The Impact of Economic Reform on the Growth of Agriculture Production and Productivity in India since Liberalisation

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Introduction

Agriculture is the main occupation of Indian peoples. The performance of Indian economy is dependent upon the growth of Agriculture sector. It contributes nearly 14 percentage of India's Gross Domestic Product (GDP) and 13 percentages of total exports during the period 2012-13. It provides employment to 52 percentage of the country's work force and livelihood security to more than 620 million people. After the institution of planning in India, the share of agriculture has persistently declined on account of the development of the secondary and tertiary sectors of the economy. The share of Agriculture and allied activities in GDP was 37.9 per cent in 1980-81 and it was continuously declined to13 per cent in 2012-13. In 1950-51, 69.5 percent of the working population was engaged in agriculture and to 56.7 percent in 2000-01. In 2004-05, agriculture provided employment to 52.1 per cent of the work force. However, with rapid increase in population the absolute number of people engaged in agriculture has become exceedingly large. In India, for a number of years there are three agricultural commodities like cotton textile, jute and tea accounted for more than 50 percent of export earnings of the country. The share of agriculture in total exports rose to around 70 percent to 75 percentages. The share of agricultural exports in total exports was 44.2 percent in 1960-61. This fell consistently to 30.7 percent in 1980-81 and 9.9 percent in 2009-10.

Objectives of the study

The main objectives of the study are,

1. to evaluate the performance of agricultural production in Indian economic growth.
2. to analyse the growth of Area under cultivation, Production and Productivity of total food grains and major commercial crops in India from 1990-91 to 2011-12.
3. to analyse the compound growth rate of Area, production and yield of total food grains in India from 1990-91 to 2011-12.

Methodology of the study

The data has been collected from secondary sources comprising of Hand Book of Statistics on Indian Economy, Ministry of Agriculture in India and the Directorate of Economics and Statistics. The period of study from 1990-91 to 2011-12 and the collected data has been classified and analysed in a systematic manner. For analysis, statistical tools like Simple Linear Regression Model, Semi- log model and Annual growth rates have been used in this study. The linear trend equation of the form, $Y_i = \alpha + \beta X_i$ Where, Y is the area under cultivation/production/yield of total food grains and non food grains in India. X_i is the time periods (where i =1, 2,3,……,n) and $\beta = \frac{\Sigma xiyi}{\Sigma xi}$. To estimate the compound growth rate using the semi-log functions of the form $Y = \alpha \beta^t e^u$ have been estimated, the compound growth rate is given by {(anti log of β) - 1} x 100.

Trends in Agricultural Production of food grains in India

The optimum production of food grains is the most important need of each people of the country. The total production of food grains was increased to 50.8 million tonnes in 1950-51 and 187.0 million tonnes in the Eighth Plan. The Food grains output in the Tenth Plan was 202.9 million tonnes. However, because of drought conditions in the first year of the tenth plan 2002-03, the food grains output declined to 174.8 million tonnes but again rose to 213.2 million tonnes in 2003-04. Food grain production touched the record level of 259.3 million tonnes in 2010-11, but according to the second advance estimates for the year 2012-13 is likely to decline to 250.2 million tonnes in 2012-13.

Table 1: Plan-wise growth of total GDP and Agriculture GDP in India (including allied sector)

Plan	GDP	Agriculture GDP
First Plan(1951-56)	3.6	2.4
Second Plan(1956-60)	4.21	2.2
Third Plan (1961-65)	2.72	1.6
Fourth Plan(1969-1973)	2.05	3.6
Fifth Plan(1974-79)	4.83	5.7
Sixth Plan(1980-85)	5.54	3.1
Seventh Plan(1985-90)	6.02	1.3
Eighth Plan(1992-1997)	6.68	4.7
Ninth Plan(1997-02)	5.55	2.5
Tenth Plan (2002-07)	7.7	2.3
Eleventh Plan (2007-12)	7.9	3.7

Source: Planning Commission of India, various five year plans reports.

The above table shows the growth of total GDP and Agriculture GDP in India during the various plan periods. Agriculture has got a prime role in Indian economy. Though the share of agriculture GDP in national income has come down since the inception of planning era in the economy but still it has a substantial share in GDP. In the first plan, total GDP was 3.6 percent and the agriculture GDP was 2.4 percent and it has increased to 6.7 percent and 4.7 percent respectively in eighth plan. During the tenth plan, total GDP has increased to 7.8 percent but the agricultural GDP has declined to 2.3 percent. The share of agriculture and allied sector in the gross domestic product has registered a steady decline from 36.4 percent in 1982-83 to 14.1 percent in 2011-12. Notwithstanding, the trend of agriculture GDP in India was declined. So the Government of India has to give more importance to the agricultural sector to promote the economic growth.

