TO EXAMINE THE IMPACT OF MODERN INPUTS ON AGRICULTURAL PRODUCTION AND PRODUCTIVITY IN HARYANA

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ABSTRACT:

Agriculture development is a necessary condition for the over-all development of the economy. A progressive agriculture serves as a powerful engine of economic growth. Agriculture derives its importance from fact that it has vital supply and demand links with the manufacturing sector. In India, production and productivity has been increasing since green revolution with increasing use of high yielding seeds, synthetic fertilizers, and extent of irrigation, mechanical power and electricity in farm operations. Thus, the present study tries to examine the impact of modern inputs on Agricultural production and productivity in Haryana and the study is based on secondary data collected from different published issues of 'Statistical Abstracts of Haryana' for the selected period . The results of the study have been complied by compound growth rates. During the study period it was found that the use of different modern farm inputs have made a different positive and negative impact on production and productivity of studied crops. Common reason was behind that farmers were not aware regarding the use these modern inputs, improper irrigation facilities, lack of public awareness etc. However, finding of overall study revealed that use of these modern inputs have shown more positive impact on growth of production and productivity of studied crops rather than its negative impact.

Key Words: production, productivity, agriculture, fertilizers.

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Introduction:

Agriculture development is a necessary condition for the over-all development of the economy. A progressive agriculture serves as a powerful engine of economic growth (Soni, 2009). Agriculture derives its importance from fact that it has vital supply and demand links with the manufacturing sector (Dr Tyagi 2012). Ragnar Nurkse argues that the surplus population in agriculture should be shifted to the newly started industries. Nurkse's thesis is that agricultural productivity will be increased on the one hand on the other new industrial units would be set up with the use of surplus labour (Datt & Sundharam, 2006). Productivity in agriculture is mainly dependent on the two sets of factor technological and institutional (Datt & Sundharam, 2006). In India, production and productivity has been increasing since green revolution with increasing use of high yielding seeds, synthetic fertilizers, and extent of irrigation, mechanical power and electricity in farm operations (Misra & Puri, 2008). Green revolution is limited up to only some crops. Pulses, oilseeds and coarse grains productivity have been still low, even less than that of some of the developing countries (Singh *etl*, 2005). Policy support, production strategies, public investment in infrastructure, research and extension for crop, livestock and fisheries have significantly helped in increasing the agricultural productivity, food production and its availability (Kumar and Mittal, 2006).

Objective of the study: Our aim is to examine the impact of modern inputs on agricultural production and productivity in Haryana.

Methodology:

Area of the Study:

The present study is pertained to whole of the Haryana state. This State is known as a state of green revolution. During the adoption of advance technology, Haryana has registered high growth rates in agricultural sector and agricultural production has increased at a significant level.

Period of the study:

The present study has been taken the time period from 1988-89 to 2007-08 due to restricted availability of the data.

Source of the data:

The present study is based on secondary data which have been collected from different published issues of 'Statistical Abstracts of Haryana' for the selected period.

Selection of the crops:

In the present study twelve major rabi and kharif crops viz. Wheat, Rice, Bajra, Gram, Moong, Massar, Groundnut, Rapeseed & Mustard, Sugarcane, Cotton American, Cotton Desi and Maize have been selected, because of these crops constituting approximately 96.17 per cent of the total cropped area of the state.

Selection of the New Inputs:

In the present study six new inputs Electricity, Fertilizer, High Yielding Varieties, Area Irrigated, Pesticide and Tractor are selected, because these inputs effectively influence the production and productivity.

Statistical Techniques: compound growth rate have been used to estimate the impact of modern inputs on agricultural production and productivity in Haryana.

Result and Discussion:

This section deals with effect of inputs on production and productivity of selected crops during the period 1988-89 to 2007-08.

The effect of Inputs on Production and Productivity of Cotton American in Haryana:

Table 1 shows the regression coefficients for all inputs. Electricity and fertilizers have showed positive impact on both production and productivity of Cotton American expect pesticides and tractors. This shows the imbalance use of inputs which is responsible factor for loss of soil fertility and unused capacity of tractors due decreasing land holding is found another reason during the study period. From table, 67 per cent variation has been taken place due to one year inputs fluctuation of the concerned crop's production and standard error of the estimate is also very high comparatively with other.

