



# Agriculture Sector and Ground Water Balance in Punjab

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## **Abstract**

*This study highlights some important environmental issues that are related to intensive cultivation in Punjab. After late green revolution, some disturbing trends are arising in Punjab economy due to the agriculture pattern. The era of the green revolution started with wheat and rice production. The over dependence on wheat and rice and intensive use of farm land led to a problem of over exploitation of natural resources like soil and ground water. To find out the impact of intensive cultivation on environment, this study, examined the cropping pattern, irrigation system and subsidies provided by the state Government for agricultural sector. This study found that Extensive reliance of Punjab farmers on intensive wheat and rice cultivation has adverse environmental effect in the form of rapid ground water depletion and soil degradation. This study also focused on the causes behind the increasing dependency of farmers on ground water. This study found that the economic incentive in the form of free /subsidized electricity pricing for water pumping puts a stress on ground water by encouraging rice wheat rotation.*

## **Keywords:**

*environmental, green revolution, dependence, agricultural sector, ground water depletion*

## **Introduction**

The green revolution had negative impact on the environment as well as on the people of India. Even after green revolution India continues to fail to completely satisfy the demand for basic sustenance for many among its expansive population. With regards to the environment, the new techniques used during the green revolution are destroying India's land in the long run. With the change in plantings patterns, land quality has deteriorated greatly. High level of chemicals in fertilizers has hardened the ground and carbon level within them has decreased. The major environmental impact is the loss of biodiversity. Chemical fertilizers pesticides and insecticide have killed off many species in the Indian eco

system, including various bird and insects. Unbalanced use of chemical fertilizers and pesticides destroyed the fertility of the soil and made large areas of Land Barren. These chemical fertilizers and pesticides are dangerous for health of human being and animals. These enter in human body along with food, vegetables, fruits, and causes various diseases. After green revolution, some disturbing trends have been arises in Punjab economy due to the agriculture pattern of economy. The era of the green

revolution started with wheat and rice production. Punjab Rank seventh as gross producer of wheat in the world. The over dependence on wheat and rice and intensive use of farm land led to a problem of over exploitation of natural resources like soil and ground water. This green revolution has negative impact on Punjab economy by disturbed the ground water balance in Punjab. The ground water table has gone down to dangerous level in many areas of Punjab.

### Agriculture Profile of Punjab State

Net Sown Area	4158 thousand Hectare
Gross Cropped Area	7882 Thousand Hectare
Major Crops	PADDY WHAET, AMIZE, COTTON AND SUGARCANE
Area Under Paddy Wheat Rotation	77% of Cropped Area
Cropping Intensity	190%(Highest in India)
Irrigated Area	98%(Highest in India)
Fertilizer Consumption	239 kg/ha (Highest in India)
Pesticide Consumption	923 kg/ha (highest in India, 2007)

Source: Statistical Abstract of Punjab 2013-14

### AREA UNDER MAJOR AGRICULTURAL CROPS

ITEM	1990-91	2000-01	2010-11	2011-12	2012-13	2013-14
<b>Rice</b>	<b>2015</b>	<b>2612</b>	<b>2826</b>	<b>2814</b>	<b>2845</b>	<b>2773</b>
Wheat	3273	3408	3510	3527	3512	3470
Other Cereals	237	203	148	146	145	177
Pulses	143	54	20	20	13	48
Total Food grains	56668	6277	6504	6507	6515	6468

Source: Statistical Abstract of Punjab 2013-14

The area under wheat and rice increased at a very sharp rate in Punjab economy. The area under rice , was 4.79 per cent of the total cropped area in 1960-61 which was increased to 17.74 percent in 1980-81 and further to 33.07 percent in 2003-04. The area under wheat increased from 29.58 percent of the gross cropped area in 1960-61 to 41.58 percent in 1980-81 and 43.57 percent in 2003-04. The area under cultivation in the state was 41.34 lakh hectares in 2011-12. Wheat and rice covers the large portion of the gross cropped area of Punjab. The area under rice in Punjab increased from 1182 thousand hectares in 1980-81 to 2015 thousand hectares in 1990-91 and further increased to 2773 thousand hectares in 2013-14. Its shows that area under rice has slightly increased during the period 1980 to 2013. Rice is a water intensive crop and required 24 to 28 time irrigations in its four month production

period. Such a high intensity of irrigation cannot be met with the canal water even if it is available. So demand is met through pumping the groundwater with electricity operated tube- wells. The electric operated tube wells were 2.80 lakh in 1980-81, which increased to 11.91 lakh in 2012-13. It is observed that number of diesel operated tube wells have declined during the period 1990-91 to 2011-12. This is because Punjab Government supplied electricity to the agricultural sector at highly subsidized rate or even free of cost for some years. The economic incentive in the form of free subsidized electricity pricing for water pumping not only puts a stress on water by encouraging rice wheat rotation but also on soil because these crops are nutrient exhaustive. Due to this the percentage of tube wells operating on electricity has gone up from 75% in 1990-91 to 82% in 1998-99.

**Energisation of Tube wells in Punjab (Lakh)**

Year	Diesel operated	Electric operated	Total
1980-81	3.20	2.80	6.00
1990-91	2.00	6.00	8.00
2000-01	2.85	7.88	10.73
2008-09	2.71	10.05	12.76
2009-10	2.70	11.06	13.76
2010-11	2.40	11.42	13.82
2011-12	2.26	11.57	13.83
2012-13	1.94	11.91	13.85

Source: Government of Punjab, Statistical Abstract, Various Issues.

