UNIT 13 NEW TECHNOLOGY AND DISTRIBUTION OF GAINS

Structure

13.1 INTRODUCTION

In the previous unit we discussed the impact of new technology on agricultural output growth in India. The introduction of new technology, popularly called green revolution, comprised use of HYV seeds in the presence of chemical fertiliser and irrigation facilities. Within few years of introduction India witnessed a rapid growth in agricultural output, which was made possible mainly by increase in yield of crops. The new technology could solve the intense food crises that India faced during the 1960s.

However, quite a few questions come up in our minds: Who gained from the green revolution? Was its positive impact felt throughout the country or was it limited to few pockets? Did all categories of farmers gained from the introduction of the new technology?

We will attempt to answer some of these questions in this unit and will discuss the gains from HYV technology mainly under three heads:

- effect on regional inequalities
- effect on inequalities among farmers (farm size)
- effect on inequalities in growth of yield among crops.

13.2 IMPACT OF GREEN REVOLUTION

Before discussing the gains from green revolution we recapitulate its impact that accrued to the country.

1) The real significance of HYV technology lies in the fact that it provided a base for further development of agriculture. It helped in achieving self-sufficiency and even some exports are being made in the last few years; thus it contributed to India's journey from begging bowl to export capability. The new technology not only cut down food imports, it also saved from the humiliation of strings being attached to food aid from developed countries, especially the USA. It helped agriculture in keeping pace with population explosion after 1950s (see Table 13.1).

Table 13.1 : Population Growth vs. Agricultural Growth

Year	Population Growth Total Population	Annual Compound Growth Rate (%)	Period	Agricultural output growth (% per annum)
1951	361.1	1.25	1949-50 to 1964-65	3.13
1961	439.2	1.96	1967-68 to 1980-81	2.38
1971	548.2	2.20	1980-81 to 1991-92	3.21
1981	685.2	2.22	1949-50 to 1991-92	2.70
1991	844.3	2.11		
2000	987.3	1.09		

Source: V.M. Rao (2000)

Table 13.2 : Indices of Area, Production and Yield – All Crops

(Base: Triennium Ending 1981-82 = 100)

Year	Area	Production	Yield
1964-65	91.7	76.4	88.3
1965-66*	90.7	63.7	73.2
1966-67*	90.6	63.0	73.6
1967-68	94.6	77.1	86.8
1971-72	95.8	85.2	91.6
1972-73*	92.5	78.2	86.0
1973-74	98.2	86.5	91.1
1986-87	100.3	115.2	112.4
1987-88*	96.0	115.3	114.4
1988-89	103.4	140.0	130.5

Note: Drought years are indicated by asterisk. Rest of the years in the table are considered to be free of the effect of drought.

Source: V.M. Rao (2000)

3) The ability to withstand the impact of recurrent droughts has increased over the years. Thus the overall resilience of Indian agriculture in the face of natural calamities has increased. Though the instability of year-to-year foodgrains output has increased in post-HYV period (see Table 13.2), a heartening feature of recent period is that Indian agriculture is getting more and more resilient to the vagaries of monsoon. For most of the crops, the sensitivity of output to fluctuations in rainfall has declined. This development is all the more impressive as in seven out of ten years ending 1994-95, rainfall index for all crop production was below normal, four of which were particularly bad rainfall years. In spite of this, agriculture output did not show sharp declines, unlike earlier years. Recent periods of severe drought provide convincing evidence of the ability of Indian Agriculture to withstand the stress created by such critical situations, which used to cause widespread devastation in the past.

4) The new technology gave impetus to irrigation expansion as without irrigation the technology is of no use. Irrigated area in post-green revolution period increased at a much higher rate than in the earlier period as we saw in Table 12.8 in Unit 12.

5) The new technology might have encouraged own cultivation because of the higher returns. Several researchers have observed that in HYV areas owners resumed cultivation on a large scale. The extent of tenancy and absentee landlordism might have gone down. Hence the ill effects of both these on growth might have come down.

6) By raising the net returns from agriculture the new technology might have arrested the tendency for concentration of land and in saving small and marginal farmers. This is observed in all states except Punjab.

7) The fragmentation of land that is observed is more due to population growth and division of land among family members, than due to adverse effects of HYV technology. The HYV technology might have given further impetus to consolidation of holdings, as it is easier to go for tube-well which caters to a bigger plot than tiny and scattered plots. Tube-well irrigation is more stable, and controlled and efficient than canal irrigation and farm-to-farm irrigation. Though canal irrigation is cheaper for individual farmer, its social costs are very high.