Estimated trend equation of total food grains production in India during 1990-91 to 2011-12 has been

	Coefficients	*Standard Error*	*t Statistics*
Intercept	168.03	5.33	31.53
X Variable	3.16	0.41	7.78

R Square = 0.75

The slope coefficient is statistically significant at 5 percent level and 20 degrees of freedom. The average production of food grains has been increases 2.62 million tonnes per year during the post reform periods. The explanatory variable time(x) could explain nearly 75 per cent of the variation in the dependent variable. In 1990-91,

the total food grain production was 176.36 million tonnes and it increased to 203.61 million tonnes in 1998-99. Further, it rose to 208.59 million tonnes in 2005-06 and it reached to 259.29 million tonnes in 2011-12.

Table 2: Estimated trend of total food grains production in India from 1990-91 to 2011-12.

Major Crops	Variables	Values	Standard Error	t value	R^2
Rice	Constant t	72.78 1.16*	2.32 0.18	31.35 6.55	0.68
Wheat	Constant t	54.79 1.38*	1.97 0.15	27.79 9.21	0.81
Coarse Cereals	Constant t	28.13 0.48*	1.62 0.12	17.36 3.91	0.43
Total Cereals	Constant t	155.69 3.02*	4.86 0.37	33.03 8.17	0.77
Pulses	Constant t	12.33 0.14	0.64 0.05	19.40 2.80	0.28

Source: values computed from hand book of statistics on Indian Economy 2012-13.
**indicates that 5 per cent level of significance.*

The above most of the estimated slope coefficients were statistically significant at 5 percent level and the one variable like pulses was statistically insignificant. During the post reform period from 1990-91 to 2011-12, the average production of rice and wheat has been increased to 1.162 million and 1.38 million tonnes per year respectively. At the same period the total cereals was increased to 3.02 million tonnes per year, but the production of pulses were increased a small amount compare to the cereals. In 1990-91, the production of rice, wheat and pulses were 74.29, 55.14 and 14.26 million tonnes respectively. It was rose from 88.53 million tonnes in 2003-04 to 105.30 million tonnes in 2011-12. The production of wheat increased from 55.14 million tonnes in 1999-2000. However, it fell thereafter and stood at 65.76 million tonnes in 2000-01. After 2004-05, wheat production was continuously increasing, in the year 2011-12 it rose to 94.88 million tonnes. The explanatory variable time(x) could explain more than 75 percentage of the variation in the dependent variables.

Table 3: Estimated trend of major commercial crops in India from 1990-91 to 2011-12.

Major Crops	Variables	Values	Standard Error	t value	R^2
Groundnut	Constant t	7.79 -0.05	0.59 0.04	13.18 -1.06	0.05
Rapeseed and Mustard	Constant t	4.87 0.10	0.44 0.03	10.91 2.99	0.31
Soya bean	Constant t	2.07 0.42*	0.50 0.04	4.15 11.07	0.86
Total Oilseeds	Constant t	17.86 0.48*	1.37 0.10	12.99 4.57	0.51
Coffee	Constant t	181.33 6.13*	11.52 0.86	15.74 6.98	0.71
Cotton (lint)	Constant t	4.92 0.98*	2.02 0.15	2.43 6.34	0.67
Raw Jute and Mesta	Constant t	9.18 0.12*	0.33 0.03	27.66 4.31	0.48
Sugarcane	Constant t	237.60 4.13*	13.17 1.00	18.04 4.12	0.46
Tea	Constant t	658.60 15.57*	12.52 0.95	54.76 16.33	0.93

Tobacco	Constant t	0.62 -0.004	0.07 0.01	8.68 -0.85	0.03

Source: values computed from hand book of statistics on Indian Economy 2012-13.
**indicates that 5 per cent level of significance.*

The most of the slope coefficients were found to be statistically significant at 5 per cent level and the other variables are statistically insignificant. The rate of increase in the production of sugarcane and tea was 4.13 million tonnes and 15.57 million tonnes per year. The average increase of oilseeds and cotton was 0.48 million tonnes and 0.98 million tonnes during the post reform periods. The production of groundnut and tobacco was declined to 0.05 million tonnes and 0.004 million tonnes per year. The explanatory variable time (x) could explain more than 70 percent of the variation in y. In the non food grains of jute and cotton show the slow and halting progress in the periods 1990-91 to 2011-12. However, the production of cotton rose from 9.84 million pales in 1990-91and it rose to record level of 35.20 million pales in 2011-12. In 2006-07, sugarcane production attained a record level of 355.5 million tonnes but declined in subsequent years. In 2010-11, it was only 342.38 million tonnes but rose to 361.04 million tonnes in 2011-12.

