

Vegetable Crops in Bareilly District of UP: Determinants of Yield Levels

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Abstract:- The literature reveals that in case of vegetable crops, our country yield levels are lower than USA and China. India stands third place after China and USA in vegetable production, among the Indian states, UP stands first place in it. Yield is the most important outcome of vegetable crops. Whereas in Bareilly, vegetable crops yield levels are performing at low level only. There is a need for enhancement of yield levels for maximum number of vegetable crops which are growing in Bareilly. In this paper, we want to examine and analyse the different vegetable crops yield levels in Bareilly. And to see the factors responsible for lower yields of the vegetable crops. And also finally we want to measure the significance levels of the various factors effecting the vegetable crops yield levels through multiple regression analysis. To achieve the above objectives of this paper, we have collected primary data in Bareilly district during 2017-18. As a result, Potato crop yield is significantly influenced by the factors like expenditure on irrigation, expenditure on fertilisers; Lobhiya crop yield is not significantly influenced by any of the factors. It clearly shows that there is a scope for enhancement of yield levels for vegetable crops growing in this district.

I. INTRODUCTION

Bareilly district is situated in the upper gangetic plain region (V), according to Planning Commission. Under the horticulture, vegetable crops like Potato followed by onion and other vegetables have occupied the successive positions according to available literature. Yield levels are most important to increase the level of production of any crop. In this paper, we want to examine and analyse the different vegetable crops yield levels in the sample district of Bareilly. As per primary data reveals that in Bareilly the yield level of Potato Vegetable crop in the MWP zone is significant. Whereas the area under vegetable crops cultivation this district falls in the low level in this state.

Potato ranks as the third most important food crop after wheat and rice. Potatoes yield on average more food energy on a per-hectare and a per-day basis than either cereals or cassava. In general, potato is perceived only as a source of carbohydrates, but is also an excellent source of essential amino acids. The predominant form of this carbohydrate is starch. A small but significant portion of this starch is resistant to digestion by enzymes in the stomach and small intestine, and so reaches the large intestine essentially intact.¹ Increased nutritional importance of

vegetables has generated interest in improving agricultural practices including use of biotechnology and genetic engineering to enhance yield, drought resistance, insectresistance, and quality^{2,3, and 4}. Potato is one of the most salt-sensitive crops, which gives potential yield in up to 1,000 ppm soil salinity. But at higher salinity concentrations the plants wilt and die. Recently, a potato variant tolerant toward salinity has been developed for cultivation in Kuwait,⁵ through plant tissue culture method.

The eggplant, known as aborigine in Europe and brinjal in south Asia, is a popular vegetable crop, since it requires a relatively long season of warm weather to give good yields. In addition to featuring a host of vitamins and minerals, eggplant also contains important phytochemicals which have antioxidant activity.⁶ The new hybrids gave higher fruit set even under hot cultural conditions. Donzella et al.(2000)⁷, have produced transgenic hybrid eggplants with DefH9-iaaM gene and compared their performance under various greenhouse conditions. Similar results of improved fruit productivity under both greenhouse and open field cultivation for transgenic eggplant have also been reported by Acclarri et al. (2002)⁸. The findings from the literature suggest that the yield of various vegetables tends to be higher for the plants grown in various growing media compared to those grown in the soil.

However, in Bareilly, vegetable crops yield levels are performing at medium level only. There is a need for enhancement of yield levels for maximum number of vegetable crops which are growing in Bareilly. In view of this the present paper want to analyse the vegetable crops yield levels in this district.

➤ *Major Objectives of this paper are:*

- To examine the variations in different variables of vegetable yields in Bareilly
- To analyse the determinants of vegetable crops yield levels in Bareilly
- Finally to suggest the suitable ways to develop vegetable crops yield levels in this district.

II. DATA AND METHODOLOGY

In this paper we have collected primary data during 2017-18. It has collected about the selected district in this ACZ about determinants' of yield levels in the district. A multi-stage stratified random sample design adopted in this study. The area under vegetable cultivation will be taken as the first stage of sample. Secondly, proportionately, one

district has been chosen in this agro-climatic zone of the state. And finally, from this district three blocks were selected on the basis of high, medium and low area under vegetable cultivation. From each block one village was selected and totally in this district 36 households were randomly selected to collect the data. For the Primary Data a detailed questionnaire was canvassed while covering all the aspects as mentioned above. On the basis of the above data we have calculated total average sown area per acre by crop wise, expenditure on irrigation, expenditure on fertilizers, expenditure on pesticides and type of seeds used. To achieve the above objectives of the study, first of all we have observed the crop-wise yield variations within this district comparing the maximum and minimum values and averages for each crop while calculating the coefficient of variation. And finally to examine the cause and effect relationship of the factors to determine the crop yields levels we have run the Multiple Regression Model.