8) The HYV technology by increasing the cropping intensity – (due to short duration maturity more number of crops may be grown on the same plot) – helped creating more employment (see Table 13.3). This benefits especially landless labour households who eke out their living by hiring out their labour. As we know, improvement in employment gives more income to people. Though the additional employment per worker per year varies across states (more in wheat growing states, moderate in rice growing states and least in other states) overall employment generation is modest compared to the growth rate in workforce dependent on agriculture. Still this is one of the positive aspects of new technology.

Table 13.3 : Employment Potential of New Technology

State	Irrigated area under cereals (000ha)	Irrigated area as % of cultivated area	Number of farm workers (in thousand)	Farm workers per 100 ha	Additional days of employment per worker per year
Andhra Pradesh	3442	26	12592	98	11
Assam	571	20	2815	97	9
Bihar	2249	21	14474	133	7
Gujarat	599	6	5484	53	5
Kerala	460	17	2992	108	6
Madhya Pradesh	898	5	12188	62	3
Karnataka	911	9	6737	65	6
Orissa	996	13	5295	71	7
Punjab/Haryana	2896	27	4168	39	29
Rajasthan	1292	8	6024	36	9
Tamil Nadu	2855	39	9060	124	13
Uttar Pradesh	4146	18	21407	94	8
West Bengal	1354	20	7249	104	8
Total	23553		122487	76	8

Source: B. Sen (1974)

9) Maturity period of HYV seeds is short and quick. Hence we need to complete the harvesting in a very brief period unlike local varieties. This pushes the demand for labour to high level for sometime, thus pushing up the wages – which benefits the labourers. Trends in real agricultural wages show improvement in all the states in the post-HYV period as against stagnant wages in the earlier period. The increase in wages is high in the initial low wage areas, especially in the second round of green revolution (see Table 13.4). Thus the labourers gained more in low wage areas (relatively). As a result, the wage differentials across regions narrowed down in post-HYV period. See the last column of Table 13.4 and compare the figures between 'low wage areas' and 'high wage areas' to appreciate the convergence of wage differentials across regions.

Table 13.4 : Trends in Real Agricultural Wages

(Base year 1970-71 = 100)

States	1970-71 to 1971-72	1987-88 to 1988-89	Percent increase
High Wage Areas			
Punjab	99.2	108.2	9.1
Haryana	98.7	98.1	0.7
Himachal Pradesh	105.3	119.8	13.8
Kerala	105.6	161.7	53.6
Low Wage Areas			
Andhra Pradesh	97.6	155.4	59.2
Bihar	98.5	150.0	55.2
Orissa	99.8	141.7	42.0
Madhya Pradesh	99.7	158.0	59.0

Source: C.H.H. Rao (1994).

10) The increased income provides scope for improvement in related non-farm activities, which in turn gives rise to backward and forward linkages. Machine repairing services (pump sets, tractors, threshers, sprayers, etc.) trade and commerce related activities such as dairying, poultry, agro-processing units are some examples. Perceptive observers like Blyn concluded that in post-HYV period, incomes from family resources increased relatively more for families with smaller holdings. Thus income inequalities tend to get reduced.

11) All these would lead to withdrawing of male labourers from agriculture and their shifting into higher paid jobs. The increasing feminisation of agriculture is observed.

12) The brief peak seasons and increased demand for labour and improvement in non-farm activities all necessitated the movement of agricultural labourers from backward areas to advanced areas particularly during cultivation seasons. According to an estimate by Sidhu and Grewal (1984) the estimated number of migrant labourers in Punjab for the years 1978-79 and 1983-84 were 2,20,000 and 2,86,000 respectively. You can have an idea on the extent of migration of agricultural labourers.

13) Thus we observe that the new technology resulted in the emergence of national labour markets. There is also a tendency of convergence of agricultural wages across different regions, (see Table 13.4) which may be due to migration of labourers from stagnant and backward areas where there is hardly any expansion of employment sources.

13.3 REGIONAL INEQUALITIES

Inequality across regions is inevitable because of natural factors. Some areas may be endowed with rich productive land while others may be arid zones.

