Commission on Agricultural Costs and Prices, the Food Corporation of India, and State Civil Supplies

Table 4.2: Regression Results: Production Function - Yield Equation (Dependent Variable Wheat Yield)

	Variable Coefficients						Variable Coefficients						
Years	FERT	HYV	IRRG	RAIN	Adj.Rsq	F	LFERT	LHYV	LIRRG	LRAIN	Adj.Rsq	F	N
1966/67-1998/99	11.3550 (5.459) ***	0.1277 (0.0051)	6.9173 (0.824)	1.9321 (1.161)	0.96	191.9	0.4881 (5.307) ***	0.0150 (0.460)	0.0401 (0.145)	0.1326 (1.286)	0.95	155.2	33
1980/81-1998/99	3.5885 (1/236)	23.2397 (3.081) ***	19.4504 (2.077) **	2.372.4 (1.163)	0.93	63.0	0.2042 (1.565)	0.8894 (2.794) **	0.6110 (1.990) *	0.0986 (1.070)	0.94	69.8	19
1990/91-1998/99	4.634 (0.843)	32.7064 (1.943)	25.9277 (1.319)	2.6399 (0.663)	0.55	3.5	0.2314 (0.917)	1.1584 (2.002)	0.9155 (1.465)	0.1093 (0.685)	0.59	3.9	9

Note: Yield Kg/ha
FERT Fertilizer Kg/ha
HYV Percentage area under high yielding varieties
t-statistics are in parenthesis under the coefficients

Significance: *** at 0.99, ** at 0.95, * at 0.90

IRRG Percentage area irrigated
RAIN Rainfall Index (June - Sept)
Suffix of 'L' indicates log of the variable

Corporations. Some of the features and indicators of this system are brought out in Table 5.1 for wheat.

Minimum support prices (MSP) or procurement prices are announced every year at the beginning of every wheat season by the government. These are based largely on the cost of cultivation which is systematically studied every year at the farm level, as well as on market information and government decision-making process. It can be seen that the MSP has risen considerably over the decade of 90's, one of the major jumps coming after the liberalisation reforms in early 90's. The issue prices or the price at which the grain is released to the government Public Distribution System (PDS) is fixed and revised only from time to time. The distribution is through state governments and thousands of fair price shops spread throughout the country in the urban and rural areas. There is an element of subsidy in this but the government is trying to target and reduce this in the recent years.

The total procurement ranges from 8 to 14 million tons and it may be noted that this is only about 11 to 20 percent of the total production. Thus, the government system handles a small proportion of the total wheat production and the large part is handled by private markets. Yet the support price operation and the Public Distribution System play a significant role in achieving reasonable and stable food grain prices in the country for the producers and consumers. However, substantial stocks are sometimes accumulated in the process and Table 5.1 show that these could rise to almost 20 million tons after the harvest and market arrivals, but decline over the rest of the year.

Table 5.2 gives the state-wise profile (major states) of the procurement and distribution (Targeted PDS) of wheat for 1997/98. It shows that there is substantial spatial divergence between supply and demand. Bulk of the procurement comes only from a few states, particularly Punjab and Haryana. Punjab contributes as much as 64 percent of the procurement of wheat, and Haryana 25 percent. Uttar Pradesh (U.P.) which has 36 percent of the production (shown earlier) contributes only 7 percent of the procurement. This is due to its substantial demand for own and local consumption.

However, the off-take under TPDS, which is indicative of the demand, is spread across a large number of states which are deficit in wheat. Some of the major states on the demand side are Maharashtra, Uttar Pradesh, Bihar, Delhi, Gujarat, Kerala and Rajasthan. Thus, there is a wide spatial difference between the supply and demand which needs to be bridged by the market and the government procurement and distribution systems. It also indicates that the presence and effectiveness of these systems is very important for providing a reasonable market for the wheat to the farmers especially where surpluses are produced, as well as a constant supply at reasonable prices to consumers spread over a huge area - in whose consumption baskets, food grains have a huge share.

Table 5.1: Government Minimum Support/Procurement Prices, Issues Prices, procurement, offtake and stocks for Wheat

Year	MSP/Procurement Price Rs/Quin.	Issue Price PDS Rs/Quin.	Production MT (Lagged)	Procure-ment MT	Offtake from cent. pool MT	Stocks MT 1st April	Stocks MT 1st July
1990	215	234	49.85	11.07			
1995	360	402	65.77	12.33	12.81	8.72	19.22
1996	380	402	62.1	8.16	13.32	7.76	14.13
1997	475	250/450*	69.35	9.3	7.76	3.24	11.42
1998	510	250/650*	66.3	12.65		5.08	16.70
1999	550	250/682*	70.8	14.14			

*BPL/APL: For Below Poverty Line/Above Poverty Line

Source: India, Directorate of Economics & Statistics, and India, Commission for Agricultural Costs and Prices.

