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# **Level of Information Accessibility and Adoption of Improved Irish Potato Production Technologies by Farmers in the Northern Agricultural Zone of Plateau State, Nigeria**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

The study assessed sources of information and Level of Adoption of recommended Irish Potato Production Technologies by Small Scale Farmers in the Northern Agricultural Zone of Plateau state. The multistage sampling procedure was used to draw 150 farmers as study sample. Data were analysed using descriptive and inferential statistics. The descriptive statistics used were percentages, mean scores and ranking while the inferential statistics were multiple linear regression models. Results showed that the major sources of information used by farmers were; from Co-farmers, friends/relations (100%) which ranked (1<sup>st</sup>), extension agents (98.0%) ranked 2<sup>nd</sup> and mobile phone (58.0%) ranked 3<sup>rd</sup>. The result of level of adoption revealed that 98.0% adopted cold room system technique, 96.7% adopted the use of herbicides for weeding and 94.0% adopted the fungicide application technique. The factors limiting the adoption of recommended Irish potato production technologies in the study area ranked in order of severity includes; high incidence of pests and diseases (91.3%) ranked 1<sup>st</sup>, lack of clean and certified seeds (89.3%) ranking 2<sup>nd</sup>.

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high cost of fertilizers and herbicides represented 88.7% and ranked 3<sup>rd</sup>. The farmers were found to engage in high level of adoption of recommended Irish potato production technologies like; Cold room system, use of herbicides for weeding and fungicide application among many other technologies. It was recommended that farmers in the study area should be assisted by the government and relevant stakeholders in the control of pests and diseases, provision of clean and certified seeds at affordable rate and subsidizing of fertilizers and herbicides.

**Keywords:** Information; level of adoption; Irish potato; production; technologies; small scale farmers.

## 1. INTRODUCTION

In a world with a rapidly growing population and high incidence of poverty and poor living standards, there is a great need for innovation towards crop improvement and adoption of new technologies. Increasing agricultural productivity is critical to meet expected rising food demand and as such, it is instructive to examine recent performance in cases of modern agricultural technologies [1]. Agricultural technologies include all kinds of improved techniques and practices which affect the growth of agricultural output [2]. According to [3], the most common areas of technology development and promotion for crops include the introduction of new varieties and management regimes – soil and soil fertility management; weeds and pests management; irrigation and water management et cetera. By virtue of improved input/output relationships new technology tends to raise output and reduce average cost of production which in turn results in substantial gains in farm income [1].

Irish Potato (*Solanum tuberosum* L.) is a tuber crop belonging to the family *Solanaceae*. Potato is a herbaceous plant and consists of the root system, tubers, stolons, leafy shoot, the inflorescence, berry and seed. Irish potato is an important and widely consumed tuber crop in Nigeria. It ranks 4<sup>th</sup> after cassava, yam and sweet potato among the major root and tuber crops in Nigeria. It is by far the most efficient tuber crop in the country in terms of tuber yield and maturity period [4].