Existing regional inequalities increased further as a result of initial benefits/gains accrued from HYVs. But given the desperate situation the strategy adopted was almost inevitable. The important point, however, is that the government did not focus with the same enthusiasm in the development of other regions after overcoming the food crisis. But as it happened, the benefits percolated to other regions as well in the form of migration of labourers from backward regions to these HYV pockets. These migrant labourers would earn and save here and invest back home in whatever way they can. Moreover, they would carry the tales of success to their home regions. Of course government: i) made available HYVs seeds, ii) increased supply of inputs like fertilisers, iii) increased irrigated areas in the usual course, iv) provided institutional credit through nationalization of banks, and v) invested in agricultural research development by establishing public agro research institutions, universities etc.

All these helped the backward regions in overcoming their sluggishness and catching up with the advanced districts. Though inequalities persisted, it narrowed down over time (in the next round of green revolution) as several studies showed.

Breakthroughs were observed especially in Eastern States (mainly West Bengal) where operation *Barga* and other land reform measures and other government, initiatives caused fast developments in agriculture.

The fact that regional inequalities over a period are narrowing is illustrated by two cases, viz., Punjab and West Bengal. Despite its smaller size, West Bengal's cultivated area is 50 per cent larger than Punjab's. However, Punjab produces about 50 per cent more food than West Bengal. This is made possible by higher yield and multiple cropping in Punjab.

Table 13.5 : Net and Gross cropped Area in Punjab and West Bengal ('000 Ha.)

State	1971-72		1981-82		1991-92	
	Net	Gross	Net	Gross	Net	Gross
Punjab	4076	5724	4210	6929	4139	7552
West Bengal	5463	7170	5565	7393	5334	8540
India	139721	165186	142121	177101	142509	185487

Source: CMIE, 1996.

Table 13.6 : Food Production in Various States (million Tonnes)

Year	West Bengal	Punjab	Haryana	AP	UP
1990-91	11.3	19.3	9.6	12.4	35.7
1991-92	12.9	19.6	9.1	11.7	35.5
1992-93	12.4	20.0	10.3	11.7	36.2
1993-94	13.1	21.6	10.3	12.2	37.2
1994-95	13.5	21.8	11.0	11.6	38.2
Growth 1990-95	19.5	13.0	14.6	-6.9	8.4

Source: Government of India (1996)

As we observe from Table 13.7, Punjab uses much more inputs (fertilizer, etc.) per hectare than West Bengal.

Table13.7 : Fertiliser Consumption in Punjab and West Bengal (kg. per hectare)

Year	Punjab	West Bengal	India
1980-81	111.9	35.9	31.9
1990-91	171.2	90.9	72.4
1994-95	170.9	86.6	74.0

Source: CMIE (1996)

An average holding in West Bengal used half the fertilizer employed by its Punjab counterpart per unit of land. Only about one third of cultivated land is irrigated in West Bengal; Punjab is moving fast towards one hundred per cent coverage (see Table 13.8) in 1991-92.

Table 13.8 : Net and Gross Irrigated Area as percent of Total Cropped Area in Punjab and West Bengal

State	1971-72		1981-82		1991-92	
	A	B	A	B	A	B
Punjab	72.5	76.5	80.9	86.1	93.3	94.6
West Bengal	27.3	21.5	30.3	23.5	35.8	22.4
India	22.6	23.3	28.2	29.1	35.2	35.7

A) Net irrigated Area; B) Gross Irrigated Area

Source: CMIE (1996)

Higher level of input application has also resulted in higher yield per unit of land in Punjab. In 1992-93, the yield per hectare of land was 3627 kg. in Punjab compared to 2027 kg. in West Bengal. The growth in West Bengal agriculture is attributed to land reform measures during 1977 to 1980 and establishment of the elected three-tier panchayat system in 1978. From 1983-84, West Bengal has been one of the fast developing Indian states in terms of growth rates in agricultural output. For the 12-year period during 1983-84 to 1994-95, West Bengal's annual rate of growth of food production has averaged 6.7 per cent, compared to 4 per cent for Punjab. During 1990-95, West Bengal increased production by 19 per cent, compared with 13 per cent by Punjab. It is more difficult to sustain high growth rates at higher production levels. Punjab has the proven record of more than three decades of sustained development while West Bengal's is not even two decades old in this regard. Still it is creditable that West Bengal is growing faster over a reasonably long period despite a much lower level of mechanization and input application. Table 13.9 shows that the earlier laggard states have been catching up with the advanced states in the second round of green revolution. Growth rates in eastern states, viz., West Bengal, Bihar, Orissa and Assam and also in Madhya Pradesh had picked up later on. These states showed much higher growth rates in the second round than in the first round of green revolution, thus, indicating the spread of new technology to these areas. The performance of these laggard states has been particularly better in the case of rice crop.