Table 1: The effect of Inputs on Production and Productivity of Cotton American in Haryana. (1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	2.03	3.76	2.12	4.11
Fertilizers	1.98	1.34	1.64	1.16
Area Irrigated	-0.26	-0.39	0.52	0.82
Pesticides	-0.00	-0.49	-0.22	-1.24
Tractors	-3.28	-1.94	-3.86	-2.38
R^2 = 0.67			R^2 = 0.70	
Standard Error of the Estimate = 202.56			Standard Error of the Estimate = 69.99	

The effect of Inputs on Production and Productivity of Cotton Desi in Haryana:

It is observed from the table 2 that the value of regression coefficient shows that fertilizers, area irrigated and pesticides have affected positively the production of Cotton Desi as the value of coefficient has been observed as 0.59, 0.73 and 0.19 per cent, respectively. But electricity and tractors have not been able to contribute in the production of the same crop while it is shown from the figures that there has been negative impact. The five independent variables together explained 44 per cent variations in production of Cotton Desi. This shows that these modern inputs are less responsible for the production of this crop. Regarding productivity, the three inputs i.e. electricity, fertilizers and area irrigated have positive boost up to the productivity of Cotton Desi. However pesticides and tractors have again shown negative impact because the use of pesticides is little known to the farmers and its use is confined to very selective crops. All the independent variables together explained 63 per cent of the variations in Cotton Desi production. and standard error of the estimates is very high.

Table 2: The effect of Inputs on Production and Productivity of Cotton Desi in Haryana.

(1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	-0.38	-0.54	1.15	2.00
Fertilizers	0.59	0.30	2.26	1.44
Area Irrigated	0.73	0.84	0.15	0.22
Pesticides	0.19	0.77	-0.12	-0.64
Tractors	-0.26	-0.12	-2.95	-1.63
$R^2 = 0.44$			$R^2 = 0.63$	
Standard Error of the Estimate = 84.61			Standard Error of the Estimate = 78.23	

The effect of Inputs on Production and Productivity of Gram in Haryana:

The same computed estimates for the Gram crop has been presented in table- 3. The value of the regressions coefficient shows that all inputs have negative effect on Gram crop in both the cases of production and productivity except for tractor which has shown a positive effect in both conditions. All the independent variables together explained 85 per cent of the variation in Gram production. The pesticides have shown higher value as -1.92 per cent which shows negative impact on the production of Gram, because new inputs have been used under rain fed cultivation. In the case of productivity, tractors have shown higher values as 3.64 with positive impact. The five independent variables together explained 26 per cent of the variations in Gram productivity. So it can be interred from the figures of the table that contrasted results have been obtained for this crop.

Table 3: The effect of Inputs on Production and Productivity of Gram in Haryana.

(1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	-0.74	-2.05	-1.12	-1.38
Fertilisers	-0.58	-0.59	-1.80	-0.81
Area Irrigated	-1.34	-2.99	-1.12	-1.11
Pesticides	-1.92	-1.52	-0.00	-0.02
Tractors	1.66	1.46	3.64	1.42
$R^2 = 0.85$			$R^2 = 0.26$	
Standard Error of the Estimate = 74.76			Standard Error of the Estimate = 157.92	

The effect of Inputs on Production and Productivity of Groundnut in Haryana:

Table 4: The effect of Inputs on Production and Productivity of Groundnut in Haryana.

(1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	-0.06	-0.08	-0.56	-0.64
Fertilizers	0.21	0.11	2.54	1.05
Area Irrigated	-2.02	-2.31	-0.88	-0.81
Pesticides	-0.24	-1.01	-0.03	-0.11
Tractors	1.36	0.61	-1.19	-0.43
$R^2 = 0.45$			$R^2 = 0.14$	
Standard Error of the Estimate = 0.57			Standard Error of the Estimate = 44.01	

Table 4 explains the regression coefficients for inputs like fertilizers and tractors show positive impact with the value of 0.21 and 1.36 per cent in case of groundnut production. Area irrigated

has shown higher value but it has negative impact due to changing cropping pattern scenario. The value of coefficient of determination was observed 0.45 which reflect that all these inputs explain only 45 per cent variation in the production. In the case of productivity all estimated coefficients like electricity, area irrigated, pesticides and tractor have shown negative impact except fertilizers with highest value. The R^2 value is 0.14, which shows the 14 per cent of the variation in the dependent variable can be explained by the specified independent variables.

