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RECENT DEVELOPMENTS IN AGRICULTURE : THE HARYANA EXPERIENCE

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ABSTRACT : The Paper endeavours to examine the post green revolution developments in agriculture in Haryana. With the extension and intensification of agricultural infrastructure base the disparities have declined. Associated with the changes is the transformation of the cropping pattern but the crop structure has failed to diversify. Agricultural productivity, both land and labour, has increased in real terms but with widening disparities.

Haryana experienced agricultural transformation with the beginning of the Green Revolution which coincided with its formation in 1966. However, some vital inputs had gone into the agricultural development of the state even before the onset of green revolution, the most prominent among these being: consolidation of landholdings and the conferment of land rights on tenants of long standing, which was one the factors leading to a decline in tenancy and resumption of land for self-cultivation; the extension of canal irrigation in the north western parts and subsequent colonisation of new agricultural land, a sizeable part of which was used for the rehabilitation of the displaced persons from Pakistan and which got reflected in an increase in the share of cultivated land in the state from 67.94 percent in 1950-51 to 77.81 percent in 1966-67. When the Green Revolution technology was introduced, the most tangible results accrued in the areas where the "refugee" population was substantial.

Simultaneously the culturable wasteland, the land under permanent pastures, miscellaneous tree crops and groves declined from 12.33 per cent in 1950-51 to 3.12 percent in 1966-67 and further to 1.16 percent in 1995-96 (Table 1). The fallow land had also declined considerably by the time the state was formed. The frontiers of agricultural settelement were gradually getting exhausted.

The remaining area, at present about 11.23 percent, is under settlements, roads, canals, railroads, water-bodies, hills, drainage lines and other barren lands and, thus, not available for cultivation.

Thus area expasion had ceased to be significant source of growth of crop output, in Haryana as so in the country since the mid-1960s.Infact the rate of growth of net sown ares had decelerated over time and particularly since the mid-eighties a declining trend is noticed because of diversion towards urbanisation.With the introduction of short duration crops in the wake of green revolution the cropped ares is incersing through notable increases in intersity of cultivation (Table 2). The growth of land productivity and of output is positively associated with expansion and intensification of irrigation,rise in relative importance of tubewell irrigation,

Table 1

Haryana : Land Utilisation, 1950-51 to 1995-96

	Category	Percentage in total area			Percent change between 1966-67 and 1995-96
		1950-51	1966-67	1995-96	
1.	Forests	0.55	2.07	2.50	+0.43
2.	a) Land put to non-agricultural uses	-	5.84	9.09	+3.25
	b) Barren and uncultivable land	-	5.27	2.14	-3.13
	Land not available for cultivation (a+b)	9.68	11.11	11.23	+0.12
3.	a) Permanent pastures and other grazing lands	-	1.05	0.55	-0.50
	b) Land under miscellaneous tree crops and groves	-	0.09	0.09	-
	c) Culturable waste	-	1.98	0.52	-1.46
	other uncultivated land excluding fallow land (a+b+c)	12.33	3.12	1.16	-1.96
4.	a) Fallow land other than current fallows	-	-	-	-
	b) Current fallows	-	5.89	3.55	-2.34
	Fallow land (a+b)	9.50	5.89	3.55	-2.34
5.	Net area sown	67.94	77.81	81.54	+3.73
6.	Area sown more than once	11.12	26.73	54.30	+27.57
7.	Gross cropped area as per cent of net area sown	116.36	134.36	166.59	+32.23

Source : Economic Adviser to Government of Haryana : Statistical Abstracts of Haryana 1966 to 19197, Chandigarh.

Table 2

Haryana and India : Growth of Net Area Sown, Cropped Area of Major 43 Crops - 1962-65 to 1992-95

Period	Per Cent Annual Compound Growth Rate*			
	Net Area Sown		Gross Cropped Area	
	Haryana	India	Haryana	India
A)	0.24	0.19	1.31	0.43
B)	0.19	0.14	0.96	0.56
C)	-0.36	0.07	0.58	0.24
D)	0.01	0.12	0.90	0.40

Note : *Per Cent Annual Compound Growth Rate
A) 1970-73 over 1965-65; B) 1980-83 over 1970-73;
c) 1992-95 over 1980-83] and D) 1992-95 over 1962-65;

Source : Government of India, Indian Agriculture Statistics (Various issues), Ministry of Agriculture, New Delhi.

use of HYV seeds, fertilizers, modern farm inputs, besides cropping intensity.

From 35.54 percent in 1966-67,the proportion of net irrigated ares to net area sown incersed to 76.96 percent in 1995-96 -- a remarkable achievement indeed.