Table 13.9 : State-wise Growth Rates in Output (per cent per annum)

States	Rice		Foodgrains	
	1967-68 to 1977-78	1978-79 to 1988-89	1967-68 to 1977-78	1977-78 to 1988-89
Andhra Pradesh	2.66	1.70	2.56	0.41
Assam	0.8	2.21	1.27	1.63
Bihar	0.82	2.83	1.14	3.52
Gujarat	3.39	-0.43	2.23	-4.97
Haryana	11.34	5.12	2.86	3.94
Himachal Pradesh	0.04	-1.14	1.24	0.36
Jammu and Kashmir	1.73	0.09	1.47	0.36
Karnataka	-0.01	-004.	2.50	-0.58
Kerala	0.54	-2.36	0.48	-2.30
Madhya Pradesh	0.96	5.30	1.23	4.36
Maharashtra	4.79	-0.44	4.84	-0.46
Orissa	-1.00	2.61	0.80	2.59
Punjab	18.21	7.04	5.29	4.57
Rajasthan	10.90	-1.77	3.03	1.37
Tamil Nadu	1.45	0.89	1.69	0.74
Uttar Pradesh	4.06	7.32	4.06	5.16
West Bengal	1.71	5.23	2.60	4.53
All India	2.16	3.19	2.31	2.68

Source: Directorate of Economics and Statistics, Government of India.

Research in dryland agro-technologies has also helped in reducing the regional inequalities further. The prospect of developments in biotechnology, tissue culture and genetic engineering would reduce the disadvantage experienced by these backward regions further as these technologies are effective equally, in all areas irrespective of agro climatic conditions and irrigation endowments.

Check Your Progress 1

1) Bring out five positive effects of HYV Technology in India.

.....

.....

.....

.....

.....

.....

.....

.....

.....

2) What are the reasons for accentuation of regional inequality due to introduction of new technology?

.....

.....

.....

.....

.....

13.4 INEQUALITIES ACROSS FARMS

Inequalities have another dimension in that different farming groups within the same region are differently endowed, reaping the benefits differently. How much a particular group would be benefited depends on how much irrigated area the particular group happens to possess and operate. Also how much they are able to invest on inputs matters a lot as the technology is effective only in a package (seed, water, fertilizers). Hence the resource rich farmers had the initial advantage in introducing HYVs and using costly inputs; these paid high returns. As it happens in any new innovation the early adopters always have the maximum benefits; the late adopters the least benefited and the middle adopters reaping in between. Hence in the initial period inequalities among different size groups of farmers widened. The Government was more concerned with boosting production (economic aspect) rather than about social aspect of reducing inequalities.

The supply of inputs (seeds, fertilisers) at subsidized rates and providing liberal institutional credit was seized upon by the early adopters. This was also inevitable as the objective was to make immediate boost in production. This does not mean other sections did not benefit. Whoever could adopt HYVs were benefited because HYVs give higher yields in irrigated fields without fertilisers also, though lower than those who could apply fertilisers. But without irrigation HYVs would not yield higher than local variety. With improved returns gradually even small and marginal farmers could adopt HYVs.

Traditionally, it is observed that there is an inverse relationship between size of land holding and productivity. This implies small farms have higher yield than large farms because of personal supervision the small farmers could provide. However, the inverse relationship between farm size and productivity got reversed in the early period because of the advantage employed by resource rich farmers who could spend on capital-intensive inputs. It was even observed that the traditional patterns of large farmers leasing out land to small farmers got reversed as large farmers retained land for self cultivation after seeing the improved returns due to new technology. In some cases the large farmers leased in land from small farmers. This phenomenon is described as ‘reverse tenancy’. Thus, the inequalities between the two groups further widened. The reverse tenancy defeated the gains made by tenants as a result of land reform measures.

