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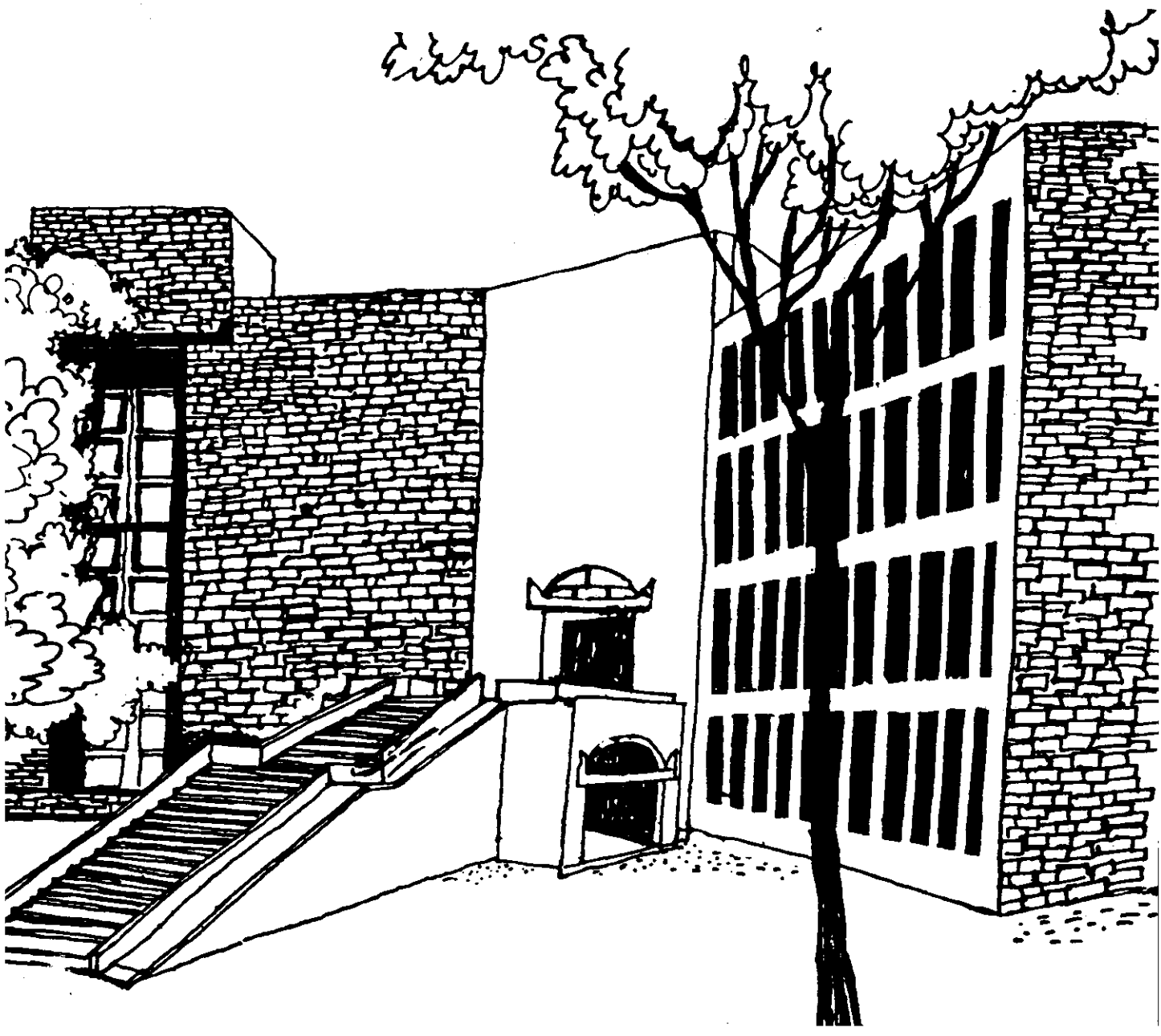

COARSE CEREALS IN INDIAN AGRICULTURE

A REVIEW OF PERFORMANCE AND PROSPECTS

by

T. M. Gajanana

Abstract

Emerging imbalances in Indian agriculture reflected in the differences in production performance of different crops are now well recognised. One of the causes of these uneven agricultural situations is the relatively poor performance or complete stagnation of the important coarse cereals.

Coarse cereals are the staple diet of millions of peasants and labourers. Not only are these cereals cultivated under rainfed conditions but they are also grown in drought-prone areas. Consequently, their production is subject to violent fluctuations. Coarse cereals constitute about 22 per cent of production and 38 per cent of area under cereals. The proportion of these cereals has been declining over the years and the yields of these crops are quite low. Growth rate analysis indicates that the performance of coarse cereals has not at all been satisfactory particularly after the major technological breakthrough in Indian agriculture during the mid 60s. In this paper an attempt has been made to analyse the performance of coarse cereals and to identify the constraints hindering the growth of these cereals. Policy options are suggested to overcome the constraints and to bridge the burgeoning supply-demand gap in the availability of these cereals.