High proportion of net irrigated area is typical of those tracts where : (i) canals were introduced at an early date, and (ii) subsoil water is sweet, permitting development of tubewell irrigation. Area with dissected terrain, such as parts of Ambala district, or those infested with sanddunes, such as Bhiwani, Mahendragarh and parts of Rohtak, or having brackish subsoil water, such as the west/south-west of Haryana, are noted for lack of irrigation. Extending in a broad belt north of Delhi and further to the northwest was a tract having better irrigation facilities than those in the northeast, west, and south.

Concomitant with an expansion of area under irrigation, the modes of irrigation have also been changing in favour of tubewells. In 1966-67, almost four-fifths of the irrigated area in Haryana was served by canals and about one-fifth by tubewells; in 1995-96, canals and tubewells shared the irrigated area in fairly equal proportions (Table 3). Whereas tubewell irrigation was predominant in the eastern and southern parts, canal irrigation dominated in the central and western areas. This variation is attributed to the differential suitability of underground water for tubewell irrigation in different areas.

The electricity consumption by agricultural sector has increased from 22.68 percent in 1966-67 to 45.37 percent in 1995-96. Most of this went to energise tube-well (r=0.80) and pumpsets whose number per thousand hectares of net sown area increased from a mere of 7 in 1966-67 to 153 in 1995-96. The government's contribution in the form of loans for installation of tubewells and in rural electrication was critical to this process.

Not only has there been an increase in the proportion of the net area irrigated to net area sown but intensity of irrigation (as measured by gross irrigated x 100/net irrigated area) has also risen from 136.992 in 1966-67 to 173.00 in 1996-97. The relationship between the proportion of net irrigated area and the intensity is positive (r=0.38). The irrigation intensity is more in areas of tubewell irrigated area than in canal irrigated ones.

There has also been a manifold increase in consumption of chemical fertilizers and HYV seeds. The consumption of fertilizers which was 2.90 kgs per hectare of gross sown area in 1966-67 went up to 121.16 kgs in 1995-96; an increase by 42 times. The picture differed by areas. The fertilizer use varied from 39.14 kgs per hectare of gross cropped area in Bhiwani district to 217.36 kgs in Kurukshetra district. Similarly, the number of tractors in the state increased from 4803 in 1996-67 to 162032 in 1995-96. Consequently the net area sown in hectares per tractor has got drastically reduced from 713 to 22 during the corresponding period.

A study conducted by the National Council of Applied Economic Research (1980, p.14) showed that the median size of an operational holding owning a tractor has declined from 13.80 hectares in 1970 to 6.28 hectares in 1980. This indicates that tractor acquisition has become more widespread over the years. Initially only farmers with large landholdings invested in tractors but now even the small and medium landholders have acquired tractors. Availability of credit on easy terms from cooperative and other institutions and the scope of enhancing income through custom hiring are some of the factors which explain this tendency. The number of tractors per 100 landholdings

Table 3

Haryana : Salient Features of Agriculture Transformation 1966-67 to 1995-96

Indicator	1966-67	1975-76	1985-86	1995-96
1. Area sown more than once as percentage of net sown area	34.36	50.41	55.02	66.59
2. Cropping Intensity	1.34	1.50	1.55	1.66
3. Irrigation Intensity	136.99	155.76	163.66	173.00
4. Consumption of fertilizer (kgs) per hectare of cropped area	2.90	17.78	66.45	121.16.00
5. Share of agriculture in electricity consumption (percentage)	22.68	36.99	40.28	46.75
6. Number of tractors	4803	25451	83120	162032
7. Net area sown (ha per tractor)	713.00	142.00	44.00	22.00
8. Net area irrigated as percentage of net sown area	37.77	48.40	62.22	76.96
9. Irrigated by				
i) Wells & tubewells	8.44	19.67	29.12	37.70
ii) Govt. canals	28.95	28.59	32.96	38.34
iii) Other sources	0.38	0.14	0.14	0.92
10. Number of tubewells and pumpsets per '000 hec. of net area sown	7.00	56.00	112.00	153.00

***Source** : Economic Adviser to Government of Haryana : Statistical Abstract Haryana (Various issues), Chandigarh.*

ranged from 12.90 in Sirsa district to 2.30 in Mahendragarh in 1985. The frequency was higher in the northern districts.

High yielding improved strains, particularly those of wheat and rice have revolutionised the subsistence agricultural scenario of the state. The proportionate area under high yielding variety seeds, among foodgrains, currently is 98.0 percent in case of wheat, 61.5 percent for Bajra, and 48.0 percent for Maize. The case of rice is a little complex. A steep rise in the area under HYV rice upto 1981-82 (87.4 percent) is followed by a significant decline to 62.2 percent only. This is because around mid-eighties 'Basmati', a traditional variety of rice, an export market and hence became more remunerative. The Haryana Agricultural University and The State Agriculture Department have played a creditable role in this regard.