But all these changes though contributed to increase in inequality it helped in increasing the returns of small and marginal farmers in absolute terms. Irrespective of the size of the farm on which it is tried, the new technology benefits all. Those small and marginal farmers who could buy inputs from their incomes from supplementary sources like non-farm activities (dairy, poultry, kitchen gardening, petty trade, traditional crafts, etc.) got benefited. The increased employment on HYV farms as a result of increased cropping intensity (due to short duration crops) made small farmers to withdraw from labour market and concentrate on getting employed in their own cultivation. If the

family size is large enough one or two would work in own field while others would supply their labour to the market as labourers.

There are some studies which show that the traditionally observed inverse relationship between farm size and productivity got restored due to all these factors. Consequently, smaller the farm higher is the returns.

13.5 IMPACT ON AGRICULTURAL LABOURERS

We have seen in Unit 2 that the colonial policy threw the traditional craftsmen, artisans out of their livelihood source and as there was no other way to go, they joined the ranks of agricultural labourers. The independent India came up with land reform measures but these were confined mainly to abolition of inter-me diaries and consolidation of holdings. It did not deliver on the promise of implementing land ceiling and distribution of surplus land from the landlord class to the landless. Instead the policies were confined to indirect approach of tackling labourers through developmental programmes. All these could not address the problem of landlessness and improvement in their incomes and employment.

Of all these measures, the HYV technology made indirect attack on the poverty of labour households by increasing the yields of farms. In the process it increased the cropping intensity thus generating higher demand for labour and causing more employment. The increased yields and returns also caused the emergence of non-farm avenues which provided further employment sources. As a result of improved returns from HYV foodcrops, farmers could switch over to commercial crops which are remunerative. This resulted in shifts in cropping pattern from foodcrops to commercial crops such as cotton, tobacco, chilli and sugarcane. This was another source of improved employment avenues for agricultural labourers.

All these changes facilitated the withdrawal of small farmers from the labour market (to devote more time on own operated farms and in non-farm activities). It improved the probability of employment for agricultural labourers and thus improved their bargaining strength for higher wages. Studies show improved real wages across the country, especially in advanced HYV districts, since the seventies. The withdrawal from agricultural labour market is mainly by the male labourers, thus leaving the agriculture to more and more female labourers. Thus agriculture is increasingly getting feminised, according to observers of agricultural scene.

One more phenomenon after the introduction of HYV technology is the emergence of national labour markets. Agriculture product markets got more and more integrated. Due to the improved employment in HYV pockets, the labourers from poor, non-HYV backward areas started migrating to HYV pockets in search of employment and income. There they received much higher wages and employment than in their home regions. The short duration nature of HYVs, increased cropping intensity, the squeezing of peak operations in HYV farms, improved non-farm avenues for local labour all necessitated this migration from backward areas. As a result, their bargaining strength at the home region (which is backward with relatively low wage rate) increased. Thus, the labour markets got integrated at the national level. The seasonal movement of labourers from poor regions like Eastern Uttar Pradesh and Bihar to the North West region, viz., Punjab, Western Uttar Pradesh and Haryana is taking place since the seventies. All these changes improved the incomes of labourers in developed as well as backward regions. Moreover, the widening wage differentials (observed in 1970s) across regions narrowed down over a period of time.

13.6 INEQUALITIES ACROSS CROPS

A third dimension of inequalities is the inter-crop differentials in terms of adoption levels, production and yields. The green revolution is often referred to as the ‘wheat

revolution,' showing the pre-eminence of wheat vis-à-vis other crops in adoption, production and yields. HYV technology started with wheat; later on rice varieties came on the scene. Since these are the two principal cereals in the country, green revolution is also referred to as cereal revolution as it has not done much in the other crops, especially in non-foodgrains. The yield improvements in wheat were spectacular whereas the same was not the case with rice.

The yield of wheat in India is comparable to the world average while the yield of rice is only three fourths of world average (see Table 13.11 given at page 31). There are several reasons for these differences across crops.

