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# Determinants of behavioural indicators of potato (*Solanum tuberosum*) growers in Kannauj district of Uttar Pradesh

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ABSTRACT

The present study was carried out to find out the factors that may affect the behavioural dimensions of potato farmers, viz. their knowledge and adoption level as well as their knowledge-adoption gap about scientific potato cultivation practices in Kannauj district of Uttar Pradesh during 2016–17. Multiple regression and stepwise regression analysis was done with selected independent variables to see the effect of independent variables on the selected indicators. The analysed data showed that at knowledge level out of 18 variables taken for analysis of regression, four variables, viz. housing pattern, occupation, material possession and formal extension contact were highly significant (P<0.01); five variables, viz. education, housing pattern, informal extension contact, scientific orientation and risk orientation were highly significant (P<0.01) for their adoption level; and at knowledge-adoption gap one variable i.e. education was highly significant (P<0.01). The $R^2$ value and F value of knowledge, adoption and knowledge adoption level were 0.59, 0.29, 0.33 and 8.63, 2.52 and 2.95 (P<0.01), respectively. The $R^2$ value of stepwise regression in knowledge, adoption and knowledge-adoption gap level was 0.54, 0.24 and 0.24.

**Keywords**: Adoption, Knowledge, Multiple regression, Potato

Potato (*Solanum tuberosum* L.) belongs to family Solanaceae, is well known as the king of vegetables and has emerged as the most important food crop of India. Despite higher retail price of potato, the sowing of tuber is set to shrink in Northern states as farmers prefer alternate crops including onion, garlic, sugarcane and other perishables during *rabi*. Introduction of potato crop is not only important for ensuring socio-economic upliftment of the local farmers but for warranting financial sustainability of crop husbandry also (Rana *et al.* 2017). In last few years, the gap between wholesale and retail price of potato has widened by two-three times. It has disappointed potato growers and many are shifting to other crops. Mostly big farmers who store their produce have incurred losses in potato business and many such farmers are shifting from cultivation of tuber. In the last three years, glut in potato production has caused unrest among farmers in North. The annual output has grown to 53 million tonnes (MT) in 2018–19 compared to 51 million tonnes in 2017–18 (Krar 2019). The increase in area of potato cultivation has squeezed margins for growers as well as traders in the region.

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Uttar Pradesh is a major potato growing state in India followed by West Bengal and Bihar with the production of 10455.30, 7482.30 and 1720.20 thousand tonnes, respectively. It produced almost 13.1 MT of potato, thus contributing nearly 28.6% of total potato production in the country (Directorate of Economics and Statistics 2016). Kannauj district is the highest producer of potato followed by Farrukhabad and Agra with production of 9.43, 8.33 and 6.47 lakh metric tonnes with area being 34.6, 29.8 and 18.20 thousand hectares, respectively (Anonymous 2001–02). Therefore, considering the significance of potato in Kannauj district, the study was carried out to analyse the profile of potato farmers of the district and to identify the determinants which may affect their behavioural dimensions in terms of their level of knowledge, adoption and knowledge-adoption gap.

## MATERIALS AND METHODS

The present study was carried out in Kannauj district of Uttar Pradesh during 2016–17, which was selected purposively due to its high grown area under potato crop. It is considered to be the most climatically suitable area for potato cultivation. Jalalabad block of Kannauj district with maximum area under potato cultivation was further selected purposively. Five villages, viz. Paraspur, Gadnapur, Mirpur, Purva, and Bisundhua were selected randomly and from each village, 25 farmers actively involved in cultivating potato were further selected randomly.

Thus, the total sample size was 125 potato growers. An interview was designed based on the objectives of the study for data collection. Considering the mentioned objective of the study, behavioural dimensions of potato farmers were operationalized in terms of their knowledge and adoption level as well as knowledge-adoption gap which were considered as dependent variable, besides, the independent variable were classified into four categories such as socio-personal, economic, social participation and psychological variables. The analysis was done using percentage, mean, correlation and standard deviation for drawing the inferences. To identify the predicting factors independent and dependent variables were subjected to multiple regression analysis as well as step-wise regression. For analysis of multiple regression, methodology adopted by Roy and Bhagat (2012) was utilized. The stepwise regression was done using the method utilized by Dubey *et al.* (2011), Shirur *et al.* (2017) and Kumar *et al.* (2018).

## RESULTS AND DISCUSSION

*Background variables of respondents:* The socio-personal, economic, social participation, and psychological profile of the potato growers was analyzed taking various independent variables.