Table 5.2: Procurement and Off Take (TPDS) of Wheat in 1997/98 by State ('000 tons)		
	Procurement	Off take under TPDS
Andhra Pradesh	-	106
Assam	-	143
Bihar	-	485
Delhi	1	459
Gujarat	-	433
Haryana	2290	77
Himachal Pradesh	-	99
Jammu Kashmir	-	128
Karmataka	0	214
Kerala	-	328
Madhya Pradesh	107	247
Maharashtha	-	914
Orissa	-	127
Punjab	5961	7
Rajasthan	320	307
Tamil Nadu	-	123
Uttar Pradesh	617	753
All India	9298	5993

Source: India, Directorate of Economics & Statistics, and India, Commission for Agricultural Costs and Prices.

Table 5.3 presents the price trends in wheat over the last decade. The all-India wholesale price index for wheat indicates that the wheat prices have been rising over the 90's, and a comparison with the all commodities price index shows that by and large wheat prices have kept pace with the general prices in the economy. There was a gap in 1990/91 which has been corrected over the next few years with the economic reforms that followed, and periodically gaps have emerged but have been corrected over time. The actual wholesale prices in the sample market of Delhi also reflect the price rise. It can be also seen from the table that the market prices have throughout been well above the minimum support prices (MSP), which indicates that the minimum support price mechanism and systems are by and large working reasonably well. The international prices of wheat show differences across qualities, but appear to show a rising trend over most of the 90's. Ignoring the price blip of 1995/96, the U.S. no.2 Hard Winter wheat prices have risen from US$ 118 per ton in 1990/91 to US$ 181 per ton in 1996/97.

Table 5.3: Wheat Prices							
					(US$/ton) International Prices		
	WPI All Comm	Wheat Wholesale Price Index (1981/82=100)	Delhi Average Wholesale Price (Rs/Qui)	MSP (Rs/Q)	US No. 2 Hard Winters	US No.2 Soft Winter	Argentina Trigo Pan
1990/91	182.7	172.1	284	215	118	112	85
1991/92	207.8	203.7	349	225	150	147	114
1992/93	228.7	227.0	365	275	143	142	124
1993/94	247.8	253.4	385	330	143	132	120
1994/95	274.7	272.7	414	350	157	145	136
1995/96	295.8	271.4	432	360	216	198	218
1996/97	314.6	330.3	588	380	181	158	157
1997/98	329.8	333.3	554	475	144	131	139
1998/99	352.6	337.6	543	510			

Source: India, Directorate of Economics & Statistics, India, Ministry of Finance and India, Commission for Agricultural Costs and Prices.

6. Trade, Cost of Production and Competitiveness

At times India has been a significant importer of wheat, but in the 1990's India has been both a marginal importer and exporter. However, since India is a large country, these marginal quantities can be significantly large for the world market. Wheat trade has been under government control in the past and the import and export quantities reflect government decisions during each year as well as over the years in managing the supply, demand and stock situation and the food prices in the country. There has been a tendency to use trade more frequently than in the earlier decades.

Table 6.1 gives figures on imports and exports in the 1990's. The import quantities have varied from nil to 1.34 million tons between 1990/91 and 1997/98. The unit prices show a variation depending perhaps on the quality, sources and government decision making. The export quantities vary from almost nil to 1.84 million tons over this period. Some of the exports are to neighbouring countries such as Bangladesh and Nepal with which India has a transport advantage, and this often depends on the agricultural situation in those countries relative to India's.

Table 6.1: India's Trade in Wheat			
	Imports		Export
	Quantity '000 tons	Unit Value Rs/Qtl	Quantity
1990/91	63.61	354.03	139.54
1991/92	-	-	660.43
1992/93	1363.70	520.69	37.73
1993/94	241.70	519.86	3.88
1994/95	0.57	701.75	92.17
1995/96	8.69	1232.45	1091.59
1996/97	616.01	658.71	1847.77
1997/98	1344.55	722.14	1.56

Source: India, Directorate of Economics & Statistics, and India, Commission for Agricultural Costs and Prices.