One of the reasons is the traditional wheat producing areas in India (consisting of Punjab, Haryana and Western Uttar Pradesh) have been the most advanced agriculturally – whereas the traditional rice growing areas (Bihar, Bengal, Assam, Orissa) are among the poorest regions barring few districts. The poor areas are characterised by: i) stifling agrarian structures (high level of land inequalities), ii) poor infrastructure (roads, electricity), iii) heavy rainfall and frequent cyclone but poor drainage, leading to recurring floods, iv) stagnant farming communities, and v) acute poverty stricken population. On the other hand, traditional wheat growing areas are characterised by: i) successful land reforms (abolition of intermediaries, consolidation of land holdings), controlled irrigation such as tube wells, ii) reasonably good irrigation facilities, iii) infrastructure (road, electricity), iv) proximity to big metro city, v) industrious and dynamic farming community willing to adopt improved farming techniques, and vi) generally better standards of living. These contrasting factors cause definite differentials in cultivation of rice and wheat crops. In 1983-84 out of 24 million hectares of wheat growing areas 16 million (67%) were irrigated while only 18 million hectare out of 40 million hectare (45%) of rice growing area was irrigated.

Secondly, certain technical complexity of rice cultivation adds to the differentials in these two crops. For example, rice can adapt to several climates and soils. Moreover, the farming methods differ widely: direct sowing or transplantation from seed beds; irrigated or rainfed; low land, upland or hillsides; long cycle or early variety; tall or short stem; floating rice that survives in 2 or 3 mentres of water. This diversity has its advantages (in that rice can adapt to several physical surroundings) and also some inconveniences. The introduction of new varieties of rice is more complicated than for wheat, the latter being cultivated in less diversified climatic conditions and with less varied techniques. The initial varieties of HYV wheat from Mexico gave good results (1965-67) almost throughout Asia. However, one needs a large number of varieties of rice to suit each environment, seeds from Taiwan (tried in 1966 and 1967) were unsuccessful in the Gangetic basin. The IR-8 from Indian Rice Research Institute (IRRI) was highly productive in some districts in India but not in others. Secondly, those paddy fields which are dependent on rainfall are subject to the whims of monsoon. That is why irrigation becomes essential as a complement to rainfall and large scale efforts are needed to control the rivers. Regarding drainage, the low lying lands that suffer from an excess of water even in times of normal monsoon can be found in Bengal, Assam, Orissa, Eastern Uttar Pradesh and Bihar. This constitutes a key problem of the entire Eastern part of India, which is compounded by floods when the monsoon is heavy. The paddy fields situated in the North Eastern part of Deccan are, by and large, dependent on rainfall and thus subject to irregularities.

Thirdly, Rice is much more vulnerable to diseases and parasites than wheat. Rice grows mainly during the monsoon, which period is more conducive to pests than the dry season. Pesticides are therefore required in greater quantities, which in turn creates difficulties for the introduction of new varieties.

Besides technical aspects, there are other variables which explain the differences; man's behaviour, his outlook towards agriculture, the part played by State governments and administration. All these factors together contributed to the spectacular success of HYV wheat in contrast to poor performance in HYV rice varieties.

The other cereals performed even worse than rice. Coarse cereals like Jowar, Maize and Bajra were only briefly touched by HYV technology. These crops are grown mostly on non-irrigated land. As we have seen in Unit 11 dryland technology is altogether different from HYV technology (which is irrigation based). Only some success is reported with respect to maize and jowar - ICRISAT made some progress in introducing new varieties in these crops and yields improved to some extent.

Crop-wise yields in the 1980's and the 1990's are given by VM Rao (2000), which shows declining yields in the 1990s compared to 1980s (see Table 13.10). Yields have gone down in 1990s in all crops except coarse cereals and pulses while growth rates in production have gone down in 1990s compared to 1980s among all crops without exception.

Table13.10 : Trend Growth Rate of Area, Production and Yield of Important Crops

(percent per annum)

Sl. No.	Crops	Area		Production		Yield	
		80s	90s	80s	90s	80s	90s
1.	All Crops	0.1	0.4	3.2	2.2	2.6	1.4
2.	Foodgrains	-0.2	-0.1	2.9	1.8	2.7	1.4
3.	Non-food grains	1.1	1.5	3.8	3.3	2.3	1.4
4.	Rice	0.3	0.5	3.6	1.9	3.2	1.3
5.	Wheat	0.5	1.7	3.6	3.1	3.1	1.6
6.	Coarse Cereals	-1.4	-1.8	0.4	0.2	1.7	2.0
7.	Pulses	-0.1	-0.2	1.5	1.0	1.6	1.7
8.	Oilseeds	2.4	0.8	5.5	3.4	2.9	2.6
9.	Sugarcane	1.5	1.8	2.7	2.5	1.2	0.7
10.	Cotton	-1.3	3.3	2.8	1.7	4.1	-2.0

Source: V.M. Rao (2000).