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A REVIEW OF PERFORMANCE AND PROSPECTS

T.M. Gajanana*

Indian agriculture has witnessed significant quantitative and qualitative changes over the last two decades. Whether these changes are impressive or not, the changes have been generally observed to be uneven both in terms of regions and crops. While there has been a dramatic improvement in area and production of superior cereals, rice and wheat, it is not so in case of coarse cereals such as jowar, bajra, maize, ragi (finger millet), barley and other small millets.

Coarse cereals are the staple diet of millions of peasants and labourers. In India, more than 70 per cent of the area is rainfed and major portion of this area is frequently visited by drought. The production of coarse cereals is confined mostly to such drought-prone areas.

Coarse cereals constitute 31 per cent of the area under and 20 per cent of production of foodgrains. Among cereals, coarse cereals' area is about 38 per cent while their production share is 22 per cent (Appendix I). Production of coarse cereals is concentrated in the states of Gujarat, Maharashtra, Karnataka, U.P., M.P., Rajasthan, A.P. and Tamil Nadu, majority being

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drought-prone states. While Maharashtra, Karnataka, A.P. and M.P. are predominantly jowar growing areas, Gujarat and Rajasthan produce major portion of bajra. Karnataka has hegemony in the production of ragi in India (Appendix II). In these states coarse cereals account for two-third of the cereal consumption in rural areas and one-third in urban areas.

Coarse cereal consumption is concentrated in Rajastan, Maharashtra, Karnataka and Gujarat which are the major coarse cereal producing areas. In these states, share of coarse cereals in total cereal consumption ranged between 51 per cent(Rajasthan) and 70 per cent(Gujarat) in rural areas. In urban areas, the share of coarse cereals ranged between 37 per cent in Gujarat and 45 per cent in Karnataka. All these suggest that consumption of coarse cereals is mostly confined to areas where they are grown thereby indicating the presence of limited movement of these cereals from their production point. This also implies that slow growth of these cereals in the respective areas adversely affects both the consumers and producers.

National Sample Survey (NSS) data show that of the total cereal consumption by the poor, coarse cereals accounted for 46 per cent in rural areas and 36 percent in urban areas against 32 and 11 per cent for those above the poverty line in the respective areas. This speaks of the importance of the coarse cereals for the lower income households. Studies by NCAER showed negative income elasticity of demand for coarse cereals (see

Bapna(1976)].

Over the years, the proportion of area and production of coarse cereals in total cereals as well as foodgrains has been declining and growth of area, production and yield of these crops has been either slow or stagnant. The situation is especially true after the green revolution of mid sixties with rice and wheat taking away the major chunk of benefits of green revolution leaving the coarse cereals far behind. Keeping the above in view, this paper examines the constraints hindering the growth of these crops. Further, it identifies the supply- demand gap by the turn of the century. Finally, the paper draws certain conclusions and suggests certain policy options to overcome the constraints and to bridge the supply-demand gap.

Performance of Coarse Cereals

Area and production share of coarse cereals vis-a-vis rice and wheat - Temporal analysis : As can be seen from Table 1a. the proportion of coarse cereals in total area under foodgrains declined from 39 per cent during 1950-51 to 31 per cent during 1985-86 while there has been a spectacular increase in the area share of wheat which increased to 19 per cent from a mere 10 per cent between 1950-51 and 1985-86. Rice maintained its share at around 32 per cent over the years. On the production front, the contribution of coarse cereals was around 38 per cent during 1950-51 and it declined to 28 per cent during 1970-71 and thereafter to 20 per cent in 1985-86. While there was no

Table 1a : Distribution of Total Cropped Area Under Foodgrains
(per cent)

Crops/Groups	1950-51	1960-61	1970-71	1980-81	1983-86 average
Rice	31.7	29.5	30.2	31.7	32.2
Wheat	10.2	44.2	14.7	17.6	18.7
Coarse cereals	38.7	36.9	37.0	33.0	31.3
All cereals	80.4	79.6	81.9	82.3	81.8
All pulses	19.6	20.4	18.1	17.7	18.2
All foodgrains	100	100	100	100	100

Table 1b : Contribution of Crops in Total Production of Foodgrains
(per cent)

Rice	40.5	42.2	38.9	41.4	40.7
Wheat	12.7	13.4	22.1	26.4	30.7
Coarse cereals	30.3	28.9	28.2	22.4	20.3
All cereals	83.5	84.5	89.1	91.8	91.7
All pulses	16.5	15.5	10.1	8.2	8.4
Total foodgrains	100	100	100	100	100

Source:Economic Survey, 1987-88

Table 2a :Proportion of Different Cereals in Total Cereal Area

(per cent)

Cereals	1950-51	1960-61	1970-71	1980-81	1983-86 average
Rice	39.58	37.09	36.93	38.47	39.18
Wheat	12.46	14.05	17.72	21.38	22.65
Jowar	19.90	20.01	17.07	15.17	15.30
Bajra	11.54	12.46	12.69	11.19	10.43
Maize	4.08	4.79	5.75	5.76	5.57
Other cereals	12.64	11.60	9.64	8.03	6.87
Coarse cereals	48.16	48.86	45.15	40.15	38.17
Superior cereals	51.84	51.14	54.85	59.85	61.83
Total cereals	100	100	100	100	100