➤ *Vegetable crop yield determinants with various techniques on the basis of Primary data:*

In Bareilly, as per our survey villages, there are 12 vegetable crops which are growing in a year (all three seasons put together). The predominant yield level shows that In Kharif season, 1040Kg/ha. of pigeonpea, during the Rabi season, 918 Kg/ha. of Toriya, 821 Kg/ha. of Lentil followed by 805 Kg/ha. of Mustard. As per collected primary data there are Lobhiya, Baigan, and Laucky in Kharif season; Cabbage, Cauliflower, Potato, Onion, and Tomato during Rabi season; Laucky, Turai, Bhindi, Kheera, Brinjal and Kaddu in zaid season; Bareilly has fallen relatively in the category of Low area under vegetable cultivation.

Comparison of Maximum and minimum: As seen from the crops grown in Bareilly district, during the survey period we found the variations between the yield variables are as follows: The data shows that maximum sown area of tomato crop (2.15 acres) whereas minimum crop area of brinjal is (0.01 acre); and maximum yield of Laucky and Turai (3996 kg/acre) but lowest yield (28q/acre) of kheera crop; expenditure on irrigation maximum on cabbage (Rs. 55000) whereas bhindi shows the minimum of expenditure on irrigation (Rs. 392); expenditure on fertilizer per acre maximum for the cabbage crop (Rs. 41667) and minimum for bhindi (Rs. 275); and maximum expenditure on pesticides for cabbage (Rs. 8333) whereas minimum on Bhindi crop (Rs 0).

Crop yield determinants: Crop yield is the most important factor to measure the growth, variations, changes, comparison and determinants of different type of vegetables which are growing in this district of Uttar Pradesh. There are several factors determine the crop yield levels. The main factors in this study are sown area, type of seeds used (Hybrid, Traditional), irrigation expenditure, fertilizers expenditure, pesticides expenditure. It means vegetables yield is depending on the above factors.

SOWN AREA: It is one the first and foremost important factor to determine the yield levels. Obviously, the type of

area chosen and the extent of land used for each vegetable crop is the most important for determination of yield. The major cultivated vegetable crops in Bareilly district are, cabbage, cauliflower, potato, onion, tomato, brinjal, lobhiya, lauki, turai, kheera, kaddu and bhindi. Maximum average sown area (in Acre) covered by tomato (2.15) and minimum average sown area (in Acre) covered by onion (0.17). Coefficient of variation shows high for potato crop (116%) and low for onion (0%).

Utilisation of Seed: The second factor for determination of yield is seed. There are two types of seeds available in the market. The first one is traditional seed and the second one is Hybrid or High yielding seed. The better seed you sow, then better yield you can achieve. Majority of the farmers are sowing hybrid seeds only for majority of the crops.

Expenditure on Irrigation per Acre: Third important factor for determination of yield is expenditure on irrigation per acre. Irrigation is a must for vegetable crops. Borewell, ponds, and other sources are the major sources of irrigation in Uttar Pradesh. To run the borewell, electricity is a must. The charges on electricity are considered as irrigation charges. Maximum average expenditure on irrigation per acre on Turai (Rs. 7440) and minimum on onion crop (Rs. 1470). Coefficient of variation on expenditure in irrigation per acre shows highest for turai (191.69%) and lowest for onion crop (0%).

Expenditure on Fertilizers per Acre: Fourthly, expenditure on fertilizer is also most important to achieve the yield. There are different types of fertilizers available for growth of vegetables and they can be used in different quantities at different prices. Maximum average expenditure on fertilizer per acre on cabbage crop (Rs. 5429) and minimum expenditure on onion (Rs. 588). Highest coefficient of variation shows in cabbage (167%) and lowest for onion crop (0%).

Expenditure on Pesticides per Acre: Finally, expenditure on pesticides is also most important to reduce the plant diseases throughout the crop period. There are different types of pesticides available for removal of plant diseases and they can be used in different quantities at different prices. Maximum average expenditure on pesticides per acre on laucky (Rs. 2615) and minimum expend on bhindi (Rs. 0). The coefficient of variation shows highest in cabbage (104%) and less variation shows in tomato, onion, brinjal, and kaddu (0%).