Table 6.2 give a break-up of the wheat imports by type. It shows that in the 90's Durum wheat, seed and flour imports have been nil or very limited. The main type of wheat imported is the regular grain wheat.

Table 6.2: Wheat Import by Type '000 tonnes					
	Durum	Seed	Others	Flour	Total
1990/91	-	-	62.6	1.01	63.61
1991/92	-	-	-	-	-
1992/93	21	-	1342.7	-	1363.7
1993/94	11.8	-	229.9	-	241.7
1994/95	-	-	0.54	0.03	0.57
1995/96	-	-	8.24	0.45	8.69
1996/97	-	-	612.68	3.33	616.01
1997/98	-	-	1344.55	-	1344.55

Source: India, Directorate of Economics & Statistics, and India, Commission for Agricultural Costs and Prices.

India signed the GATT/WTO agreement in 1994/95. The WTO Agreement on Agriculture (AOA) entailed conversion of all non-tariff barriers (NTBs) into equivalent tariff barriers i.e. tarrification. In the Uruguay Round, India has also agreed to make adjustment in tariff rates for 3373 commodity groups or sub-groups (at 6-digit HS level) (Gulati, Mehta and Narayanan 1999). These commodities account for around 65 per cent of India's tariff lines. In agricultural lines, India committed to tarrification of 673 lines or sub-groups (at 6-digit HS level).

A number of steps have already been taken during the 1990s to liberalise the import regime. With the export-import policy for the year 1999-2000, only 2114 tariff lines (about 20 percent out of 10261 tariff lines), are now subject to any type of

NTBs. Out of the lines under NTBs, only 606 (29 percent) are of agriculture (HIS-24) (Gulati, Mehta and Narayanan 1999). India has unilaterally gone ahead to reduce tariff barriers much below the bound rates of duty under URA. The biggest agricultural commodities like rice and milk (skimmed milk powder) are already committed at zero import duty. For wheat the bound rate of duty is 100 percent, but roller flour mills are allowed to import at zero import duty. Similarly, for pulses the bound rate is 100 percent, but they are being imported under OGL at zero import duty. Edible oils, most of which are bound at 300 per cent import duty, are open for imports at 15 per cent duty. It further appears that by 2001 end most of the QR's will be done away with (Gandhi 1999). Table 6.3 provides a look at some of the tarrif rates.

Table 6.3: Tariff Rates on Selected Agricultural Commodities

Description	Export-Import Policy		Bound Tariff	Applied Tariff 1997-98	Applied Tariff 1998-99	Applied Tariff 1999-2000
	Export	Import				
Durum wheat	Free	Restricted	100%	0%	0%	0%
Other			0%	0%	0%	0%
Barley			100%	0%	0%	0%
Oats			100%	0%	0%	0%
Rice in the husk(paddy or rough)			0%	0%	0%	0%
Husked(brown) rice		Canalised	0%	0%	0%	0%
Semi-milled or wholly-milled			0%	0%	0%	0%
Broken rice		Canalised	0%	0%	0%	0%
Grain sorghum			0%	0%	0%	0%
Millet			0%	0%	0%	0%
Groundnut oilseeds in shell			100%	40%	40%	40%
Source: Government of India.						

What is the cost of production of wheat in India? The cost of cultivation of wheat in India is continuously evaluated through the cost of cultivation surveys of the Government. The summary results for wheat from 1990/91 to 1995/96 are given in Table 6.4. The table shows that the cost of production of wheat varies substantially across states and ranges from an average of Rs.292 per quintal to Rs.377 per quintal (1995/96). Haryana shows the lowest cost in all the years followed by Punjab and Uttar Pradesh. Madhya Pradesh show the highest cost of production. This is reflective of agro-ecology as well as crop management.

Table 6.4: Cost of Production of Wheat in India in Major Producing States						
						(Rs. per Quintal)
States	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96
Haryana	155.44	168.41	217.52	246.72	263.30	292.26
Madhya Pradesh	256.86	317.17	343.69	-	348.15	377.02
Punjab	190/79	210.41	250.72	268.32	306.58	342.83
Uttar Pradesh	220.23	-	-	-	-	328.02
Note: C2 Cost						

Source: India, Directorate of Economics & Statistics.