Table 2b : Contribution of Different Cereals in Total Ceral Production

(per cent)

Rice	48.51	49.88	43.71	45.08	44.45
Wheat	15.24	15.87	24.67	30.52	33.23
Jowar	12.96	14.16	8.39	8.77	8.15
Bajra	6.12	4.74	6.31	4.49	4.25
Maize	4.08	5.89	7.75	5.85	5.67
Other cereals	13.09	9.46	7.17	5.29	4.23
Coarse cereals	36.25	34.25	31.62	24.40	22.30
Superior cereals	63.75	65.75	68.38	75.60	77.70
Total cereals	100	100	100	100	100

Source : Economic Survey, 1986-87, 1987-88 and 1988-89.

significant increase in the share of rice there was a marked improvement in the share of wheat which increased from 13 per cent to 22 per cent and then to 31 per cent during the said periods. Production of cereals as a whole nevertheless increased during this period [Table 1b].

The share of coarse cereals in total cereals is no different from their position in total foodgrains. It is evident from Table 2a. that wheat gained heavily in area while coarse cereals as a whole lost throughout. A disaggregated look at coarse cereals indicates that while jowar and bajra declined, there was a marginal increase in case of maize. Other coarse cereals declined sharply. As regards production, wheat recorded a two fold increase in its share while coarse cereals as a whole experienced a 14 per cent decline between 1950-51 and 1985-86. Superior cereals have increased their share from 64 to 78 per cent between these periods. The major share of this increase has come from the phenomenal increase in the share of wheat [Table 2b].

Composition of coarse cereals

Among coarse cereals, jowar, bajra, maize and ragi are important. A perusal of Table 3 indicates that maize has made some big strides over the years and there has been a two fold increase in its share while other minor millets have either lost their share or maintained the same position. Jowar is the major contributor to coarse cereals followed by bajra and ragi. Minor

millets experienced a three fold decline in their share over the years.

Table 3 : Composition of Coarse Cereal Production (%)

Crop	1950-51	1960-61	1970-71	1980-81	1985-86
Jowar	36	38	31	39	37
Bajra	16	15	23	17	19
Maize	12	18	22	22	25
Ragi	9	8	8	9	9
Other minor millets	27	21	16	13	10
All coarse cereals	100	100	100	100	100

Source : Fertiliser Statistics, 1986-87

Trends in yields of coarse cereals

It may be seen from Table 4 that the yields of all the cereals were low during 1950-51 and over the years, yields have improved. It is to be noted that after the mid sixties yields of rice and wheat have improved considerably presumably because of the green revolution. But the same was not true of other cereals. Yields of jowar and bajra were almost half and one thirds respectively of the yields of wheat.

Coarse cereals are generally grown in semi-arid and arid regions of the country and as such their yields are much low as compared to rice and wheat which are mostly cultivated under favourable (irrigated) conditions. However, coarse cereals have the advantage of doing reasonably well in areas where rice and wheat would not grow at all and if grown would give uneconomic yields.

Table 4 : Trends in Yields of Coarse Cereals in relation to Rice and Wheat (kg/ha.)

Crops	1950-51	1960-61	1970-71	1980-81	1983-84	1985-86
Rice	668	1013	1123	1336	1457	1552
Wheat	663	881	1307	1630	1843	2046
Jowar	353	533	466	660	725	633
Bajra	288	286	622	458	653	344
Maize	547	926	1279	1159	1352	1146
All cereals	542	753	949	1142	1296	1323

Source : Economic Survey, 1989-90

Performance of Coarse Cereals : Growth Rate Analysis

Another way of looking at the performance of coarse cereals is through growth in area, production and yield. Growth rates before and after green revolution would be interesting as it would throw light on as to whether green revolution had any impact on cereals, and if so, where the effect is felt most, and whether coarse cereals had any benefits from this revolution etc. Therefore, compound growth rates (CGR %) were compared both across the crops and across the periods. The entire period is divided into two sub periods viz. pre-green revolution period (1949-50 to 1964-65) and post- green revolution period (1967-68 to 1986-87). Table 5 presents the CGR (%) of area, production and yields of foodgrains during these periods.