YIELD: In Bareilly, the high average yielding vegetable crops is turai (552quin/acre) and the lowest one is kaddu (60quint/acre). Maximum coefficient of variation of yield is shown in Cabbage (283%) and minimum in onion, tomato, brinjal and kaddu (0%).

On the basis of above results the data shows about the variation among the crops which are growing in Bareilly district. So far we have analyzed compare means higher and lower (Maximum, Minimum), Averages and coefficient of variation has explained only the variations. After that we

have examined the location effect while computing one-way anova among the various factors of the vegetable crops yield within and between groups results. The vegetable crops like potato, Lobhiya, Turai and laucky crops location effect is significant. Which means there is a possibility of the above mentioned crops will grow in this district according to the yield factors. Based on the above we are not in a position to conclude which factors are influencing and determining the yield levels in a significant manner. To achieve this we have run the regression analysis to determine the cause and effect relationship between yield and its determinants like type of seeds use, net area sown, expenditure on irrigation, expenditure on fertilisers and expenditure on pesticides. The coefficients of regression estimate the relationships or effects that exist in the entire population of the district. However, inferential process estimates these parameters along with a margin of error, which enables the analysis to

determine statistical significance. However, specifically the above factors which are significantly influence the vegetable crops grown in this district is still answerable. In view of this the following multiple regression analysis has been computed for Potato and Lobhiya crops. For other crops sample size is very small and no significant effect on dependent factor like Yield. Hence we have considered these three crops regression analysis to explain the factors influencing the yield levels in this district.

➤ *Regression Analysis:*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + E$$

Potato Yield Regression:

Equation: $Y (\text{potato}) = 72.19 - 0.01652X_1 + 0.035674X_2 - 0.02536X_3 + 2.6571 X_4 + 0X_5$

Table 1. Multiple Regression Results of Potato Yield:

<u>Mult. R</u>	<u>R²</u>	<u>Adj. R²</u>	<u>S. Error</u>	<u>D.f</u>	<u>SS Reg.</u>	<u>SS Res.</u>	<u>Sig. F</u>
0.96511	0.93144	0.719013	43.23	5,6	152334	11213	0.002

<u>Variables</u>	<u>Co-efficients</u>	<u>P-value</u>
<u>Expenditure on Irrigation</u>	-0.01652	0.08***
<u>Expenditure on Fertilizers</u>	0.03567	0.006**
<u>Expenditure on Pesticides</u>	-0.02536	0.169
<u>Net Sown Area</u>	2.65714	0.9585
<u>Type of Seeds used</u>	0	0

Source: primary Data Survey, 2018.

➤ *Summary information*

The multiple correlation coefficient is 0.96511 this indicates (table 1) that the correlation among the independent and dependent variables is positive. This statistic, which ranges from -1 to +1, does not indicate statistical significance of this correlation. The coefficient of determination, R² is 93%. This means that 93% of the variation in the dependent variable (Potato Yield) is explained by the independent variables. The adjusted R², a measure of explanatory power, is 0.719013. This statistic is not generally interpreted because it is neither percentage (like the r square) nor the test of significance (Such as the f statistic). The standard error of regression is 43.23 which is an estimate of the variation of the observed yield about the regression line.

➤ *Analysis of variance*

The analysis of variance information provides the breakdown of the total variation of the dependent variable (in this case yield levels of potato) into the explained and unexplained portions. The SS regression (152334) is the variation explained by the regression line, “SS residual (11213) is the variation of the dependent variable that is not explained. The f statistic is calculated using the ratio of the mean square regression (MS regression) to the mean square residual (MS residual). This statistic can then be compared with the critical f value for 5 and 6 degrees of freedom (available from f table) to test the null hypothesis: Ho: B1=B2=B3=B4=B5 vs HA: at least one B1 not equal to zero. The P value associated with the calculated f statistic is

probability beyond the calculated value. Comparing this value with 10%, and 5% for example, indicates rejection of the null hypothesis.