How competitive is India in the production of wheat? The results of a study (Naik 1999) are presented in Table 6.5. Domestic Resource Cost (DRC) analysis is used in evaluating the international competiveness of wheat production in India. A coefficient less than one indicates that the production is internationally competitive. The results show that wheat production in the major wheat producing states in the country is internationally competitive with a good margin (U.P. was not included in this study). This includes the states of Punjab, Haryana and Rajasthan which are competitive in all the years. Madhya Pradesh and Gujarat are not competitive in some of the years. The competiveness has eroded somewhat between 1995/96 and 1998/99 mainly due to changes in the international price but Punjab, Haryana and Rajasthan remain competitive.

Table 6.5: Competitiveness of Indian Wheat Production: Estimated Domestic Resource Cost Coefficients for Wheat				
State	1995/96	1996/97	1997/98	1998/99
Haryana		0.5295	0.6333	0.7609
Gujarat	0.6828		0.8410	1.0178
Madhya Pradesh		0.8884	1.0682	1.2921
Punjab		0.5127	0.6090	0.7362
Rajasthan	0.5052		0.6872	0.8405

Source: Naik (1999).

7. Demand and Consumption

The consumption of wheat in India is surveyed periodically by the National Sample Survey Organization (NSS) and the latest NSS data available is form the survey in the year 1993/94. Table 7.1 gives the data of cereal consumption for the rural areas against the total consumer expenditure by population deciles. Figure 7.1

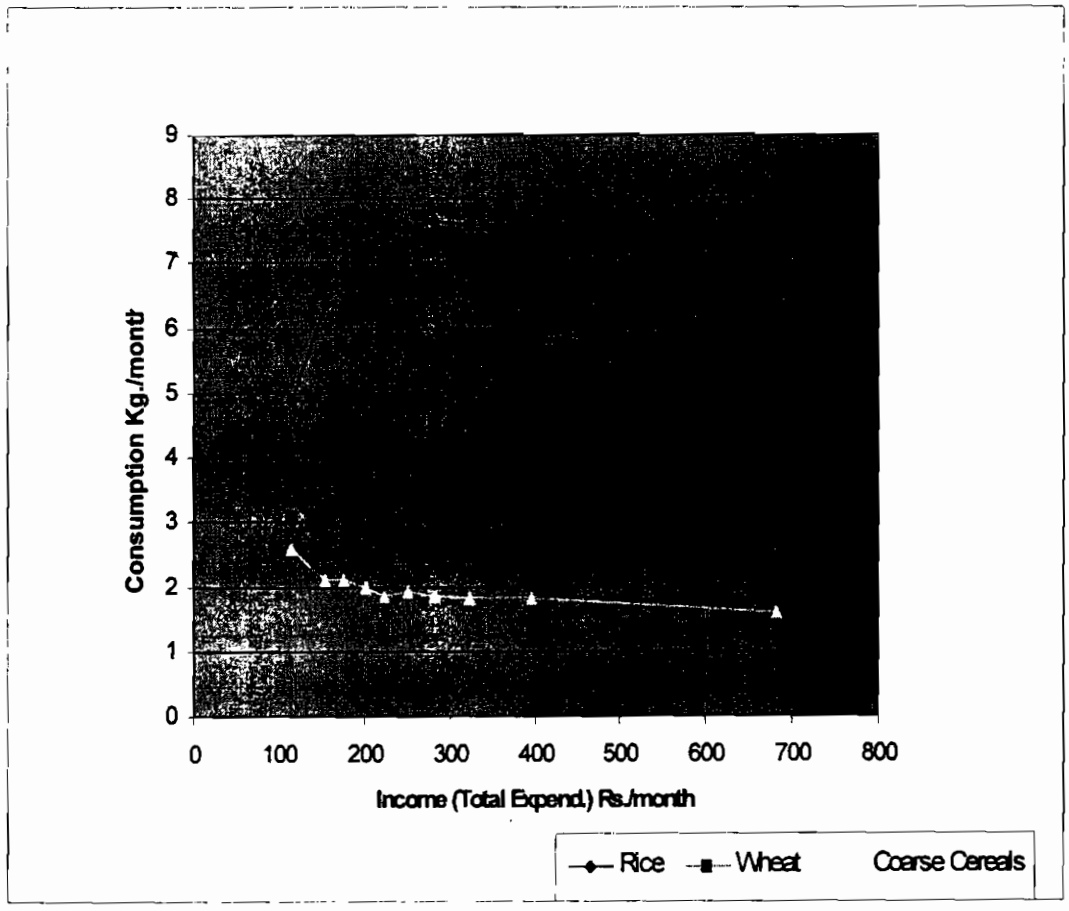
provides a graph plot of the consumption of rice, wheat and coarse cereals against the total consumer expenditure, which is frequently used as a proxy for income.