Pre-green revolution period (1949-50 to 1964-65)

This was a period preceding the introduction of HYVs. During this period, rice, wheat, maize and ragi recorded more than 3 per

Table 5 : Compound Growth Rates in Area, Production and Yield of Foodgrains in India

(per cent)

Crops	Pre G.R.Period (1949-50 to 1964-65)			Post G.R.Period (1967-68 to 1986-87)			Aggregate Period (1949-50 to 1986-87)		
	A*	P	Y	A	P	Y	A	P	Y
Rice	1.33	3.49	2.13	0.63	2.54	1.93	0.83	2.52	1.61
Wheat	2.68	3.99	1.27	2.23	5.48	3.17	2.67	5.95	3.2
Jowar	0.99	2.5	1.5	-0.65	1.24	1.9	-0.21	1.19	1.4
Bajra	1.08	2.34	1.24	-0.79	0.15	0.56	0.21	1.74	1.55
Maize	2.66	3.87	1.16	-0.08	0.98	1.07	1.65	2.51	0.85
Ragi	0.84	3.08	2.22	0.19	2.03	1.84	0.17	1.71	1.54
Small millets	-0.3	-0.2	-0.09	-2.31	-2.2	-0.11	-1.03	-1.22	-0.19
Barley	-0.64	-0.28	0.36	-4.74	-3	1.81	-2.39	-1.03	1.39
Coarse cereals	0.9	2.23	1.29	-0.92	0.44	1.32	-0.07	1.28	1.21
Total cereals	1.3	3.24	1.66	0.28	2.9	2.19	0.76	2.98	1.86
Total pulses .	1.9	1.39	-0.22	0.44	0.68	0.32	0.32	0.34	0.19
Total foodgrains	1.41	2.93	1.43	0.31	2.76	2.32	1.86	2.97	1.15

Source: India Data Base.1990.

*A = area, P = production and Y = yield.

cent growth in production while jowar and bajra experienced less than 3 but more than 2 per cent growth. Barley and small millets had a negative growth rates of around 0.2 per cent. Coarse cereals production grew at 2.23 per cent while cereals as a whole had 3.24 per cent growth which may be largely due to the growth rates of superior cereals, and ragi and maize. The production growth of foodgrains as a whole was around 3 per cent. As regards area, all the coarse cereals barring barley and small millets experienced positive growth and the coarse cereals as a whole grew at an annual rate of 0.93 per cent. Maize and wheat had relatively high growth rates in area. The yield rates of growth were in the range of 1 to 2 per cent. Ragi and rice fared well in respect of yield. On the whole, during this period, the performance of coarse cereals was almost on par with the performance of foodgrains as a whole and there were instances of ragi and maize overtaking the superior cereals. Thus, there was not much disparity in the growth rates of superior and coarse cereals before the introduction of HYVs.

Post-green revolution period (1967-68 to 1986-87)

Late 60s saw some breakthrough in technology in respect of crops and regions with assured irrigation facilities. Wheat being the irrigated crop, cornered the major chunk of benefits of this technological breakthrough. As is evident from Table 5, wheat registered a spectacular growth of 5.5 per cent in production and, 2.2 and 3.2 per cent in respect of area and yield. There was

a positive growth in production of all the cereals (but of smaller magnitudes as compared to pre-green revolution period) except barley and small millets . Ragi has slightly improved largely because of the yield advantage it had during this period. But its area growth has not at all been satisfactory. In fact, almost all the coarse cereals started showing a declining tendency in area with barley assuming an alarming proportion of 4.74 per cent decline. Small millets also had a negative growth of more than 2 per cent which clearly had an impact on the growth rate of area under coarse cereals as a whole. Jowar fared slightly better in respect of yield as compared to pre-green revolution period. Production growth of cereals was relatively low perhaps due to lower growth rates of coarse cereals. In most of the cases, negative area growth far outweighed the positive growth rates achieved in yield and resulted in growth rates of smaller magnitudes in production of these cereals. Thus, it can be said that deceleration of coarse cereals started after the major technological breakthrough has been achieved in case of cereals confined to well-endowed regions and crops.

Aggregate period (1949-50 to 1986-87)

During the last 35 years or so, production of foodgrains grew at 2.97 per cent and cereals as a whole at 2.98 per cent per annum. A spectacular increase was witnessed in case of wheat which grew at 6 per cent per annum while excepting for maize and bajra, growth rate of coarse cereals was very low and the growth was negative in case of barley and small millets.

Joshi and Agnihotri (1984) observed that the production performance of major coarse cereals was not at all satisfactory even in the major producing states due either to declining area or diminishing productivity. In case of bajra, while the decline in area resulted in slow growth of this crop in Gujarat, U.P. and M.P., it was the marked decline in the productivity of bajra that was responsible for its unsatisfactory performance in Karnataka, Rajasthan, Haryana and Maharashtra which together account for more than 60 per cent of area under this crop.

As regards jowar, the production performance was slow in M.P. U.P., Rajasthan and Haryana, and in case of area, all the jowar growing states presented a dismal picture of negative growth rates. Though there was a gain in productivity of jowar in Karnataka and Gujarat, yet this was more than offset by its declining area growth.

Production of ragi is largely confined to Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra. Karnataka alone produces more than 40 per cent of the total production of ragi in India. While analysing the performance of ragi in Karnataka, Charan (1984) observed a decline in the growth during 1964-65 to 1981-82 which was the period during which HYVs were introduced. He found that the cause of this decline was the considerable decline in the area under this crop. The case of ragi in other states also was discouraging. Joshi and Agnihotri (1984) also observed this trend for the period 1970-71 to 1981-82. Charan (1984) observed a totally depressing situation for small millets. While acreage

deceleration was observed in almost all the millet growing states, yield growth was not at all satisfactory in A.P. and M.P. Coarse cereals, thus, present a dismal picture especially after the green revolution.