13.7 LIMITATIONS OF HYV TECHNOLOGY

Several studies have highlighted the negative consequences of HYV technology. It is pointed out that the new technology: i) accentuated inter-regional and inter-class inequalities; ii) benefited only one or two crops at the cost of other crops; iii) helped concentration of landholdings; iv) marginalized the small farmers; v) increased the landlessness, and swelled the ranks of agricultural labourers; and vi) increased the cost of cultivation.

Some prominent observers of agricultural scene counter all these arguments. Quite a few of the critics emerged from the first round of green revolution period. There is some realisation that most of these criticisms were made too soon and do not hold the scrutiny from experience of the second round of green revolution.

But some other criticisms made against the HYV technology seem to continue, highlighting the limitations of HYV technology. The HYV technology is suited for agriculture in developed economics as it is capital intensive (requiring costly inputs like

chemical fertilisers, pesticides) and; energy intensive (requiring high doses of petroleum-based products to produce chemical fertilisers). The nature of HYV seeds being pest and disease prone requires high doses of pesticides leading to harmful environment effects. Moreover, it has a tendency to push up mechanization (the brief harvest season makes it advantageous to go for combined harvesters, threshers as it happened in Punjab). This sort of cultivation is often considered as inappropriate for a country like India with low per capita income and high poverty. According to these critics India should have gone for more labour intensive technologies. It should have emphasised more on irrigation especially minor irrigation, water harvesting technologies, water maintenance systems and development of organic fertilizers.

We have mentioned earlier that adoption of HYV technology was inevitable because of food crisis. However, according to the critics, there was a need to rethink on the continuity of the same strategy after overcoming the food shortage. Green revolution should have been used only as an immediate outlet rather than as panacea for all the ills of Indian agricultural scene. The ills emanating from the agrarian structure, irrigation, production and distribution strategies, all seemed to be addressed with this strategy. The chronic problems of surplus labour, unemployment, underemployment, poverty and low purchasing power would not find solution with a single strategy.

In any case the HYV technology cannot be a permanent success story given its limitations. The agro climatic and agrarian structural constraints come in the way of agricultural expansion.

It has not yet resulted in bringing the agricultural production and yields up to the world averages in the most successful crops like wheat and rice also (see Table 13.11). Even before reaching these average and while still lagging behind the major producing countries in respect of yields, the growth rates in yields, already started showing declining tendency.

Compared to 1980s these have already come down in 1990s (see Table 13.10). Of late the agricultural performance is also being classified into two periods by the researchers as well as in the government documents. The periods are: (a) a decade immediately preceding the economic reforms introduced in 1991 and a decade after, i.e., after 1991. Table 13.10 gives the growth rates in area, production and yields of important crops for the 1980s and 1990s. In this classification it is possible to interpret that production or yields declined in the post reform period.

It seemed to have reached its limits even in the regions where it has succeeded most. In fact its ill effects are too obvious to be able to ignore – For example, over-exploitation of ground water in terms of (a) fall in water table forcing the farmers either to deepen the well or abandon it depending on the accessibility of financial resources, (b) adverse effects on equity issues, and (c) abandoning agriculture itself and becoming agricultural or non-agricultural labourers. The adverse effects of land degradation due to salinity and water logging are: decline in farm production and income, unemployment and migration, disparities and ecological imbalances.

Table 13.11 : Yield of Important Crops in Major Producing Countries in 1997 (kg/ha)

Sl.	Paddy		Wheat		Ground Nut		Sugarcane		Cotton		Jute	
No.	Country	Yield	Country	Yield	Country	Yield	Country	Yield	Country	Yield	Country	Yield
1	China	6331	China	4087	China	2574	Brazil	69021	China	943	Bangladesh	1577
2	Indonesia	4561	France	6530	Nigeria	1124	China	75982	USA	769	China	2517
3	Pakistan	2827	USA	2673	USA	2828	Thailand	55878	Pakistan	552	Thailand	3548
4	Philippines	2933	Australia	1712	Indonesia	1519	Mexico	72734	Turkey	1065	Myanmar	939
5	Thailand	2143	Canada	2128	Sudan	762	Australia	97337	Argentina	368	Brazil	1714
6	India	2915	India	2654	India	988	India	69737	India	321	India	1830
7	World	3827	World	2686	World	1273	World	63324	World	584	World	1734
	Yield in India as % of World Average	76.2		98.8		77.6		110.1		55.0		105.5

Source: Production Year Book, Food and Agriculture Organisation, 1997.