Rice and wheat crops consumed 66 percent of the total irrigation water used in the agricultural sector. The Punjab farmers preferred rice and wheat crops even on less suitable lands because the growth in their productivity was higher and variations in productivity lower resulting into higher profitability and low risk. The effective minimum support price, assured marketing and low yield risk are other important factors that encourage farmers to grow more wheat and rice. The minimum support price is effective only for these two crops. In this way the farmers were induced to divert the land from the other crops to wheat and rice. But extensive reliance of Punjab farmers on intensive wheat and rice cultivation has adverse environmental effect in the form of rapid ground water depletion and soil degradation.

### Chemical Fertilizers Used for Agriculture

Punjab has the highest consumption of chemical fertilizer per hectare in the

country. The consumption of nitrogenous is maximum followed by Phosphatic and potassic during the period 1980-81 to 2011-12. The total consumption of NPK fertilizers in Punjab has increased from 2.13 lakh nutrient tones in 1970-71 to 19.72 nutrient tons in 2012-13. A big jump in use of fertilizers can be seen during 1970-71 to 1980-81, after that fertilizer use in the Punjab economy has moved high on a continuously rising trend. . This is due to the adoption of new varieties of paddy and wheat. The rising trend of fertilizer consumption in state shows imbalanced use of NPK. The growth of chemical fertilizer consumption was highest during the period 1970-71 to 1980-81. The highly concentration found towards the nitrogenous fertilizer. Structure of subsidy provided by state government on fertilizer is responsible for more use of NPK, which affects adversely on soil fertility and productivity.

### CONSUMPTION OF FERTILISERS IN PUNJAB (000 nutrients tonne)

Year	Nitrogen	Phosphatic	Potassic	Total (NPK)
1970-71	175	31	7	213
1980-81	526	207	29	762
1990-91	877	328	15	1220
2000-01	1008	282	23	1313
2008-09	1332	379	57	1768
2009-10	1358	434	74	1866
2010-11	1403	435	73	1911
2011-12	1416	448	54	1918
2012-13	1486	462	24	1972

Source : Economic Survey of Punjab 2012-13.

### **GROUND WATER USES AND DECLINING WATER TABLE**

Due to green revolution the water resources of Punjab continued to be over exploited. The total available water resources in Punjab is 3.13 million ha meters out of which 1.45 million ha meters is from canals and 1.68 ha meters is from rainfall and seepage. The total required water is 4.33 million ha meters. the deficit of 1.20 million ha meters is met by underground water withdrawal. The deficit of 1.20 million ha meters shows the overexploitation of water resources.

### **AVAILABLE WATER RESOURCES IN PUNJAB**

Canal water	1.45
Rainfall and seepage	1.68
Total availability	3.13
Water demand	4.33
Deficit	1.20

Source: Statistical Abstract of Punjab 2013-14

Approximately 95-98% of the area under rice and wheat is irrigated. Irrigation from ground water account for 73% of the total irrigation requirement and the remaining

27% is met through surface water. The intensive exploitation has caused the ground water table problems.

### **IRRIGATED AREA BY DIFFERENT SOURCES IN PUNJAB (000 hectares)**

Year	Canals	Tube wells
1970-71	1292	1591
1980-81	1430	1939
1990-91	1669	2233
200-01	962	3074
2004-05	1108	2919
2005-06	981	2912
2006-07	1148	2878
2007-08	1142	2922
2008-09	1113	2950
2010-11	1116	2954
2011-12	1116	2969

Statistical Abstract of Punjab.

The Punjab economy has highest net irrigated area in the India and agriculture sector accounts for about 85% of water consumption in the Punjab state because mostly farmers are adopting more water intensive crops and used fertilizers that required protective irrigation. Tube wells are the main source of irrigation in the Punjab state followed by canals. The irrigated area

by tube wells has increased from 1591 thousand hectares in 1970-71 to 2969 thousand hectares in 2011-12. At present, there are 12.32 lakh tube well connections in the state as compared to 1.92 lakh in 1970. The area under irrigation by tube wells in the Punjab state has increased from 55 percent to 73%. The over use of ground water for agriculture purposes especially for rice cultivation the water table is decreasing at an alarming rate in the state. In the

central Punjab, where around 66% of tube wells are located, water table is declining at a rate of 54 cm per year.

Punjab economy has 4158 thousand hectare land under agriculture out of this, 4070 thousand hectares land is getting irrigation from canals (27%) and tube well (73%). Due to cheap credit and free supply of electricity, the use of tube wells for irrigation has increased steeply in the Punjab state.

#### SOURCES OF IRRIGATION IN PUNJAB

Net Irrigated Area of Punjab Economy	97.9% (Highest in India)
Consumption of Water for Agriculture Purposes	85%
Irrigation through Tube wells	73%
Irrigation through Canals	27%

Source: Statistical Abstract of Punjab 2013-14

This figure indicates that ground water in Punjab economy is over exploited to meet the increasing demands for water for irrigation purposes. Extensive use of canal irrigation and reckless use of groundwater through tube wells have caused water logging problems in some areas and lowering of the ground water table in other areas. The water table in the central districts of Punjab has been going down at an average rate of 0.23 meters per year. This

over exploitation of underground water is due to increase in the number of tube wells, free supply of electricity, cultivation of such high water consuming crops paddy, potato, wheat, sugarcane etc.

#### Suggestions for correcting the water balance

1. The crop diversification of agriculture as a policy measure is suggested in the state to match the cropping pattern with soil

and water capabilities and sustain the growth of agricultural sector in long-run.

2. Therefore it is desired that the electricity charges should be linked with the actual quantity of electricity use rather than on subsidies or free basis. It will induce the farmers to economize the use of electricity and consequently the groundwater by improving on farm water use efficiency.
3. Create awareness among the farmers towards adoption of water use efficiency measures.
4. Adoption of short duration varieties of seed.
5. More encourage to substitution of high water consuming crops with low water consuming crops.
6. Maximum use of surface water and try to increase recharge of ground water.

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