➤ *The estimated regression line*

The results of the estimated regression line include the estimated coefficients, the standard error of the coefficients, the calculated t-statistic, the corresponding p-value, and the bounds of both the 90% and the 95% confidence intervals. The independent variables that statistically significant in explaining the variation in the potato yield levels is expenditure on irrigation has indicated by (1)calculated t statistic that exceed the critical values, and (2) the calculated p values that are less than the significance level of 10% respectively. The relationship between expenditure on irrigation and yield levels is negative: The larger the expenditure on irrigation, thenlower the yield levels. The coefficient of -0.01652 indicates, on average, an additional expenditure on irrigation increases the yield levels decline by 0.01652. The expenditure on irrigationis negatively related to the yield level, this may be due to an interaction with the other variables because lower yield levels tend to have lesssown area. Secondly, expenditure on fertiliser has indicated by (1) calculated t statistic that exceed the critical values, and (2) the calculated p values that are less than the significance level of 5% respectively. The relationship between expenditure on fertilisers and yield levels is positive. The larger the expenditure on fertilisers, then higher the yield levels. The coefficient of 0.03567 indicates, on average, an additional expenditure on fertilisers increases

the yield levels increase by 0.03567. The expenditure on fertilisers is positively related to the yield level, this may be due to an interaction with the other variables because higher yield levels tend to have more sown area. The remaining variables are not significant.

➤ *Significance Level:*

In regression analysis, we see that the factors of potato crop influencing on it 93 per cent, the most affected factor is expenditure on irrigation per acre (-0.01652). So this variable is at 10% level of significance. Which means one

unit of this variable changes (positive or negative), the yield levels will also changes (positively or negatively) at the same rate or more. Second factor is expenditure on fertilisers per acre (0.03567). So this variable is at 5% level of significance. Which means one unit of this variable changes (positively), the yield levels will also changes (positively) at the same rate or more.

LouckyYield Regression

Equation: $Y (\text{Loucky}) = 679.996 + 0.01789X_1 + 0.07657X_2 + 0.15504X_3 + 1854.26X_4 + 899.99X_5$

Table 2. Multiple Regression Results of Loucky Yield:

<u>Mult. R</u>	<u>R²</u>	<u>Adj.R²</u>	<u>St. Error</u>	<u>D.f</u>	<u>SS Reg.</u>	<u>SS.Res.</u>	<u>Sign. F</u>
0.33079	0.10942	0.632916	1447	5, 6	1544773	1257212	0.9735

<u>Variables</u>	<u>Co-efficients</u>	<u>P-value</u>
<u>Expend.Irrigation</u>	0.01789	0.6574
<u>Expend.Fertilizers</u>	0.07657	0.9083
<u>Expend.Pesticides</u>	0.15504	0.6337
<u>Sown Area</u>	1854.26	0.5087
<u>Type of Seeds used</u>	895.99	0.6431

Source: Primary Data survey, 2018.

➤ *Summary information*

The multiple correlation coefficient is 0.33079 this indicates (table 2) that the correlation among the independent and dependent variables is positive. The coefficient of determination, R² is 10.94%. This means that close to 11% of the variation only in the dependent variable (Loucky Yield) is explained by the independent variables. The adjusted R², a measure of explanatory power, is 0.632916. The standard error of regression is 1447.53 which is an estimate of the variation of the observed yield about the regression line.

➤ *Analysis of variance*

The analysis of variance information provides the breakdown of the total variation of the dependent variable (in this case yield levels of Loucky) into the explained and unexplained portions. The SS regression (1544773) is the variation explained by the regression line SS residual (1257212) is the variation of the dependent variable that is not explained. F statistic can then be compared with the critical f value for 5 and 6 degrees of freedom to test the null hypothesis: Ho: B1=B2=B3=B4=B5 vs HA: at least one B1 not equal to zero. Comparing this value with 1%, 5%, and 10% for example, indicates acceptance of the null hypothesis in case of any variable. But the above variables are not at all significant at any level.

➤ *The estimated regression line*

No factor is statistically significant in explaining the variation in the Loucky yield levels. An insignificant coefficient means that the independent variable has no effect on the dependent variable, that is, its effect is statistically equal to zero. The effect of Independent variable is too little to actually affect the dependent variable most of the time.

III. CONCLUSIONS

In Bareilly as per primary data we have collected around 12 vegetable crops during 3 seasons put together. Out of these three crops are repeated in two seasons. It means around 12 vegetable crops are growing regularly. Out of these 12 crops we have run the multiple regression for 2 crops. Out of these two crops only one crop i.e. potato has highly significant and its yield is being effected by expenditure on irrigation and fertilisers which are significantly effected to yield at 10% and 5% significance level. Which means any of these factors may change (increase/decrease) one unit, then the potato yield levels will increase/decrease more than one unit significantly. Finally we conclude that there is a significant scope for expansion of Potato yield while increasing/decreasing the above mentioned factors. Apart from this the other crops like Loucky, Lobhiya and Turai crops yield enhancement will also be possible while changing the factors components in this district.

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