Table 7.1: Average Percapita Total Consumer Expenditure and Cereal Consumption per Month in Rural Areas, NSS 1993/94

Decile	Popul Shares Upper Limit	Total Expend Rs/M	Rice Consm Kg/M	Wheat Consm Kg/M	Coarse Cereal Consm. Kg/M	Total Cereal Consm. Kg/M
1	10	116.22	4.89	3.06	2.58	10.53
2	20	155.05	6.38	3.52	2.12	12.02
3	30	177.84	7.03	3.55	2.11	12.69
4	40	202.05	7.5	3.72	1.98	13.2
5	50	224.84	7.43	4.07	1.86	13.36
6	60	250.73	7.55	4.3	1.93	13.78
7	70	283.65	7.67	4.56	1.87	14.1
8	80	325.3	7.6	5	1.83	14.43
9	90	396.77	7.01	5.76	1.84	14.61
10	100	681.55	7.22	6.44	1.6	15.26

Source: Joshi (1998).

Figure 7.1 Percapita Consumption and Income Levels (NSS 1993/94) Rural



Source: Joshi (1998).

The Table and Figure show that the consumption of wheat and rice rises with income whereas the consumption of coarse cereals falls. The consumption of rice rises to a level and then tapers off. The consumption of wheat starts at a lower level but continues to rise as incomes rise, indicating a more buoyant demand with income growth. Thus, the three different cereal types show quite different consumption behaviour in relation to income, and wheat shows a sustained rise with income.

Table 7.2 compares the average consumption of cereals in rural and urban areas based on NSS 1993/94 data. These populations differ and need to be differentiated. The Table shows that the average total cereal consumption in urban areas is lower than in the rural areas. Whereas the coarse cereal consumption declines sharply from 1.98 to 0.63 kg/month, the rice consumption also declines considerably from 7.02 to 5.28 kg/month. However, the wheat consumption increases from 4.40 to 4.72 kg/month. This indicates that urbanization leads to a lower total cereal consumption but higher wheat consumption.

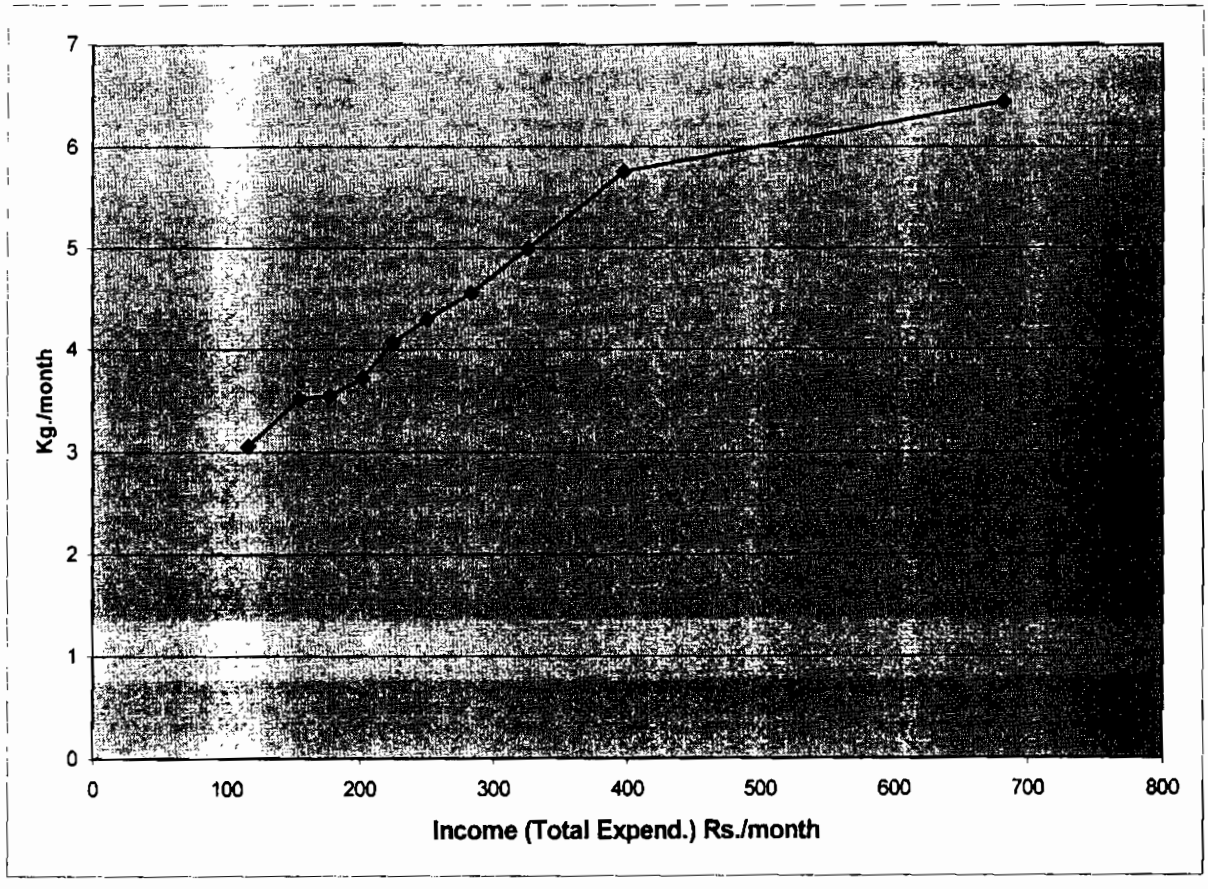
Table 7.2: Average Cereal Consumption in Kilograms per month in the rural and urban areas, NSS 1993/94