Estimated trend equation of area under cultivation of total food grain production in India during 1990-91 to 2011-12 has been

	Coefficients	Standard Error	t Statistics
Intercept	123.20	1.20	102.79
X Variable	-0.036	0.09	-0.39

R Square = 0.007

The slope coefficients are statistically significant at 5 percent level at 20 degrees of freedom. The area under cultivation of food grain production was decline to 0.036 million hectares per year during the post reform period. The value of R square shows that the explanatory variable could explain only 0.007 percentage of the variation in area under cultivation of total food grains in India.

Table 4: Estimated trend of area under cultivation of food grain production in India from 1990-91 to 2011-12.

Major Crops	Variables	Values	Standard Error	t value	R^2
Rice	Constant t	42.88 0.04	0.53 0.04	80.71 0.91	0.04
Wheat	Constant t	23.97 0.22*	0.37 0.03	64.41 7.82	0.75
Coarse Cereals	Constant t	34.21 -0.53*	0.50 0.04	68.75 -9.33	0.81
Total Cereals	Constant t	101.04 -0.09	0.85 0.06	118.58 -1.42	0.09
Pulses	Constant t	22.00 0.08	0.63 0.05	35.02 1.59	0.11

Source: values computed from hand book of statistics on Indian Economy 2012-13.
**indicates that 5 per cent level of significance.*

The above table shows that the slope co efficient of wheat and coarse cereals were statistically significant at 5 per cent level and the rest of other variables are statistically insignificant. The rate of increase on area under cultivation of rice, wheat and pulses were 0.04 million hectares, 0.22 million hectares and 0.08 million hectares respectively. But the total cereals were declined to 0.09 million hectares per year during the post reform period. The value of R

square shows that, the percentage of changes in the independent variables that can be explained by the independent variables.

Table 5: Estimated trend of area under cultivation of major commercial crops in India from 1990-91 to 2011-12.

Major Crops	Variables	Values	Standard Error	t value	R^2
Groundnut	Constant t	8.49 -0.14*	0.18 0.01	46.61 -10.14	0.84
Rapeseed and Mustard	Constant t	6.16 -0.003	0.34 0.03	17.91 -0.11	0.0006
Soya bean	Constant t	2.75 0.33*	0.20 0.01	14.04 22.22	0.96
Total Oilseeds	Constant t	24.80 0.07*	0.75 0.06	33.03 1.18	0.07
Sugarcane	Constant t	3.56 0.06*	0.15 0.01	23.92 5.02	0.56
Tea	Constant t	0.39 0.01*	0.01 0.00	56.61 18.63	0.95
Coffee	Constant t	0.19 0.01*	0.005 0.004	36.47 25.21	0.97
Cotton (lint)	Constant t	7.42 0.14*	0.36 0.03	19.93 5.08	0.56
Raw Jute and Mesta	Constant t	1.04 -0.01	0.03 0.00	34.05 -2.42	0.22
Tobacco	Constant t	0.45 -0.01	0.04 0.00	10.95 -2.08	0.18

Source values computed from hand book of statistics on Indian Economy 2012-13.
**indicates that 5 per cent level of significance.*

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The above table shows the estimated trend of major commercial crops in India during the post reform period from 1990-91 to 2011-12. Most of the slope coefficients were statistically significant at 5 per cent level and the other variables like Rapeseed and mustard, raw jute and Mesta and tobacco were statistically insignificant. The rate of increase on area under cultivation of Tea and Coffee was increased to 0.01 million hectares per year and the cultivation of sugarcane was 0.06 million hectares during the same period. Area under cultivation of Raw jute and Mesta and Tobacco was declined to 0.01 million hectares per year during the post reform period. The value of R square shows that the percentage of changes in the independent variables(y) that can be explained by the independent variables(x). Soya bean, coffee and tea were explained more than 95 percentage of the variation in the independent variables. The oil production increased from 24.15 million hectare in 1990-91 to 26.23 million hectare in 1998-99. However, it fell stood at 21.49 million tonnes in 2002-03, but rose subsequently. In the non food grains of jute and cotton show the slow and halting progress in the periods 1990-91 to 2011-12. However, the production of cotton rose from 7.44 million pales in 1990-91and it rose to record level of 12.18 million pales in 2011-12.