### 1.1 Problem Statement

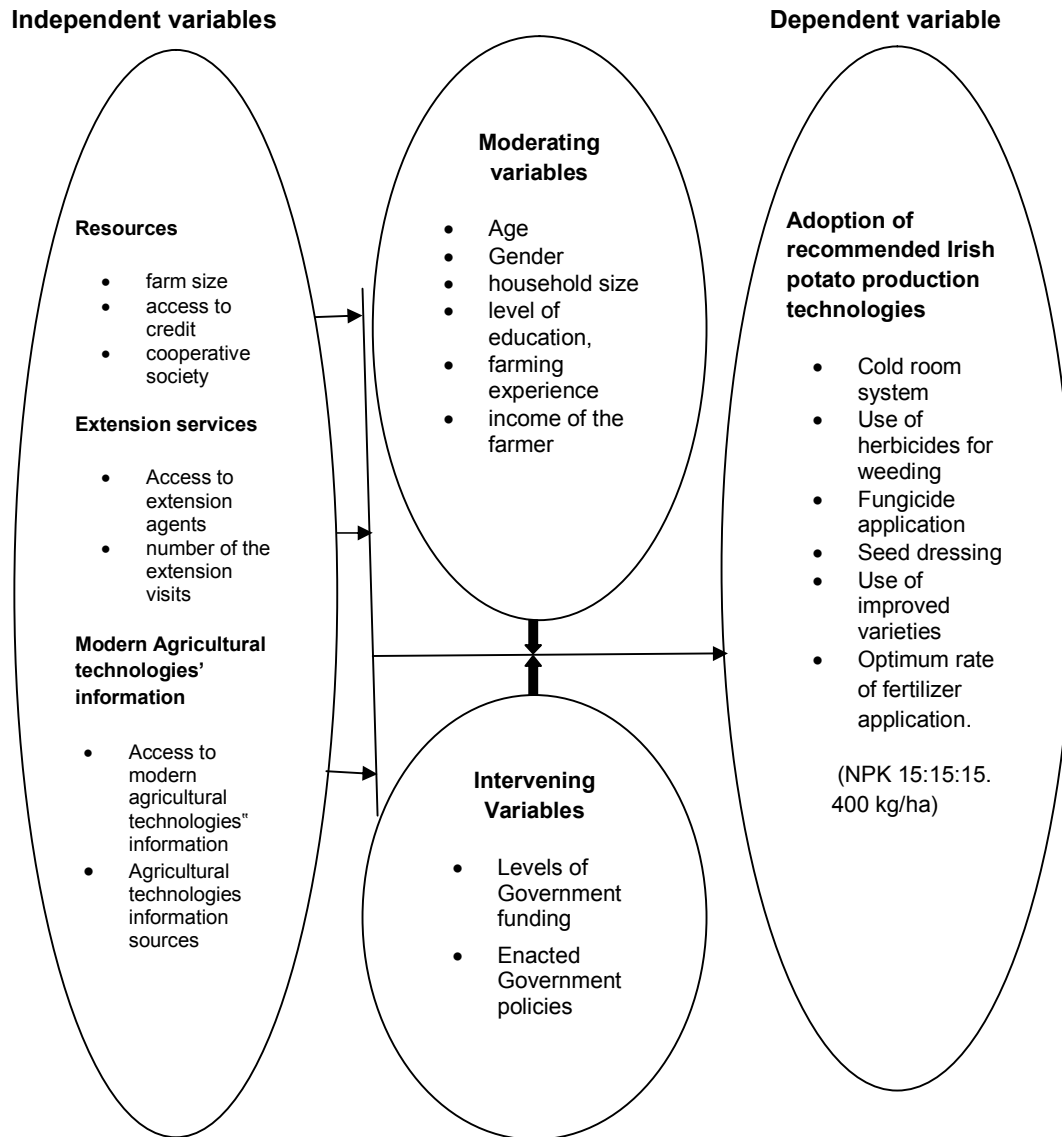
Despite its towering significance, the productivity of Irish potato remains low among small scale farmers in Plateau State. Other challenges affecting productivity of the crop and its potential as food security and poverty eradicating crop enterprise include perishability, lack of storage facilities and low production. Its productivity stands at an average of 6.5tons per hectare falling below an optimal standard of 20tons per

hectare [5]. This difference in yield has been attributed to low-quality seed, limited use of improved agro-inputs among other constraints [6].

Even with the commitment given to the potato programme in Kuru by the National Cereal Research Institute (NRCRI), decreasing level of production brings to mind the constraints facing production. The objectives of the study were to: (i) identify the sources of information on improved Irish potato production technologies used by the respondents; (ii) determine the level of adoption of the recommended improved Irish Potato production technologies by the respondents; (iii) identify the factors militating against the adoption of the selected improved production technologies by respondents.

### 1.2 Conceptual Framework

A conceptual framework is a construction that shows the relationship existing among variables and most often these relationships are depicted schematically and mathematically, it also creates awareness and understanding of the situation under scrutiny and communicates the same. In this study, the basic assumptions in the study are that farmers' socio-economic characteristics (age, gender, household size, level of education and farming experience farm size), institutional and technological factors (extension contact, income of the farmer, credit and membership of an organization or cooperative society and information sources) broken down into indicators that were studied to provide answers to the research questions. The intervening variables were levels of government funding and enacted government policies. Adoption of recommended Irish potato production technologies by small scale farmers and it gave the desired results after the study was completed. In this model, the arrows explain the relationship between the independent variables, the dependent variable and the intervening variables while the block arrows show the likely outcome of the relationship.