Socio-personal variables: The respondents' socio-personal characteristics were analysed with respect to their age, education, caste, marital status, family type and family size. It was obvious that the majority of the respondents (69%) were 38–54 years of age followed by about 18% in 37 and above age group and 14% up to 55 years of age, respectively, and the average age of respondents was 46 years. In case of education, about 10% of respondents were illiterate, 3% of them could read and write, 18% were educated up to primary school. This finding is associated with reports of Roy *et al.* (2017). Further, 30% respondents were educated up to middle school, 26% up to high school, 7% up to intermediate, the rest 6% and 2% of them were educated up to graduate and post graduate level, respectively. The variation at education level of respondents was 0.47. Among the respondents, 42% belonged to other backward caste, while the scheduled caste and general category respondents were 34% and 25%, respectively. The analysed data further showed that the maximum number of respondents were married i.e. 97% against 3% respondents who were unmarried. It was also observed that 68% respondents belonged to joint family system followed by 33% nuclear family system. It was observed that 60% respondents' families had 6–9 members followed by 33% families with up to 5 members and only 7% families with 10 and more members. The average family size was 7 members per family. The family size ranged from 3 to 11 members. Further, it is apparent from the data that the maximum respondents i.e. 66% owned houses of mixed type followed by puckka (22%) and kuchcha (11%).

Economic Variables: The economic attributes of the potato growers were also analysed. In case of size of land holding maximum respondents i.e. 78% were found to be marginal farmers (<1.0 ha area) followed by 18% small farmers (1.0–2.0 ha) and 3% medium farmers (2.0–4.0 ha) and no respondent was found in large farmers' category (>4.0 ha). Hence, the average land holding of the respondents was found to be 0.78 ha.

It was clear from the data that agriculture has emerged as main occupation (71%) followed by government service (10%), private service (6%), agriculture labourers (6%), caste based occupation (5%) and business (2%) as main occupation. In case of subsidiary occupation, the maximum i.e. 74% of the respondents had dairy, followed by agriculture (27%), business (22%). Agricultural labourers and caste based occupation (6%) had the same response followed by agro-based enterprise (2%), government services and private service. There was no response in subsidiary occupation. The annual income of the respondents ranged from ₹75,000 to 6,80,000. Further, the data revealed that the maximum number of the respondents i.e. 62% had annual income of ₹75,001 to 1,50,000 where as 26%, 10%, 2% and 0.80% respondents belonged to the income range from ₹1,50,001–2,25,000; ₹3,00,001 and above; ₹2,25,000,–3,00,001; and up to ₹75,000, respectively.

Social participation variables: Under the study, two social participation variables were considered. The results showed that out of 125 respondents, 53% respondents participated in two organizations, followed by 23% in more than two organizations, 13% in one organization and 11% had no participation in any organizations. The overall material possession was categorized into three main categories on the basis of scores as low (up to 60), medium (61- 85) and high (86 and above). The data revealed that highest number of the respondents i.e. 69% were in the medium category (61–85 scores) of material possession followed by low and high i.e. 16% and 15% categories, respectively. The mean scores of material possession was 72.94 with a minimum score of 16 and maximum of 102.

Psychological variables: Three psychological variables: economic motivation, scientific orientation and risk orientation were considered for this study. The results revealed that the maximum number of respondents i.e. 69% had medium level of economic motivation followed by 18% and 13% respondents who were those with low level and high level of economic motivation, respectively. The average mean of scores for economic motivation was observed to be 24.24 with a range of minimum 21 and maximum 26.

Thus, it is clear from the data that 66% respondents had medium level of scientific orientation followed by 25% low and 9% high. The mean score for scientific orientation was 24.43 with a range of minimum 22 and maximum 27. Data showed (Table 1) that 63% of the respondents were found to have medium level followed by low 19% and high 18% risk orientation levels. The mean score for risk orientation was observed to be 22.36 with a range of minimum 19 and maximum 26%. The findings of the study are in agreement with that Kumar *et al. (*2018, 2019).