Estimated trend equation of Yield per hectare of total food grain production in India during 1990-91 to 2011-12 has been

	Coefficients	*Standard Error*	*t Statistics*
Intercept	3627.987	1116.49	3.25
X Variable	-121.9	85.01	-1.43

R Square = 0.093

The slope coefficients are statistically significant at 5 percent level and the rate of decline on the yield per hectare of total food grain production was 121.9 kgs per hectares per year. The explanatory variable time could explain nearly 0.093 percent of the variation in yield per hectare of total food grain production in India during the post reform period.

Table 6: Estimated trend equation of Yield per hectare of food grains production in India from 1990-91 to 2011-12.

Major Crops	Variables	Values	Standard Error	t value	R^2
Rice	Constant t	1699.87 24.73*	37.36 2.84	45.50 8.69	0.79
Wheat	Constant t	2321.79 28.32*	44.38 3.38	52.32 8.38	0.78
Coarse Cereals	Constant t	794.35 28.93*	46.42 3.53	17.11 8.18	0.77
Total Cereals	Constant t	1542.26 31.36*	34.76 2.65	44.37 11.85	0.86
Pulses	Constant t	580.38 0.73	39.20 2.98	14.80 0.24	0.002

Source: values computed from hand book of statistics on Indian Economy 2012-13.
**indicates that 5 per cent level of significance.*

The above estimated trend equation shows the yield per hectare of food grains production in India during the post reform periods. The most of the variables are statistically significant and the variable pulses were statistically insignificant at 5 per cent level. The rate of increase an average of per year of wheat and rice was 24.73 kgs and 28.32 per kgs respectively. The total cereals were increased to 31.36 kgs per year. In 1990-91, yield per hectare of all food grains has increased from 1,380 kgs per hectare to 2,125 kgs per hectare in 2012-13. Most significant increase has been recorded by wheat with it yield increasing from 2,281kgs per hectare in 1990-91 to 3,119 kgs per hectare in 2012-13. While productivity of jowar, bajra and maize has increased relatively slow. Moreover, there are wide yearly fluctuations. In fact, the productivity of pulses rose somewhat to 578 kgs per hectare in 1990-91 and it slightly higher in 786 kgs in 2012-13.

Table 7: Estimated trend equation of yield per hectare of major commercial crops in India from 1990-91 to 2011-12.

Major Crops	Variables	Values	Standard Error	t value	R^2
Groundnut	Constant t	900.88 13.89	77.18 5.88	11.67 2.36	0.22
Rapeseed and Mustard	Constant t	794.62 16.16*	40.50 3.08	19.70 5.24	0.58
Soya bean	Constant	899.10	57.26	15.70	0.25

	t	11.14	4.36	2.56	
Total Oilseeds	Constant t	729.58 15.50*	37.79 2.88	19.31 5.39	0.59
Sugarcane	Constant t	67170.52 6.05	1348.75 102.69	49.80 0.09	0.00
Tea	Constant t	1767.92 -2.47	32.52 2.48	54.37 -0.99	0.047
Coffee	Constant t	845.47 -0.57	29.35 2.23	28.81 -0.26	0.003
Cotton (lint)	Constant t	154.44 12.96*	28.72 2.19	5.38 5.80	0.63
Raw Jute and Mesta	Constant t	1568.66 31.78*	23.85 1.82	65.78 17.17	0.94
Tobacco	Constant t	1489.74 -9.12	144.75 11.02	10.29 -0.83	0.033

Source: computed from hand book of statistics on Indian Economy 2012-13.
*indicates that 5 per cent level of significance.

The above table shows that, the most of the slope coefficients are statistically significant at 5 per cent level. Yield per hectare of tea, coffee and tobacco were shows the declining trend in the post reform periods and other variables are increasing trend. The oil production increased from 771kgs per hectare in 1990-91 to 944 kgs per hectare in 1998-99. However, it fell stood at 691kgs per hectare in 2002-03, but rose subsequently. It raised 1159 kgs per hectare in 2010-11 and further decline 1135 kgs per hectare in 2011-12. In the non food grains of jute and cotton show the slow and halting progress in the periods 1990-91 to 2011-12.