**Fig. 1. Diagrammatic conceptual framework of adoption of recommended Irish potato production technologies by small scale farmers in the study area**

### 1.3 Adoption of Recommended Irish Potato Production Technologies

In the studies by [7] while examining the adoption of improved agricultural technologies for Irish potatoes (*Solanum tuberosum*) among farmers in Mbeya Rural District, Tanzania observed that about eight (8) improved agricultural technologies for Irish potato farming recommended in the area by ARI-Uyole were found to have been disseminated in the area by local extension agents and other stakeholders. These technologies include improved varieties such as Kikondo (CIP 720050), Bulongwa, Sesamua,

Baraka and Malawi; Chemical fertilizer application at the rate of 150 kg per acre; Folial fertilizers-NPK application (booster); Insecticides such as Thionex, Selecrone, Sumithion and Karete; Fungicides such Ridomil, Blue copper, Red copper, Brava, and Kocide; Plant spacing of 30 cm by 60 cm; seed rate of 8 to 10 bags of 100 kg per acre; and timely sowing i.e. from August to November and then from March to May. Proportions of surveyed households adopted some of the technologies such as seeding rate, timely sowing and fungicide application were the highly adopted technologies; about 92%, 100% and 80% of respondents indicated to have

adopted these technologies, respectively. Improved varieties and pesticide application were moderately adopted technologies. These technologies were used by 58% and 51% of the surveyed households, respectively. Recommended chemical fertilizer application rate as well as folia/booster fertilizer application, together with recommended spacing were the least adopted technologies. While none of the surveyed households adopted the recommended spacing rate, the other two technologies were adopted by only nearly one-third of the surveyed households). Furthermore, when data analysed by number of technologies adopted (i.e. overall adoption) [8], it was noted that a significant portion of respondents (50%) had adopted not more than three technologies out of eight. Therefore, it is evident that several technologies for improved agricultural technologies for Irish potato farming are available in the area.

Also [9] assessed factors influencing the adoption of recommended Irish potato production practices in Kudan and Giwa Local Government Areas of Kaduna State, Nigeria. It was found that 15% of the respondents adopted planting material, while 16% adopted planting time, approximately 12% adopted weeding time while 11% adopted plant depth and harvesting techniques, also 10% and 9% of the respondents adopted method of planting and planting space, respectively. Finally, approximately 17% adopted fertilizer application. Fertilizer application has the highest adoption (17%) level. This can be seen as evident in the yield. Proper application of fertilizer has been described as an essential prerequisite for the realization of increasing crop yield as well as for restoration and maintenance of soil fertility.

Planting space recorded the least of adoption among the respondents (9%), weeding time and planting depth recorded 12% and 11% of adoption, respectively. These could be attributed to old management techniques employed by the farmers to control pest infestation and therefore does not deviate from the practices that rural youth have known. Method of planting recorded 10% of adoption. This could be attributed to the fact that Irish potato farmers in the study area still use the traditional method of planting.

#### **1.4 Sources of Information used by Irish Potato Farmers**

In a research conducted by [10] on Use of Agricultural Information Sources and Services by