*Correlation analysis:* The data (Table 1) presents the association between attributes of respondents with their

Table 1 Correlation and multiple regression analysis of independent variables with knowledge, adoption, and knowledge-adoption gap level of potato farmers

| Variable | Knowledge | | Adoption | | Knowledge-Adoption Gap | |
|---|---|---|---|---|---|---|
| | b Value | t value | b value | t value | b value | t value |
| Age | 7.185 (0.175) | 1.797 | -4.466 (-0.024) | -0.792 | 1.165 (0.147) | 1.669 |
| Education | 1.939 (0.209**) | 0.976 | 7.677 (-0.094) | 2.741* | 9.616 (0.228**) | 2.771* |
| Marital status | -1.007 (0.000) | -0.673 | 2.265 (0.039) | 1.073 | -3.273 (-0.031) | -1.252 |
| Caste | -7.801 (-0.207**) | -0.236 | -4.979 (-0.071) | -1.067 | 4.199 (-0.096) | 0.727 |
| Family Type | -9.156 (0.141) | -0.973 | 1.946 (0.081) | 1.468 | -2.862 (0.039) | -1.742 |
| Family Size | 6.266 (0.202**) | 0.244 | -2.704 (0.061) | -0.746 | 3.331 (0.100) | 0.742 |
| Housing Pattern | 1.757 (0.284*) | 3.610* | 2.672 (0.209**) | 3.894* | -9.144 (0.043) | -1.076 |
| Social Participation | -4.228 (-0.053) | -1.487 | -5.664 (0.013) | -0.141 | -3.662 (-0.050) | -0.738 |
| Occupation | 1.606 (0.071) | 3.025* | -6.872 (-0.075) | -0.919 | 2.293 (0.111) | 2.474** |
| Annual Income | 5.537 (0.390*) | 2.182** | 3.735 (0.159) | 0.104 | 5.163 (0.160) | 1.165 |
| Material possession | 6.588 (0.279*) | 5.182* | 1.426 (0.106) | 0.796 | 5.162 (0.121) | 2.325** |
| Agri. Implements | -3.182 (-0.142) | -3.362 | 6.838 (-0.037) | 0.512 | -3.866 (-0.075) | -2.339 |
| Formal Ext. Contact | 3.710 (-0.222**) | 2.668* | 8.095 (-0.009) | 0.413 | 4.520 (-0.156) | 1.861 |
| Informal Ext. Contact | 6.668 (0.353*) | 1.825 | 1.453 (0.204**) | 2.821* | -7.857 (0.098) | -1.232 |
| Mass Media | 9.608 (0.253**) | 2.573** | 8.395 (0.036) | 1.595 | 1.213 (0.157) | 0.186 |
| Economic Motivation | -3.874 (-0.102) | -1.399 | -1.156 (-0.044) | -0.030 | -3.758 (-0.040) | -0.777 |
| Scientific Orientation | -2.975 (-0.116) | -1.069 | 1.536 (0.158) | 3.914* | -1.833 (-0.210**) | -3.772 |
| Risk Orientation | 1.126 (-0.051) | 0.688 | 6.363 (0.034) | 2.756* | -5.236 (-0.210**) | -1.831 |
| Age | 7.185 (0.175) | 1.797 | -4.466 (-0.024) | -0.792 | 1.165 (0.147) | 1.669 |
| Education | 1.939 (0.209**) | 0.976 | 7.677 (-0.094) | 2.741* | 9.616 (0.228**) | 2.771* |
| Marital status | -1.007 (0.000) | -0.673 | 2.265 (0.039) | 1.073 | -3.273 (-0.031) | -1.252 |
| $R^2$value | 0.5945 | | 0.2998 | | 0.3341 | |
| F value | 8.634* is significant at P<0.01 on 18 and 106 DF | | 2.521* is significant at P<0.01 on 18 and 106 DF | | 2.955* is significant at P<0.01 on 18 and 106 DF | |
| Significant Value for correlation | *Significant at 0.01% probability level 0.254<br>**Significant at 0.05% probability level 0.195 | | | | | |

Figure in parentheses indicate the correlation value. *Significant at 0.01% probability level 2.61. **Significant at 0.05% probability level 1.97.

knowledge, adoption, and knowledge-adoption gap. The attributes like housing pattern, annual income, material possession, and informal extension contact were found to be positively and highly correlated (P<0.01), whereas attributes like education, family size, and mass media were positively significant (P<0.05) and attributes like caste and formal extension contact were found to be negatively correlated (P<0.05) with knowledge level of potato growers. Similar findings were reported by Sangeetha et al. (2009). Attributes like housing pattern and informal extension contact were found to be positively associated (P<0.05) with adoption level of potato growers. Similar findings were reported by Kakkad et al. (2019). In case of knowledge-adoption gap, a single attribute i.e. education was found to be positively associated (P<0.05), whereas scientific orientation was found to be negatively associated (P<0.05).

*Regression analysis:* The multiple regression analysis was carried out to find out the extent of influence of independent variable towards knowledge, adoption, and knowledge-adoption gap of potato farmers (Table 1). The perusal of data revealed that out of 18 variables taken for analysis of regression, four variables i.e. housing pattern occupation, material possession and formal extension contact were found to be highly significant (P<0.01%) and two variables, viz. annual income and mass media were found to have significant (P<0.05%) effect on knowledge level of potato farmers. The $R^2$ value of this model was 0.59 which indicates that 59% variation in the knowledge of potato farmers was explained by 18 independent variables which were selected for the study (F value 8.634 significant at P<0.01 on 18 and 106 DF).