Another breakthrough is needed in Indian agriculture as the one introduced in 1960s has reached a plateau. This is especially needed in the context of globalisation where only the best can survive in the global markets. Cost effective technologies to compete with the major producing countries with their far superior productivity levels (see Table 13.11) are imperative, if Indian agriculture has to prosper now that it is a part of WTO. Indian agriculture has to meet the growing food and non-food demands from increasing population and from a prospective reduction in the acreage under crops. According to Abul Kalam, scientist turned President of India, the present 200 million tonnes of food production from 170 million hectares will have to be raised to 300 million tonnes by the year 2020 from 100 million hectares. It is possible only by doubling the present productivity levels. Hence he called for a second green revolution, which, of course, should avoid the negative consequences of the first one. The next breakthrough is anticipated from two sides: (a) from the effective management of water resources, and (b) from the impending strides by biotechnology.

Check Your Progress 2

1) Do you think that agricultural labourers have benefited due to introduction of HYV technology?

.....

.....

.....

.....

.....

2) Why did the HYV technology realise lower success in rice growing areas?

.....

.....

.....

.....

.....

13.8 LET US SUM UP

HYV technology in India has helped in overcoming the acute food shortage of the 1960s. It increased foodgrains production mostly through increase in yield. The overall gains to the country from this new technology can be discussed broadly in terms of its impact on the inequalities across regions, farms and crops.

In the beginning the new technology was introduced in Punjab, Haryana and western Uttar Pradesh keeping in view the availability of accompanying inputs. The higher returns from use of HYV seeds encouraged farmers to adopt it in these areas. Farmers in other areas, however, could not adopt the new technology. As a result, inter-regional inequality increased in the beginning years. Over time, farmers in other states have accepted the HYV technology and the gap in yield across states is lessening.

There is a definite increase in employment opportunities for agricultural labourers. There is large-scale seasonal migration of agricultural labourers from backward to

advanced regions. Mobility of labour and employment opportunity has increased the real wage.

In the beginning HYV technology was introduced in wheat. Later on, adoption of HYV rice also picked up. However, in the case of other crops the relative gains from HYV technology are rather limited.

13.9 KEY WORDS

Population explosion : Before Independence both birth rate and death rate in India were quite high. Consequently population growth rate was reasonably low. In the post-independence period because of better health care facilities death rate declined whereas birth rate continued to remain high. This resulted in high population growth rate.

Cropping intensity : Number of crops grown on the same plot in a year. Any technology that helps raise cropping intensity augments land resource which is very scarce.

Real wage : The money wage deflated by consumer price index for agricultural labourers gives real wage. Real wage, thus, is a more realistic measurement of wage and can be compound overtime as price index is constructed with a base year.

13.10 SOME USEFUL BOOKS

Blyn, G, 1983, The Green Revolution Revisited, *Economic Development and Cultural Change*.

Byres, T. J., 1972, 'The Dialectic of India's Green Revolution', *South Asian Review*, Vol. 5, No. 2.

Dantwala, M.L., 1991, *Indian Agricultural Development since Independence: A Collection of Essays*, Oxford and IBH Publishing Co.

Etienne, G., 1988, *Food and Poverty: India's Half Won Battle*, Sage Publications.

Kurien, C. T., 1981, *Dynamics of Rural Transformation: A Study of Tamil Nadu, 1950-1975*, Orient Longman.

Rao, C. H. H., 1994, *Agricultural Growth, Rural Poverty and Environmental Degradation in India*, Oxford University press, Delhi.

Rao, V. M., 2000, *Modernising Indian Agriculture: Priority Tasks and Critical Policies*, DRG Study No.21, Reserve Bank of India, Mumbai.

Sen, B., 1974, *The Green Revolution in India: A Perspective*, New York, Wiley.

13.11 ANSWERS/HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Go through Section 13.2 and bring out five positive aspects.

2) The reasons for accentuation of inequality across regions could be differences in adoption of new technology, availability of accompanying inputs, etc. See Section 13.3 and answer.

Check Your Progress 2

1) Agricultural labourers have benefited from introduction of new technology because of increase in demand for labour, increase in real wage and creation of national labour market. See Section 13.5 for details.

2) Bring out the adverse conditions in rice growing areas and answer the question.