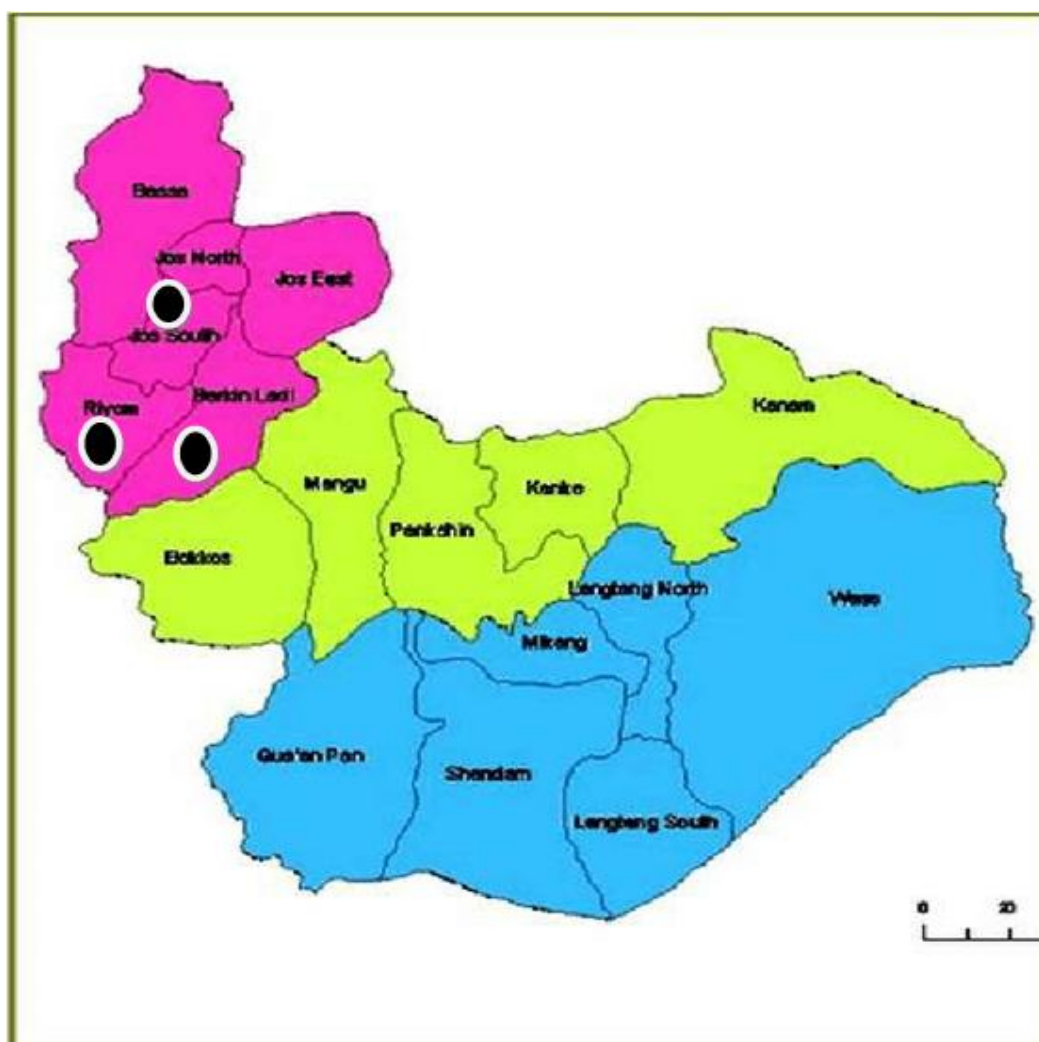
Farmers for Improved Productivity in Kwara State, using descriptive statistic (percentage) and results in multiple responses revealed that the only available information sources and services that could be considered adequate for the farmers in the selected local government areas of the state were town crier 363 (90%), relations 357 (89%) and film shows 332 (82%). However other information sources and services such as conferences and workshops, extension workers contact, television, Non-Governmental Organization (NGOs), mobile phones were rated low. This implies that they are not adequately available to farmers in the area. This would mean that the only information sources and services available for utilization in production practices in the areas were town criers, relations and film show; while others like conferences, workshops and Non –Governmental organization were inadequate.

Similarly, [9] conducted a research on Factors Influencing Adoption of Recommended Irish Potato Production Practices in Kudan and Giwa Local Government Areas of Kaduna State, Nigeria and results revealed that the sources of information on recommended Irish potato production practices available to farmers included extension workers, village/community leaders, co-farmers/friends, research institutions, traders and others such as radio, television and print media. It was found that most of the respondents 31% acquired information about recommended Irish potato production practices through extension worker, approximately 13 % through co -farmers and research institutes, 11% village/community leaders and traders, finally, 20% acquired information through other sources such as radio, television and print media. The efficiency of extension organizations providing information to Irish potato farmers on improved Irish potato production practices plays a significant role in the level of farmers' innovation uptake with respect to Irish potato production.

## **2. METHODOLOGY**

### **2.1 Description of the Study Area**

This study was conducted in the Northern Agricultural Zone of Plateau State in Nigeria. The Northern Agricultural Zone of the State covers Barkin-Ladi, Jos North, Jos South, Jos East, Bassa and Riyom Local Government Areas (LGAs). The study area lies between longitudes 8°40' and 9°50'E and latitudes 9° and 10°45'N [11].



**Fig. 2. Map of Plateau State with Plateau Northern Agricultural Zone shaded in pink**

Source: <http://www.plateaustate.gov.ng> (2006)

Key:

● Study area

● The 3 LGAs used for the study

The mean annual rainfall varies from 131.75 cm (54 in) in the southern part to 146 cm (57 in) on the Plateau. The study area has near temperate climate with an average temperature of between 18 and 22°C Harmattan winds cause the coldest weather between December and February. The warmest temperatures usually occur in the dry season months of March and April [12].

## 2.2 Sampling Procedures and Sample Size

The target population for this study was the small-scale Irish potato farmers in the Northern

Agricultural Zone of Plateau State. A multi-stage sampling procedure was used for this study. In the first stage, three (3) LGAs out of the six LGAs in the zone were purposively selected based on high concentration of Irish potato production. These are Barkin Ladi, Riyom and Jos South LGAs. Stage 2 involved the selection of 5 Irish potato producing villages from each of the three (3) selected LGAs, giving a total of fifteen (15) villages. Finally, stage 3 involved the random selection of ten (10) Irish Potato farmers from each of the 15 villages to give a total of 150 respondents for the study.