	Consumption in Kg. Per month			
	Rice	Wheat	Coarse Cereals	Total Cereals
Rural	7.02	4.40	1.98	13.40
Urban	5.28	4.72	0.63	10.63

Source: Joshi (1998).

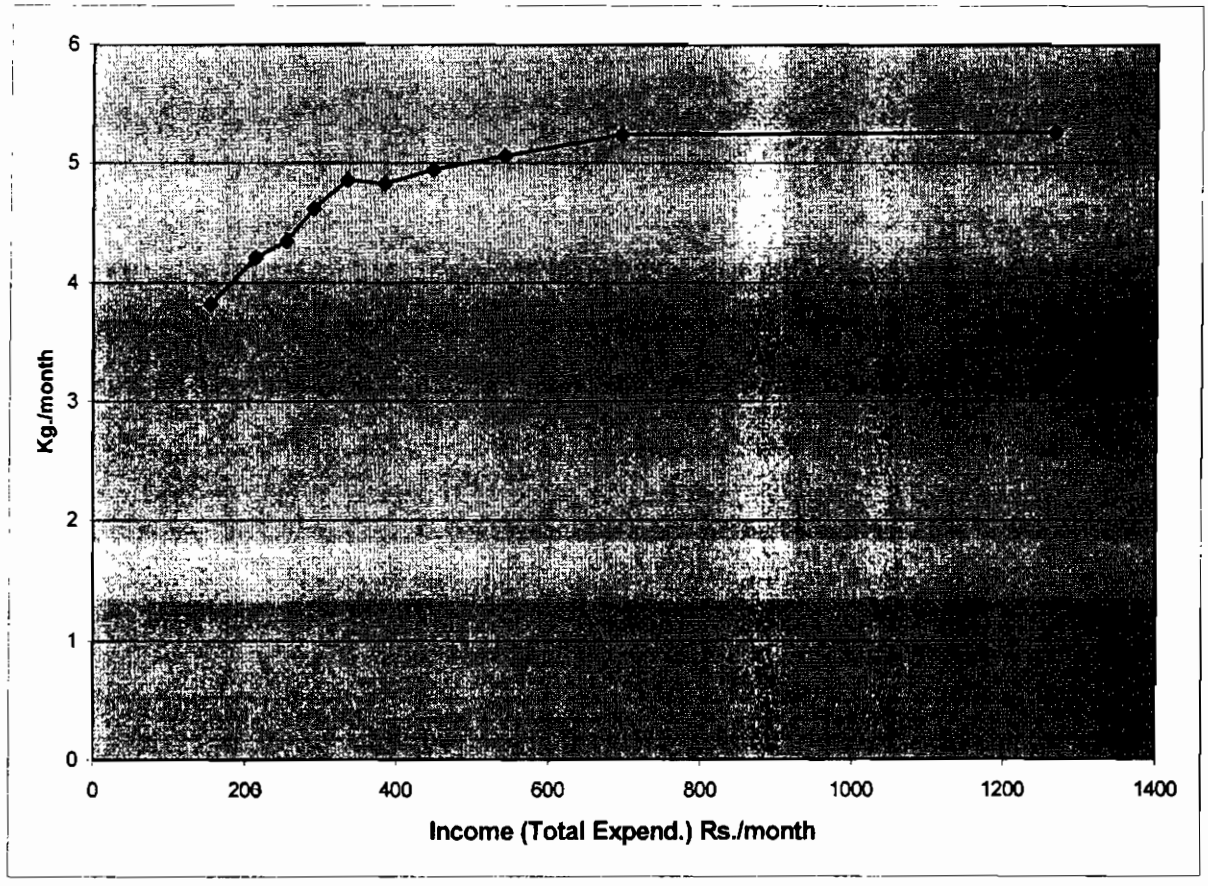
Figure 7.2 gives the profile of the wheat consumption in the rural areas over the total expenditure (income) levels. Figure 7.3 gives the same for the urban areas. The figures show that in the rural areas the wheat consumption rises significantly with income levels. Thus, higher incomes in the rural areas will lead to greater wheat consumption. In the urban areas too the rise is there but not as much. However, as indicated earlier, the average consumption is higher in urban than in rural areas.