Simultaneous with the spread of irrigation and its intensification and the use modern farm inputs combined with credit and market network, there was a rise in the degree of cropping intensity. Computed as a ratio of gross area sown to net area sown, it moved up from 134 in 1966-67 to 166.59 in 1995-96.

Table 4

Haryana : Disparity in Agricultural Infrastructure : 1966-67 - 1995-96

Indicator	Coefficient of spatial disparity* (in percentage)	
	1966-67	1995-96
Input indicators		
Net area irrigated as per cent of net sown area	48.75	23.19
Intensity of irrigation	19.17	13.12
Diesel pumping sets and electric tubewells per thousand hectares of net area sown	79.88	35.36
Consumption of fertilisers per hectare of gross cropped area gross cropped area	64.24	33.81
Percentage of area under high yielding variety seeds of wheat and rice	38.93	10.66
Net area sown (hec) per tractor	93.18	70.29
Tractors per 100 landholdings	50.80	48.86
Consumption of power in agriculture per thousand hectares of gross cropped area	40.04	57.04

Coefficient of spatial disparity : Standard deviation x 100/mean

Broadly speaking areas of high cropping intensity are associated with tubewell intensity are associated with tubewell irrigation covering eastern and central Haryana. The north east and southern parts of the state are noted for low cropping intensity. Sonipat and Rohtak are low cropping intensity due to water lagging.

Another notable feature has been the reduction in regional disparities in the provision of agricultural infrastructure in general (Table 4). Regional disparities in tractorisation remain high, though with a slight tendency towards decline. Power consumption is the only input in whose case regional disparities increased. This is explained by an exceptionally high level of power consumption in tubewell irrigated areas where the Green Revolution blossomed to its brightest hue.

Associated with the above changes are a transformation of the cropping pattern (Table 5). Significant to note is the fact that although the proportion of area under cereals to total cropped area did not change a perceptible shift towards increase in share of wheat and rice at the cost of other cereals such as bajra, gram and jowar because of higher yields and a remunerative price regime took place. The area under pulses particularly gram declined sharply. On the contrary, the important gainers were oilseeds particularly rapeseed and mustard and cotton. The changes in these crops along with rice were most impressive since mid-seventies. Wheat registered a decline in its acreage since mid-eighties.

The area under sugarcane however increased from 1.88 percent in 1950-51 to 3.73 per cent

Table 5

Haryana : Changes in Proportion of Area under Different Crops, 1966-96

Crops	Percentage in total cropped area				Change in Percentage
	1966-67	1975-76	1985-86	1995-96	1966-96
1	2	3	4	5	6
Rice	4.97	7.0	12.17	13.62	8.65
Jowar	6.69	3.64	2.02	2.89	1.62
Bajra	21.11	19.85	14.94	9.51	11.60
Maize	2.39	2.50	1.17	0.44	1.95
Wheat	18.66	27.52	35.69	33.12	14.46
Barley	4.97	2.64	1.28	1.54	0.69
Total Cereals	**58.79**	**63.16**	**68.40**	**59.39**	**0.60**
Gram	25.50	22.97	13.71	6.22	19.28
Pulses excluding gram	1.61	1.65	1.54	1.22	0.39
Total Pulses	**27.10**	**24.61**	**15.25**	**7.44**	**19.66**
Total Foodgrains	**85.89**	**87.78**	**83.65**	**66.84**	**19.05**
Rapeseed and mustard	4.93	2.92	6.66	9.79	4.86
Other oil seeds	0.34	0.30	0.31	0.75	0.41
Total Oilseeds	**5.24**	**3.22**	**6.97**	**10.55**	**5.28**
Cotton	5.12	5.34	7.01	10.32	5.20
Sugarcane	3.73	3.65	2.38	2.35	1.38
Index of Diversification	**82.64**	**81.58**	**80.09**	**79.32**	

Note : Gibbs Martin Index of Diversification is computed using the formula: $1 - \frac{\Sigma x^2}{(\Sigma x)^2}$ where x is the number of crops

Source: Econiomic Adviser to Government of Haryana: Statistical Abstract if Hartyana, 1966 to 1996, Chandigarh.

in 1966-67 but later declined to 2.35 percent in 1995-96. This was due mainly to unremunerative price for the crop, particularly in non-sugar mill areas. Opening up of more sugar mills could boost its production.

A note of caution is that in Haryana 65.7 percent of area under rice forms part of Rice-Wheat crop system and 23.5 percent wheat area is put under paddy cultivation. The ecological hazards of this crop system are well documented.

The new technology introduced during the mid-sixties has failed to diversify the crop structure. The Gibb's Martin diversification index had moved from 82.64 in 1966-67 to 79.32 in 1995-96. A more important diversification that needs encouragement is growing of fruits, vegetables, flowers and other horticultural crops. This, in turn, would depend on the generation of adequate surpluses through higher investment in rural infrastructure and in scientific research and emphasis on allied agricultural activities.