The data (Table 1) revealed that out of 18 variables taken for analysis of regression, five variables, viz. education, housing pattern, informal extension contact, social orientation and risk orientation had significant (P<0.05%) effect on adoption level of potato farmers. The $R^2$ value of this model was 0.29 which indicates that 29% variation in the adoption of potato farmers was explained by 18 independent variables which were selected for study (F value 2.521 significant at P<0.01 on 18 and 106 DF). Further, data revealed that out

Table 2 Stepwise regression (backward elimination) analysis of independent variables with knowledge, adoption, and knowledge-adoption gap level of potato farmers

| Variable | Knowledge | | Adoption | | Knowledge-Adoption Gap | |
|---|---|---|---|---|---|---|
| | b value | t value | b value | t value | b value | t value |
| Education | - | - | 0.7234 | 2.8750* | 0.8230 | 3.1337* |
| Land Holding | 2.342 | 2.9234* | - | - | - | - |
| Housing Pattern | 1.9416 | 4.4554* | 2.3978 | 3.7905* | | |
| Occupation | 2.0782 | 4.2858* | - | - | 2.6407 | 3.0926* |
| Material possession | 0.4957 | 3.5991* | - | - | 0.5995 | 3.1761* |
| Agri. Implements | -0.3886 | -4.9398* | - | - | -0.3577 | -2.5886* |
| Formal Ext. Contact | 0.588 | 4.8083* | - | - | 0.4232 | 2.1308* |
| Informal Ext. Contact | - | - | 1.3849 | 3.0477* | - | - |
| Mass Media | 0.1396 | 5.1702* | 0.1260 | 3.01568* | - | - |
| Scientific Orientation | - | - | 1.4406 | 4.4389* | -1.1766 | -3.3210* |
| Risk Orientation | - | - | 0.6102 | 3.0547* | - | - |
| $R^2$ value | 0.5483 | | 0.2453 | | 0.2416 | |
| F value | 20.293 on 7 and 117 d.f. | | 6.3932 on 6 and 118 d.f. | | 6.2680 on 6 and 118 d.f. | |

*Significant at 0.01% probability level 2.61. **Significant at 0.05% probability level 1.97.

of 18 variables taken for analysis of regression, only one variable i.e. education was found to be highly significant (P<0.01%) and two variables, viz. occupation and material possession had significant (P<0.05%) effect on knowledge-adoption gap of potato farmers. The $R^2$ value of knowledge adoption gap was 0.33 which indicates that 33% variation in the knowledge-adoption gap of potato farmers was explained by 18 independent variables which were selected for study (F value 2.955 significant at P<0.01 on 18 and 106 DF). Similar findings were observed by Dubey *et al.* (2011) in linkage perspective of Agricultural Extension for Dairy and Livestock.

*Stepwise regression (Backward Elimination):* Considering the large number of variables showing non-significant contribution in the multiple regression, backward regression analysis was done to eliminate the least contributing variables in each step to identify the highest contributing variables. The results of backward regression analysis (Table 2) showed that in addition to land holding, housing pattern, occupation, material possession, formal extension contact and mass media were highly significant and agriculture implement was highly but negatively affecting the knowledge level of potato growers. Variables like education, housing pattern, informal extension contact, mass media and risk orientation were highly affecting the adoption level of potato growers. The variables education, occupation, material possession and formal extension contact were highly associated, and variables like agriculture implements and scientific orientation were highly but negatively affecting the knowledge-adoption gap.

Therefore, it can be concluded from the study that variables like land holding, housing pattern, annual income, material possession, and informal extension contact were positively and highly significantly associated with knowledge level of potato growers, and attributes like land holding, housing pattern and informal extension contact were found to be positively and significantly associated with adoption level of potato growers. In case of knowledge-adoption gap only one attribute i.e. education was found to be positively associated (P<0.05). Then, after stepwise regression analysis it was concluded that if focus is laid on variables like land holding, housing pattern, occupation, material possession, formal extension contacts and mass media the knowledge level of potato farmers will increase. Similarly, in adoption level, variables like education, housing pattern, informal extension contact, mass media and risk orientation need to be more focussed for increasing the adoption level and in knowledge-adoption gap the variables like education, occupation, material possession and formal extension contact are vital for minimizing the gap.

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