Table 8: Compound Growth Rate of area, production and yield of principle crops in India during 1990-91 to 2010-11.

Crop	1990-91 to 1999-2000			2000-01 to 2010-11		
	Area	Production	Yield	Area	Production	Yield
Cereals	0.04	-0.02	1.59	0.09	2.01	3.19
Pulses	-0.60	0.59	0.93	1.62	3.35	1.90
Total Food grains	-0.07	2.02	1.52	0.37	2.12	2.89
Oilseeds	-0.86	1.63	1.15	2.14	4.60	3.59
Non Food grains	1.18	2.69	1.09	2.16	3.67	2.49
All Principal Crops	0.27	2.29	1.33	0.91	2.50	3.25

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation.

The above table shows that the compound growth rate of area, production and yield of principle crops in India during post reform period. In 1990-91 to 1999-2000 the area under cultivation of cereals crops was 0.04 percent but it rose to 0.09 percent in the year 2000-01 to 2010-11. At the same time production of cereals was negative growth but the growth rate yield of cereals was 1.59 percent and it rose to 3.19 percent in 2000-01 to 2010-11. The area under cultivation of total food grains was declined to 0.07 percent in 1990-91 to 1999-2000 but it rose to 0.37 percent in the year 2000-01 to2010-11. At the same time production of total food grains was negative growth but the growth rate yield of total food grains was 2.02 percent and it rose to 2.12 percent in 2000-01 to 2010-11. The area under cultivation of non-food grains was 1.18 percent in 1990-91 to 1999-2000 but it rose to 3.67 percent in the year 2000-01 to 2010-11. At the same time production of non-food grains was 2.69 but it rose to 3.67 percent in a 2000-01 to 2010-11.The growth rate yield of non-food grains was 1.09 percent and it rose to 2.49 percent in

2000-01 to 2010-11. The area under cultivation of all principle of crops was 0.27 percent in 1990-91 to 1999-2000 but it rose to 0.91 x in the year 2000-01 to 2010-11.At the same time production of all principle crops was 2.29 percent but it rose to 2.50 percent in the year.2000-01 to 2010-11. The growth rate yield of principle crops was 1.33 percent and it rapidly increase to 3.25 percent in year 2000-01 to 2010-11.

Table 9: Estimated trend of Agricultural Exports and Imports in India

	Variables	Values	Standard Error	t value	R^2
Exports	Constant t	-10973.5 4577.56*	5802.91 462.14	-1.89 9.91	0.84
Imports	Constant t	-8132.95 2429.54*	3144.20 250.40	-2.59 9.70	0.83

Source: computed from hand book of statistics on Indian Economy 2012-13.
**indicates that 5 per cent level of significance.*

From the above table shows that estimated trend of agricultural exports and imports in India during the post reform period. The slope coefficients were statistically significant at 5 per cent level and the rate increase on the average of agricultural exports and imports was Rs. 4577.56 crores and Rs. 2429.54 crores per year during the periods 1990-91 to 2011-12. During 1990-91 agricultural export was Rs.6012.72 (18.49 percentage) crores and the export was increased to Rs.89522.59 (20.33 percentage) crores. The percentage of agricultural export to total national exports is continuously declining from 1999-2000 to 2009-10, ie from 15.91 percent to 10.59 percent respectively.

Conclusion

The growth of agriculture in the eleventh plan was 3.7 percent, which is higher than in the tenth plan growth rate. The twelfth plan target growth rate for agriculture is 4 percent with food grains growth rate is about 2 percent and non-food grains sector growing at about 5 to 6 percent. The production of food grains, oilseeds, pulses and other commercial crops is increasing continually in India. But capital formation level is decreasing in the agricultural sector due to the unfavorable policy of the government regarding investment promotion. Globalization is a necessary but not a sufficient condition for high growth production, India has undertaken economic reforms, both internal and external. Agricultural price policy has played an important role in Indian agriculture but is facing some challenges. The slowdown in agriculture growth could be attributed to the supply side factors such as public investment, irrigation water management, rural credit, technology, land management, agricultural research and development including extension services, rural infrastructure like roads, electricity, marketing, post-harvest management and so on. Reforms are needed to address these issues in order to achieve 4 to 4.5 per cent growth in agriculture. All farmers, agricultural labourers, societies, Government and people's organizations should work collectively to revive agriculture.

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