Table 6: Nutrient Contents of Foodgrains

Foodgrains	Energy (Kilo calories per 100 g)	Protein (g/100g)	Minerals (g/100g)
Rice(raw boiled)	345	6.8	0.6
Wheat(whole)	346	11.8	1.5
Jowar	349	10.4	1.6
Bajra	361	11.6	2.3
Maize(dry)	342	11.1	1.5
Ragi	328	7.3	2.7

Source : Gopalan, C., B.V. Rama Sastry and Balasubramanian,1977. Nutritive value of Indian Foods, National Institute of Nutrition, Hyderabad.

Results of Table 6 indicate that in terms of calorie content, coarse cereals are as good as rice and wheat, and as far as protein content is concerned they are at least better than rice. In terms of mineral content they are richer than wheat. All these suggest that the nutrient content has nothing to do with the production performance of coarse cereals. Obviously, then the question arises as to what are the major constraints hindering the growth of coarse cereals. Attempts to identify the constraints have been made by Jodha(1973), Jodha and Singh (1982), Charan (1984), Nadakarni (1986) and others. A discussion of these constraints is in order.

1. Coarse cereals are crops of moisture deficient areas or they are poor resource base crops

The geographical distribution of coarse cereals suggests that they are basically crops of moisture deficient areas. Major portion of coarse cereal production as well as area comes from the drought-prone states like Maharashtra, Rajasthan, Gujarat, Karnataka, Madya Pradesh and Andhra Pradesh.

As can be seen from Table 7 hardly 5-6 per cent of the area under jowar and bajra was irrigated and in case of maize, it was around 20 per cent. There has not been any appreciable increase in the proportion of the coarse cereals area being irrigated over the years. Not only is the irrigated area low but also use of

Table 7 : Irrigated and HYV Area under Crops (%)

Crops	1970-71	1975-76	1981-82	1985-86	1986-87
Superior Cereals					
Rice	37 (20)	39(32)	42(48)	42(57)	43(58)
Wheat	55 (41)	62(46)	70(76)	75(83)	77(83)
Coarse Cereals					
Jowar	4.4(4)	4.9(12)	3.8(28)	4.6(38)	4.8(34)
Bajra	3.7(15)	5.1(25)	5.9(39)	5.4(47)	5.7(33)
Maize	14 (8)	16(19)	19(27)	18(31)	21(37)

Note: Figures in parentheses are area under HYV.
Source : Economic Survey, 1989-90

other inputs like fertiliser, plant protection chemicals is low in these crops. Jodha and Singh (1982) found that up to 80 per cent of the coarse grain crops were planted on inferior soils in the coarse cereals dominant areas of Maharashtra and A.P. They also observed that water, fertiliser and manure were

applied in small quantities on these plots. Even the application of bullock and human labour on these plots was found to be very low and as such intensive management practices were much less in coarse cereals.

Coarse cereals are capable of yielding at least some returns even under the most adverse environmental conditions. This characteristic of these crops may have encouraged the farmers to concentrate on regions or even plots characterised by natural deficiencies (low soil fertility and moisture scarcity)[1].

2. Low and slow adoption of technology and backlash effects of HYV

It may be seen from Table 7 that rice and wheat have larger area under HYV and the increase in area under HYV has been substantial in both the crops over the years. In 1986-87, wheat has an area of as high as 83 per cent and rice more than 50 per cent under HYV. This phenomenon may be attributed to the larger area under irrigation under these crops.

Technological breakthrough has not totally bypassed the coarse cereals. The adoption of HYV has been, however, low and slow. At present, coarse cereals have an area of over 30 per cent under HYV. Several HYVs have been evolved in case of jowar (SPH 61, CSH 9, HC 136, VCC 226, Deccan Hybrid, VU 27, SPV 235, J 370 and CSV 7), bajra (BJ-104, HB-4, PHB 47, BK 560, BS 104, BD 763, DC 3, MH 65), and ragi (IE 28, I 11, EC 4840, VL 101, IMDOS 5, PR 202, HR 919, HES 176 and Indaf series) with potentiality to yield

nearly 3 to 7 times more than the traditional varieties. However, most of the varieties are location specific and are susceptible to pests and diseases. For example, HB-4 is a HYV of bajra but is highly susceptible to ergot/sugary disease and in case of jowar, grain mould, charcoal rot, rust and foliar diseases pose threats. Maize is faced with the problems of downy mildew, rust and foliar diseases. Ragi being self pollinated crop, breeders have not been able to evolve any hybrid variety so far and Indaf-8 (HYV) though yields more than 3 times the local variety, it is advisable only under irrigated conditions. It was also observed that the fodder content of the HYVs is much less as compared to traditional varieties. It was reported by Rajpurohit (1975) that the fodder grain ratio of local jowar and bajra was as high as 3:1 and 2:1 respectively while it was only 0.5:1 in case of HYVs.