Figure 7.2 Wheat Consumption per capita across Income Levels, Rural
(NSS 1993/94)



Source: Joshi (1998).

Figure 7.3 Wheat Consumption per capita across Income Levels, Urban (NSS 1993/94)



Source: Joshi (1998).

Engel curves of the following form were estimated to obtain the income elasticities of demand:

LOG(CONSUM) = a + b * LOG(INCOME) + e

Where:

CONSUM	= Wheat consumption in kg/month
INCOME	= Total consumer expenditure in Rs./month
a, b	= Parameters to be estimated.
b	= income elasticity of demand
e	= error term

The equation was estimated using regression analysis. The results are given in Table 7.3. The results show that both equations have a reasonably good fit. The income elasticity of demand works out to be much higher at 0.4561 for the rural areas as compared to that for urban areas which works out to 0.1540. Both are statistically significant. The elasticities indicate that the wheat consumption would rise significantly with income growth. Figures 7.2 and 7.3 given earlier show that the demand growth would be sharper if incomes of the lower deciles of the population i.e. the poor rises significantly. Poverty alleviation, particularly in the rural areas, would have large effect on wheat demand.

Table 7.3: Regression Estimates of Engel curve for Wheat

Equation	LOG(INCOME) Coefficient = Elasticity	t-statistic	Significance	Adj.R Squared	F
Rural	0.4561	16.208	***	0.97	262
Urban	0.1540	6.303	***	0.81	40