The cropping pattern changes are a positive development since low yield and low value coarse cereals are being replaced by high value industrial crop like oilseeds, fibre and superior

cereals like wheat and rice, without adversely affecting foodgrains output.

Most critical to this process have been the Green Revolution technology, complete rural electrification, integrated transport and communication network, efficient institutional credit and marketing facility, provision of extension services, and the support price policy of the government. But all this would not have taken place if Haryana had not strengthened its irrigation base, especially after is formation. In its present state there is a limit to the extension of irrigation in the state. One of the serious fallouts of the reorganisation of the Punjab was that Haryana lost its riparian character vis-a-vis the Punjab river system. Nowhere its boundary touched any of the Punjab rivers. The scope of getting additional canal water got highly constrained. Implications of this for agriculture in Haryana have been grave. Only the early resolution of the SYL canal could boost Haryana's agricultural economy.

Since the income and living standards of agricultural population are ultimately determined by their productivity levels, it is worth while to study the agricultural productivity patterns. This is done both in reference to land and labour. An increase in agricultural productivity is observed everywhere but with widening regional disparities, reflected in arise in the coefficient of disparity: 32.06 in 1976-68 and 30.91 in 1995-96. The uneven regional pattern of investment in rural infrastructure and in irrigation has led to variation in productivity levels.

A strong positive correlation emerges between the value of agricultural produce per hectare of gross cropped area and per cultivator : r = + 0.63 in 1975-76, r = + 0.72 in 1985-86 and r = + 0.85 in 1995-96. Obviously prosperity and efficiency go together . The disparity in agricultural producitivity per cultivator was also observed as having increased over time: Coefficient of variability being 19.44 in 1967-68,28.42 in 1985-86 and 46.28 in 1995-96.

A glance at the growth pattern of male agricultural worker (henceforth referred to as MAW) productivity reveals that Haryana ranks next only to Punjab in male agricultural worker productivity which has nearly doubled in real terms since 1960's. During 1962-65 to 1970-73 growth rate of agricultural output of 4.65 percent exceeded that of male agricultural workers of 18.2 percent per annum. MAW productivity increased at an annual rate of 2.78 percent per annum (Table 6).

Table 6

Haryana: Growth of Output, Male Agricultural Workers and Productivity, 1962-65 to 1995

Period	Agricultural output	Male Agricultural Workers	Male Agricultural Workers Productivity
		Growth rate	Rs. per worker at 1990-93 prices
(A)	4.65	1.82	2.78	11144
(B)	3.02	1.97	1.02	13874
(C)	4.74	1.70	2.99	15357
(D)	4.14	1.82	2.27	21871

Source: *Note and Source-Same as in Table (3)*

Haryana continued to experience a marginal increase in the growth rate of MAWs during 1970-73 to 1980-83 which however decelerated during post 1980's. As a result of slow down of growth of MAWs the share of MAWs in the total male workforce in Haryana declined from 65.40 percent in 1971 to 59.91 percent in 1981 to 56.27 percent in 1991. Whereas the proportion of cultivators is declining that of agricultural labourers incersed.

The 1980s mark a singnificant departure in the state in the matter of growth of agricultural output which accelerated to 4.74 percent during 1980-83 to 1992-95 compared with 3.02 percent during the prceding decade. Since the growth rate of MAWs did not accelerate there was a singnificant improvement in the growth of per MAW productivity.

CONCLUSION

With the onset of green revolution in mid-sixties Haryana has withnessed a transfromation of the traditional, largely subsistence agriculture into a mordern, commercial one. This is attributed primarily to the extension and intensification of agricultural infrastructure base.

The state has experienced impressive changes in its cropping pattern with low yield and value coarse cereals being replaced by more remunerative oilseeds, fibre, rice and wheat. The marked increase in the growth rate of agricultural output was not accompanied by crop diversification. A more important diversification that needs encouragement is growing of fruits, vegetables,flowers and other horticultural crops. This, in turn, would depend on the generation of adequate surpluses through higher investment in rural infrastructure, scientific research and emphasis on allied agricultural activities.

Most impressive has been a decline in regional disparity in the provision of agricultural infrastructure. By contrast, regional disparities in agricultural productivity have widened. The rise in productivity was more pronounced in areas which were already at a higher level of productivity assisted by both physical and technical factors.

Since the availability of assured irrigation countinues to be the essential precondition for the spread and deepening of green revolution technology and particularly so in the parched thirsty lands of southern and south-western Haryana, an early completion of SYL canal is the only panacea.

The male agricultural wokers recorded a significant increase in productivity. A higher wage level is the natural outcome. It has the potential of triggering a process of rapid growth in non-agricultural sector. However, labour force diversification has been small, which needs to be encouraged through investment in agro-processing and related activities.

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