Thus, sensitivity to pests and diseases, and lower fodder contents are some of the backlash effects of HYVs. Since the coarse cereals are by and large grown in dry areas where livestock enterprises provide substantial income to the farmers, the fodder content of the variety becomes the major determining factor in its adoption. Fodder content in HYVs is relatively less and their adoption has been slow. Resource constraints of the farmers and risk of loss under uncertain moisture conditions were attributed to low and slow adoption of inputs like improved seeds, fertilisers and plant protection chemicals (which involve huge outlay) which are essential pre-requisites for seed or crop centered technologies (HYVs).

3. Coarse cereals are high risk crops

Higher risk associated with the production of coarse cereals is considered to be one of the constraints in the growth of these crops. Table 8 gives an indication of instability in coarse cereal production measured in terms of coefficient of variation(%), probability of failure and crop-loss ratio.

Table 8 : Instability Indices of Coarse Cereals Production in relation to Rice (1965-81)

Crops	Coefficient of variation(%)	Probability of crop failure	Crop-loss ratio
Rice	12.62	0.38	3.41
Jowar	17.83	0.44	4.06
Bajra	22.77	0.50	5.05
Ragi	19.78	0.56	4.15

Source: Joshi and Agnihotri (1984)

The coefficient of variation was higher for coarse cereals as compared to rice. Further, chances of crop failure are more in case of coarse cereals vis-a-vis rice. While the probability of crop failure was around 0.5 for coarse cereals, it was 0.4 for rice. This is further supplemented by the higher crop-loss ratio for coarse cereals than rice. These figures indicate that production of coarse cereals is risky and hence may lead us to conclude that because of the riskiness, the performance of these crops has not been satisfactory[2].

4. Coarse cereals are subsistence crops

Coarse cereals are grown as a part of subsistence farming

where they are produced and are mostly consumed by the poor farmers. As such these crops are grown to meet the family food and animal feed requirements alone and sufficient care is usually not taken by the farmers since these crops are not produced for the market. The cultivation of coarse cereals is sometimes pushed to marginal and sub-marginal lands[3].

5. Coarse cereals are low value and low status crops

Coarse cereals have been branded as inferior cereals on the ground that they are mostly produced and consumed by poor people having low standard of living and also because of the considerably low returns that these cereals fetch. Jodha and Singh (1982) observed that the small farmers preferred coarse cereals to superior cereals because of the low paid

Table 9 : Ratio of Returns from Coarse Cereals to Returns from Rice

States	Jowar	Bajra	Ragi
A.P.	0.32	0.35	0.55
Gujarat	0.58	0.92	-
Haryana	-	0.20	-
Karnataka	0.45	0.19	0.62
Maharashtra	0.53	0.31	0.95
Rajasthan	0.37	0.23	-
Tamil Nadu	0.49	0.45	0.74

Source : Joshi and Agnihotri,op.cit. P 332

out costs. It may be seen from Table 9 that in majority of the cases, the per hectare return ratio was less than 50 per cent and it was heavily in favour of rice. This indicates that the per hectare returns from coarse cereals are less

than 50 per cent of the returns from rice cultivation[4]. This low relative profitability is identified as yet another strong enough factor for slow growth of these cereals.

6. Limited demand or market for coarse cereals

The low value status of coarse grains is inherent in the nature of the demand for these crops itself. Coarse cereals are mostly consumed in the areas where they are grown and they constitute the staple diet of majority of the poor farmers. Demand for these cereals is largely confined to rural areas and some urban areas of poor consumers.

The superior cereals have an edge over coarse cereals in respect of quality of markets. The markets for these cereals are mostly regulated and are better organised. Wheat and rice occupy an important place in the procurement operation of Food Corporation of India (FCI) feeding the public distribution system(PDS). During the triennium ending 1988-89, the total procurement of foodgrains was 16422 million tonnes. Rice and wheat together accounted for more than 99 per cent of the total procurement and these two crops constituted over 99 per cent of the total stock of 12117 million tonnes. Coarse cereals formed less than 1 per cent both of procurement and stock. The small quantities of production and higher procurement costs act as constraints to large scale procurement. Poor keeping quality of these cereals adds another dimension to the problem.

It may be seen from Table 10 that procurement prices have

been increasing over the years and until 1981-82, growth in prices of coarse cereals has been at par with rice. If price has been any incentive then the growth in coarse cereals should have

Table 10 :Procurement Prices of Coarse Cereals, Rice and Wheat (Rs./q)

Year	Coarse Cereals	Rice	Wheat
1971-72	55	47	76
1976-77	74	74	105
1978-79	85	85	112.5
1980-81	105	105	117
1981-82	116	115	130
1982-83	118	122	142
1984-85	130	137	152
1985-86	130	142	157
1986-87	132	146	166
1987-88	135	150	166
1988-89	145	160	173
1989-90	165	185	183

Source : Economic Survey,1987-88,1989-90

been satisfactory. Instead, we observed a rather discouraging situation for coarse cereals. This is to suggest that prices have only a limited role to play in enhancing the production of coarse cereals.