The effect of Inputs on Production and Productivity of Massar in Haryana: -

Table 5 shows that the regression coefficients of all the inputs. In case of production of Massar fertilizers, irrigated area and pesticides have negative impact. But for the productivity these inputs shows positive impact. This shows the improper and lack of knowledge regarding uses of these inputs. The R^2 value is 0.89, which shows the 89 per cent of the variation in the dependent variable due to all these independent variables. The standard error of estimates is very high in case of productivity.

Table 5: The effect of Inputs on Production and Productivity of Massar in Haryana.

(1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	-1.29	-4.26	-0.36	-0.82
Fertilizers	-0.70	-0.85	1.49	1.22
Area Irrigated	-0.50	-1.34	1.27	2.30
Pesticides	-0.02	-0.25	0.16	1.08
Tractors	1.53	1.62	-1.52	-1.08
$R^2 = 0.89$			$R^2 = 0.77$	
Standard Error of the Estimate = 0.74			Standard Error of the Estimate = 59.85	

The effect of Inputs on Production and Productivity of Moong in Haryana:

The effect of inputs on production and productivity of Moong in Haryana is presented in table 6. The value of the regression coefficient shows that fertilizers and tractors have affected positively the production of Moong as the value of coefficients fer these inputs was 1.33 and 1.09 values for these inputs. But electricity, area irrigated and pesticides have not able to contribute positively in the production of this crop while it is shown from the figures that there has been negative impact of these inputs on the production of Moong. It is also found from this table that 62 per cent variation have taken place in the production of Moong due to the use of these five selected inputs. Regarding productivity, the two inputs i.e. area irrigated and tractors have not found sufficient enough to increase it as they have played negative role in respect to the productivity of Moong however the remaining inputs of the selected inputs i.e. electricity, fertilizer and pesticides have given positive boost up to the productivity of Moong. It has found that 75 per cent variation in the productivity of this crop occurred due to the use of these selected inputs. For the study, as far as considered to the standard error, there has not emerged a impressive picture as the value of standard error has calculated very high in the case of productivity and production.

Table 6: The effect of Inputs on Production and Productivity of Moong in Haryana.

(1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	-0.17	-0.29	0.98	2.08
Fertilisers	1.33	0.84	1.53	1.19
Area Irrigated	-2.03	-2.80	-2.09	-3.58
Pesticides	-0.32	-1.62	0.17	1.03
Tractors	1.09	0.59	-0.81	-0.55
$R^2 = 0.62$			$R^2 = 0.75$	
Standard Error of the Estimate = 1.71			Standard Error of the Estimate = 75.76	

The effect of Inputs on Production and Productivity of Rapeseed & Mustered in Haryana:

Table 7 revealed that the estimated coefficients of the inputs like electricity and tractors have shown positive impact on Rapeseed & Mustard on both production and productivity. The production of Rapeseed & Mustard has been noted 4.21 per cent increase due to 1 per cent increase in tractors. All the inputs have insignificant values in both the cases i.e. production and productivity. All the independent variables together explained 39 per cent variation in the production. The accuracy level of this estimate is low. The regression coefficients of fertilizers and pesticides have made negative impact on productivity as the values -4.60 and -0.06 per cent due to imbalance use of new inputs. The value of coefficient of multiple determinations (R^2) indicates that 39 per cent variation in productivity of this crop is due to these variables. The standard error of estimate is again high.

Table 7: The effect of Inputs on Production and Productivity of Rapeseed & Mustard in Haryana. (1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	0.01	0.02	0.31	0.27
Fertilizers	-2.76	-1.37	-4.60	-1.72
Area Irrigated	-1.00	-1.09	0.13	0.12
Pesticides	0.13	0.52	-0.06	-0.19
Tractors	4.21	1.82	4.53	1.57
$R^2 = 0.39$			$R^2 = 0.39$	
Standard Error of the Estimate = 144.04			Standard Error of the Estimate = 214.54	

The effect of Inputs on Production and Productivity of Bajra in Haryana:

Table 8 shows that the variables such as all inputs under Bajra have insignificant values. The regression coefficients for inputs like electricity, tractors and area under HYV shows positive impact by 0.19, 1.89 and 0.47 per cent on the production of Bajra crop. The estimated

coefficients for fertilizers, area irrigated and pesticides have showed negative impact as the values -1.07, -0.96 and -0.31 per cent on the production of Bajra crop. The new inputs have used in un irrigated areas. Area under HYV has a higher positive impact on production. The value of coefficient of determination ($R^2 = 0.64$) is high. In the case of productivity, estimated coefficients of electricity, tractors and area under HYV have positive impact and fertilizers, area irrigated and pesticides have shown negative impact on productivity of this crop. The R^2 value is 0.620, which shows the 62 per cent of the variation in the dependent variable can be explained by the specified independent variables.

Table 8: The effect of Inputs on Production and Productivity of Bajra in Haryana.

(1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	0.19	0.31	0.10	0.17
Fertilizers	-1.07	-0.67	-0.98	-0.59
Area Irrigated	-0.96	-1.31	-0.80	-1.05
Pesticides	-0.31	-1.08	-0.26	-0.87
Tractors	1.89	1.02	2.02	1.04
HYV Area	0.47	1.48	0.26	0.79
$R^2 = 0.64$			$R^2 = 0.62$	
Standard Error of the Estimate = 167.42			Standard Error of the Estimate = 255.66	

The effect of Inputs on Production and Productivity of Maize in Haryana: -

Table 9: The effect of Inputs on Production and Productivity of Maize in Haryana.

(1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	0.19	0.27	0.22	0.62

Fertilizers	0.85	0.45	1.05	1.08
Area Irrigated	1.51	1.28	1.69	2.82
Pesticides	0.32	1.20	0.32	2.36
Tractors	-1.75	-0.80	-0.91	-0.82
HYV Area	1.32	1.32	1.02	1.99
$R^2 = 0.87$			$R^2 = 0.52$	
Standard Error of the Estimate = 207.13			Standard Error of the Estimate = 6.67	

The estimated production parameters for Maize are presented in table 9. All the regression coefficients like electricity, fertilizers, area irrigated, pesticides and area under HYV have shown positive impact on the production of Maize crop except tractors. The production of Maize crop has been noted 1.51 per cent increase due to 1 per cent increase in area irrigated. All the independent variables together have explained 87 per cent variation in Maize production. On the other side, the entire estimated coefficients like electricity, fertilizers, area irrigated, pesticides and HYV area under Maize have positive impact on productivity. The value of R^2 is 0.52 which reflects that 52 per cent variation is explained by these selected independent variables.

The effect of Inputs on Production and Productivity of Rice in Haryana: -

Table 10: The effect of Inputs on Production and Productivity of Rice in Haryana.

(1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	0.33	1.43	0.99	1.42
Fertilizers	0.38	0.56	0.72	0.35
Area Irrigated	-0.14	-0.53	-1.13	-1.37
Pesticides	0.02	0.36	-0.11	-0.48
Tractors	0.02	0.03	-0.12	-0.06
HYV Area	0.40	1.67	0.00	0.00
$R^2 = 0.95$			$R^2 = 0.54$	
Standard Error of the Estimate = 158.77			Standard Error of the Estimate = 240.80	

Table 10 shows that the regression coefficients of all the inputs have shown positive value except area irrigated in the case of production. The area under HYV has a higher positive impact on production. The accuracy level of this estimate is low. The R^2 value is 0.95 which shows that 95 per cent variation in the dependent variable has occurred due to all the independent variables. In the case of productivity, the regression coefficients like electricity and fertilizers have a positive impact as the values observed 0.99 and 0.72 per cent. HYV area has no impact on the production of rice crop. Electricity has a higher positive impact on productivity. But regression coefficients of area irrigated, pesticides and tractors have negative impact as the values have been for the productivity -1.13, -0.11 and -0.12 per cent. So, the contribution of new inputs which have been the basis of green revolution in seventies has now hardly any fresh contribution to growth in productivity.

The effect of Inputs on Production and Productivity of Wheat in Haryana:

Table 11: The effect of Inputs on Production and Productivity of Wheat in Haryana.