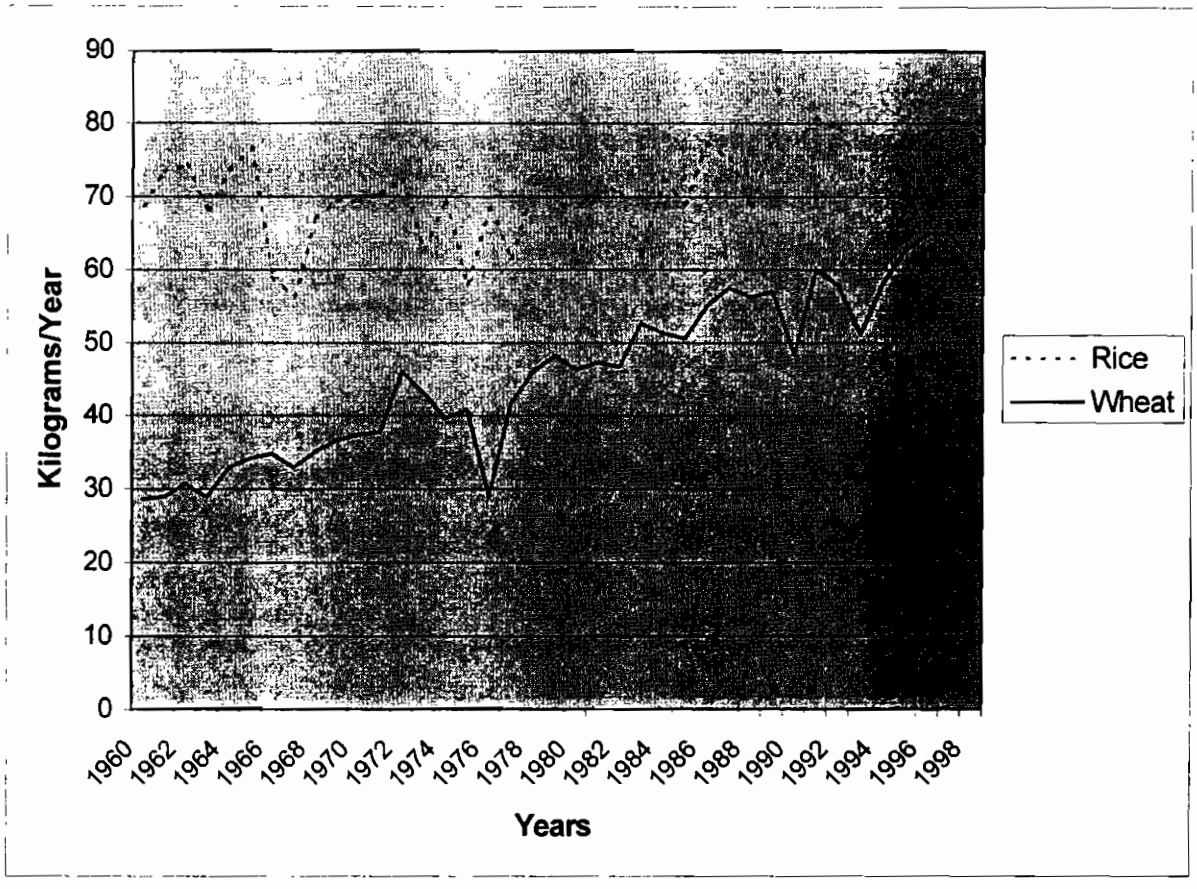
Table 7.4 gives the estimates of a figure called the per capita availability of food grains (rice and wheat) calculated by the government. This actually is an estimate of the human consumption of foodgrains and is calculated taking into account the production, use in seed and feed, wastage, imports, exports, and increase/decrease in the public food grain stocks. It seeks to estimate the "disappearance" for human consumption. Private and consumer stocks are not taken into account and therefore there are errors involved.

Table 7.4: Percapita Availability of Wheat and Rice in Kg/Year		
Year	Rice	Wheat
1960	68.8	28.6
1970	69.4	37.4
1980	60.8	46.4
1990	77.4	48.4
1991	80.9	60.0
1992	79.2	57.9
1993	73.4	51.2
1994	75.7	58.2
1995	84.7	62.8
1996	77.4	65.0
1997	80.7	65.0
1998	79.6	61.4

Source: India, Directorate of Economics & Statistics, and Fertilizer Association of India.

The estimates indicate that both rice and wheat consumption have increased but the wheat consumption has increased considerably more. Wheat consumption was 28.6 kg/year per capita in 1960 and from this it has increased to 48.4 kg/year in 1990 and about 65 kg/year in the late 90's. Figure 7.4 which gives the time-series also shows that whereas the rice consumption has not changed much, the wheat consumption has increased considerably with a clear upward trend. The estimates show considerable fluctuations. These supply-accounting based estimates are however sometimes relied on more than the sample survey NSS consumption estimates.

Figure 7.4 Percapita Availability of Wheat and Rice



Source: India, Directorate of Economics & Statistics, and Fertilizer Association of India.

8. Future Scenario

The analysis in this paper shows that the wheat demand is likely to grow rapidly with the population and income growth, and more rapidly than that of other cereals. The production is facing limits and barriers and will be hard pressed in meeting the demand. Analysis indicates that depending on the rate and nature of economic growth, a 4 to 5 percent annual rate of growth in the demand for wheat is likely in the near future, given the population growth and the income elasticity of demand. Wheat production may be expected to grow at about 2 to 3 percent per year considering the various constraints. Thus, a demand-supply gap is likely to open at a rate of about 1 to 3 percent per year. This would mean a gap of about 0.7 to 2.1 million tons of wheat per year in the near future and growing larger in the later years.

Recent IFPRI projections (IFPRI 1999) also indicate that depending on the outcomes on the development front, significant gaps are likely to emerge between the cereal demand and supply in India. The outcome will depend substantially on the rate and nature of economic development in India. Good performance in economic development will lead to a deficit whereas slow economic development will lead to a surplus. Promoting rapid economic development which includes the poor and particularly the rural poor will lead to growth in demand and a substantial expansion in trade opportunities in wheat as well as other agricultural commodities.

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