7. Price variability in coarse cereals

Coarse cereals have major disadvantage in the form of relative instability in prices. It may be seen from Table 11 that annual increase in prices of coarse cereals has been relatively low (less than 5%) while other cereals and foodgrains as a whole recorded more than 5 per cent increase. As regards variability in prices, coarse cereals appear to be more unstable

Table 11 : Behaviour of Wholesale Prices of Foodgrains

Crops	Annual increase(%)	Coefficient of variation around the trend (CVt)
Coarse cereals	4.95	15.85
Rice	6.80	11.67
Wheat	5.22	10.78
All cereals	6.12	12.16
All foodgrains	6.55	10.29

Source : Nadakarni(1986).

than other cereals. However, it is to be noted that between price and yield, the latter has been the major determining factor in obtaining the differential rates of return from these crops[5].

Availability of Coarse Cereals

Per capita availability of coarse cereals has been declining over the years. As can be seen from Table 12, during 1960-61 the

Table 12 : Per Capita Availability of Coarse Cereals

Year	g/day	Kg/annum
1960-61	136.90	49.67
1970-71	132.04	48.20
1980-81	101.55	37.02
1981-82	105.90	38.65
1983-84	106.02	38.65
1985-86	84.22	30.74
1987-88	84.20	30.71

Source : Compiled from data in Economic Survey, 1989-90.

availability of coarse cereals was 137 g/day. It decreased to 84 g/day during 1987-88. This reflects on the production performance of coarse cereals on one hand and population increase on the

other.

If production is to grow at the present rate of 0.44 per cent, then by the turn of the century, the supply of coarse

Table 13 : Projected Demand and Supply of Coarse Cereals (million tonnes)

Year	Demand[1]	Supply[2]	Gap
1970-71	24.40	-	-
1985-86	32.80	31.17*	1.63
1990-91	36.52	32.00	4.52
1995-96	40.35	32.71	7.64
2000-01	44.42	33.44	10.98

Source : [1] Taken from Kannan and Chakravarty(1983).
[2] Computed from the data in Economic Survey, 1987-88.
* 1984-85 figure was used as the base year.

cereals will be 33.44 million tonnes which would be falling short of the projected demand (44.42 mil. tonnes) by 10.98 mil. tonnes (Table 13). If this gap is to be bridged, then production has to grow at the rate of around 2.24 per cent per annum. But this growth is not likely to come about because of the constraints discussed earlier. Technological and institutional rigidities confront the production performance of coarse cereals and any change in the price policy alone may be a futile exercise as there exists perverse responsiveness of coarse cereals to prices[6].

Conclusions and Policy Options

From the preceding discussion it may be concluded that production performance of coarse cereals has not been

satisfactory and the constraints hindering the growth of these cereals are many. These constraints fall under two main categories, namely, demand constraints and technological constraints. Demand constraints can be tackled by expanding the markets for coarse cereals. Coarse cereals may be made the major items of public distribution system operated by Food Corporation of India. In order to improve the keeping quality of coarse cereals free fatty acids in the seeds are to be reduced by breeding or some mechanical process. Bio-chemical studies are needed on storage quality and investigation into alternative uses of coarse cereals. Diversification of demand by way of finding alternative uses for coarse cereals is essential in tackling the demand constraints. In addition to human consumption, coarse cereals must find their uses in the preparation of animal feeds (cattle feed, poultry feed etc.), processed products and multiple products of different kind used in industries. For example, maize has overcome the demand constraint to some extent by entering in a big way the agro-processing industries. Guar (*kyasnopsis tetragenaloba*), a fodder crop, after finding its uses in textile industry and in the preparation of animal feed concentrates, has become a commercial crop. In case of bajra, possibilitiess exist in its mixing with wheat flour, preparation of baby food, buiscuits, poultry and livestock feed and industrial uses like production of alcohol and starches [Murthy (1976)]. Establishment of integrated cooperatives encompassing such activities as input supply (including credit support), pooling, processing, grading

and marketing of coarse cereals is yet another effective way of tackling the demand constraints.

Because of their subsistence nature, the cultivation of coarse cereals is found to have been extended to marginal lands also resulting in low yields. Monetisation of these crops by way of notifying them in the regulated markets would motivate the farmers to cultivate these crops on fertile lands to produce the marketable surplus. Efforts should be made in this direction. On the production front, improvement of current status of coarse cereals depends to a great extent on the development of dryland agriculture for which dry farming technology holds the key. Technology development for coarse cereals must be multi-dimensional. For example, seed (crop) centered and resource centered (soil and moisture conservation measures) technologies have been identified as the most appropriate dry farming technologies. Besides, technologies based on management practices hold promise for the development of dryland areas. Although there are HYVs for coarse cereals, as discussed earlier, their adoption is constrained to some extent by limited resource of the farmers and the risk of loss under uncertain availability of moisture. However, one need not be pessimistic about the non-adoption of seed centered technologies. There are empirical evidences to show higher rates of adoption by the farmers. In Haryana and Tamil Nadu, the farmers, after having been convinced of the profitability and relatively less risky nature of input use under dry farming technology, were found to have adopted the technology

package in full [Rangaswamy(1982)]. Further, the wrong belief that coarse cereals do not respond to modern inputs was belied by Jha and Sarin (1981). Rangaswamy (1982) also observed a favourable yield response by jowar (K.Tall variety) and bajra (BJ 104) to improved cultivation practices. Efforts should be made to convince the farmers of the profitability of HYV and seed and fertiliser technology.