(1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	0.18	0.80	0.22	0.54
Fertilizers	-0.30	-0.49	-0.44	-0.40
Area Irrigated	0.37	1.22	0.48	0.87
Pesticides	0.04	0.60	0.19	1.40
Tractors	0.04	0.06	0.28	0.22
HYV Area	0.71	3.24	0.44	1.12
$R^2 = 0.94$			$R^2 = 0.83$	
Standard Error of the Estimate = 375.94			Standard Error of the Estimate = 141.33	

It has been observed from the table 11 that Wheat production and productivity are affected by the use of various modern inputs. The inputs have combined effect on Wheat's production and

productivity. All the estimated coefficients like electricity, area irrigated, pesticides, tractors and area under HYV (0.18, 0.37, 0.04, 0.04 and 0.71) have positive impact on Wheat production except fertilizers (-0.30). The estimated production function explained 94 per cent variation in Wheat's production due to variation in all the inputs. HYV area under Wheat crop has a higher positive impact on production. In the case of productivity, the entire estimated coefficients like electricity, area irrigated, pesticides and HYV area under Maize (0.22, 0.48, 0.19, 0.28 and 0.44) have positive impact on productivity except fertilizers (-0.44). The continuous higher use of fertilizers has reduced its marginal productivity over the period. Area irrigated has a higher positive impact on productivity with 0.48 per cent value.

The effect of Inputs on Production and Productivity of Sugarcane in Haryana:

Table 12, it can be revealed that the estimated coefficients of the inputs like electricity, area irrigated and tractors have affected the production of Sugarcane positively the values of regression coefficients have observed as 0.02, 0.78 and 1.98 per cent values for these inputs. Tractors have shown higher positive impact on Sugarcane crop production. The production of Sugarcane has been noted 1.98 per cent increase has been taken place due to 1 per cent increase in tractors. All the inputs have insignificant values in of production and productivity. All the independent variables together explained 49 per cent variation in the production. The accuracy level of this estimate is medium. In the case of productivity, estimated coefficients like electricity and fertilizers have positive impact as the values of regression coefficients have observed as 0.65 and 0.85 for the productivity of Sugarcane crop. The regression coefficients like area irrigated, pesticides and tractors have negative impact as the values have found as -0.27, -0.04 and -0.43 per cent. Little knowledge of the farmers and imbalance use of inputs in Haryana are responsible for this. The value of coefficient of multiple determinations (R^2) indicates that 70 per cent variation in productivity of this crop is due to the selected inputs for this study. The standard error of estimate is high.

Table 12: The effect of Inputs on Production and Productivity of Sugarcane in Haryana. (1988-89 to 2007-08)

Inputs	Production		Productivity	
	Value of Regression Coefficient	't' Value	Value of Regression Coefficient	't' Value
Electricity	0.02	0.03	0.65	1.26
Fertilizers	-2.20	-1.19	0.85	0.61
Area Irrigated	0.78	0.93	-0.27	-0.42
Pesticides	-0.10	-0.44	-0.04	-0.22
Tractors	1.98	0.93	-0.43	-0.26
$R^2 = 0.49$			$R^2 = 0.70$	
Standard Error of the Estimate = 94.55			Standard Error of the Estimate = 296.08	

Conclusion:

Finding of the study revealed that different uses of modern inputs have made a positive impact on different studied crops. Use of electricity made a positive impact on both production and productivity of cotton American, Rapeseeds & Mustard, Bajra, Rice, Wheat, Sugarcane, and Maize. In the same way the use of fertilizers have shown positive impact on both production and productivity of Desi cotton, groundnut, Moong Maize and Rice. Use of fertilizers also increases the productivity of Massar. Another uses of input like irrigation, pesticides, tractors also have shown increasing trends in production of Desi cotton, Maize, Rice, Wheat, Sugarcane, rapeseeds & mustard, Bajra, Groundnut, Massar and Moong. Increasing trends in productivity of Desi cotton, Massar, Moong, Rapeseeds & Mustard, Maize, Bajra, Gram and Wheat can be seen after the use of above inputs. HYV of seeds made a positive impact on both production and productivity of Bajra, Maize and Wheat. Use of HYV of seeds also increases the production of Rice. Uses of these modern inputs have negative impact also. This was due to farmers were not aware regarding the use these modern inputs, improper irrigation facilities, lack of public awareness.

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