As there exists little scope for expansion of irrigation facilities in the coarse cereal dominant dry areas, rain water managemennt and soil conservation assume crucial significance. Generation, verification and transfer of resource centered technologies are more costly and difficult. Adoption of these technologies involving soil and water conservation measures (contour and graded bunds, broad based furrows (BBF) system and having farm ponds on the farms) is constrained by the resource limitation particularly the size of holding. Results from on station experiments as well as verification trials on farmers' fields have shown substantially high rates of returns from adoption of resource centered technologies particularly in combination with other recommended inputs and management practices. Some of these measures have already been adopted in several districts of Karnataka, Maharashtra, A.P. and M.P. These measures form an integral part of watershed based development programmes which are crucial for effective transfer of dry farming technologies [Jodha(1989)]. Availability of modern inputs with easy access to adequate credit coupled with a strong

extension network may ensure the willing participation of the farmers in watershed development programmes and adoption of technologies which would ensure a breakthrough in coarse cereal production. Emerging biotechnologies may be used in evolving pest, disease and drought resistant varieties of coarse cereals. Thus, with simultaneous attack on demand and technological constraints one may expect the coarse cereal economy to flourish in the years to come thereby bridging the gap between supply and demand. Basing on the experience gained from National Oilseeds Development Programme(NODP) and National Pulse Development Programme(NPDP), a similar developmental programme for coarse cereals may be initiated. A technology mission on the lines of oil seeds would probably lend the most needed support from the government. This, we believe, would enhance the prospects of coarse cereals and reduce the regional and crop wise inequality in the agricultural economy of the country.

Notes

1. It was generally observed that whenever irrigation potential was created, area under coarse cereals had disappeared and superior cereals occupied the area. Cultivation of coarse cereals with poor resource base has led to their declining productivity resulting in slow growth or stagnation in their production [Nadakarni (1986)].

2. However, this type of comparison may not be of much use as the conditions under which these crops are grown are entirely different. Thus, it is difficult to isolate the risk associated with the crops from the risk inherent in the situations under which they are grown. Further, whenever a farmer is faced with a choice between coarse and superior cereals, he would prefer the former under adverse situations where they are relatively less risky and the latter under favourable conditions when risk is minimised to some extent [see, Nadakarni, op.cit].

3. Gajanana and Sharma (1989) observed that minor millets like *navane* (foxtail millet) and *haraka* (kodo millet) have been cultivated even on marginal lands by small and marginal farmers in order to meet their subsistence food requirements.

4. Jodha and Singh (1982) observed that in Sholapur and Mahabubnagar, the ratio of per hectare returns from jowar relative to wheat was 0.54 and to paddy it was 0.30. In case of cereal based intercrops, the ratio stood at 0.43 and 0.16 respectively.

5. Nadakarni (1986) is of the view that coarse cereals lagged behind mostly because of the very low level of absolute returns rather than the returns over total cost. For example, while the total rate of returns over total cost were 12 per cent from wheat in punjab and 28 per cent from jowar in Maharashtra, the absolute returns per hectare from wheat were 73 per cent higher than that from jowar while the farm level price of wheat was higher by 13 per cent, its yield was higher by 287 per cent.

6. For instance, Shetty (1987) observed negative response to price by jowar farmers in Karnataka and Bapna and Rao (1987) noticed inelastic responsiveness for bajra in Gujarat.

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Appendix I : Coarse Cereals as a Proportion of Total Cereals and Total Foodgrains (1983-84 to 1985-86 average)

Crops	Cereals		Foodgrains	
	Area	Production	Area	Production
Coarse cereals	38.17	22.25	31.23	20.36
Rice	39.18	44.44	32.21	40.65
Wheat	22.64	33.33	18.67	30.47

Source . Compiled from data in Economic Survey, 1987-88

Appendix II : Contribution of Different States in the Production of Coarse cereals (1983-84 to 1985-86 average)

States	Contribution (%) in the production of			
	Coarse cereals	Jowar	Bajra	Ragi
Maharashtra	18.31	40.06	10.91	9.17
U.P.	13.04	4.60	14.06	6.78
Karnataka	12,26	10.98	3.87	41.48
Rajasthan	10.37	4.13	33.34	-
A.P.	7.48	10.21	4.46	8.68
Gujarat	7.10	3.94	21.77	1.58
Tamil Nadu	4.68	5.37	16.25	10.74
M.P.	4.12	15.33	1.96	0.20

Source :1. Economic Survey, 1987-88
2. Fertiliser Statistics,1986-87