### 2.3 Method of Data Collection/analysis

Primary data were collected from farmers through a set of structured questionnaires which were administered to the Irish Potato Farmers in the study area. The questionnaire was designed to elicit relevant information necessary to achieve the stated objectives. The instrument used was subjected to validity and reliability tests. Descriptive analysis was employed to organize, summarize and analyse the collected data. Frequency distribution, mean scores and percentages were used to analyse the data vis-à-vis the research objectives.

## 3. RESULTS AND DISCUSSION

### 3.1 Sources of Information Used by Irish Potato Farmers

The results in Table 1 show that major sources of information used by farmers in the study area were; from Co-farmers, friends/relations (100%) which ranked (1<sup>st</sup>), extension agents 98.0% ranked (2<sup>nd</sup>) and mobile phone 58.0% ranking 3<sup>rd</sup>. Others were; radio/TV (33.3%) which ranked 4<sup>th</sup>, research institutes 25.4% ranked (5<sup>th</sup>), produce buyers 19.3% ranked (6<sup>th</sup>), inputs dealers 16.7% ranked (7<sup>th</sup>), internet 11.3% ranked (8<sup>th</sup>) and print media 10.0% ranked (9<sup>th</sup>). The results imply that information from Co-farmers, friends/relations; extension agents and mobile phone were the major sources of information used by farmers in the study area. According to [7], the efficiency of Co-farmers, friends/relations; extension agents and mobile phone providing information to Irish potato farmers on improved Irish potato production technologies will play a significant role in the level of farmers' adoption with respect to Irish potato production.

### 3.2 Level of Adoption of Irish Potato Production Technologies by Respondents

These components of recommended Irish potato production technologies were adopted by the farmers in varying degrees. Adoption was based on the number of technologies constantly used by the respondents. The adoption level represents the number of respondents using the technologies as a percentage of the total number of the respondents studied. The results in Table 2 show that 98.0% adopted Cold room system technique, 96.7% adopted the use of herbicides for weeding, 94.0% adopted the fungicide

application technique, 92.0% adopted Seed dressing technique, 88.0% adopted the use of improved variety (Nicola), 83.3% adopted Rate of fertilizer application (NPK 15:15:15. 400 kg/ha, 82.0% adopted the use of improved variety, (Diamant) and 44.0% adopted the use improved variety (Bertita). In the case of varieties, Nicola and Diamant were relatively better adopted; it is good in dry season farming with an adoption rate of 88.0% and 83.3% respectively. The reason for the high adoption rate of Nicola was because of its large size in nature, early maturing (can be harvested in 90 days) and its cultivation in both raining and dry seasons and has better taste and high market value. Bertita was relatively low adopted in the 2018 cropping season. The low adoption rate of Bertita was due to its smallish size, long maturing time and poor market for the variety. Generally, the results revealed high adoption of improved Irish potato production technologies in the study area. This implies that farmers in the study area were aware of the benefits of adoption production technologies.

### 3.3 Constraints to Adoption of Recommended Irish Potato Production Technologies

The constraints faced by farmers in the adoption of improved Irish potato production technologies are presented in Table 3. It was found that high incidence of pests and diseases 91.3% ranked 1<sup>st</sup>, lack of clean and certified seeds (89.3%) ranked 2<sup>nd</sup>, high cost of fertilizers and herbicides (88.7%) ranked 3<sup>rd</sup>, inadequate equipment for large scale production 88.0% (4<sup>th</sup>), high cost of improved seeds (86.0%) ranked 5<sup>th</sup>, poor packaging and measurement facilities 80.0% (6<sup>th</sup>), lack of proper storage facilities (77.3%) ranking 7<sup>th</sup> and Lack of technical skills in using technologies (72.7%) this ranked 8<sup>th</sup>, were the major constraints in the adoption of improved Irish potato production technologies among farmers. Poor transportation facilities 46.0% ranked 9<sup>th</sup>, inadequate land for large scale production represented 30.0% and ranked 10<sup>th</sup>, poor access to credit facilities accounted for 28.0% and ranked 11<sup>th</sup>, high cost of labour/tractor (24.0%) ranked 12<sup>th</sup> and Poor extension services attracted 18.7% and ranked 13<sup>th</sup>.

Similarly, high incidence of pests and diseases, high cost of fertilizers and herbicides, inadequate equipment for large scale production, packaging and measurement facilities, lack of proper storage facilities and lack of technical skills in

using technologies are causative factors of decline in Irish potato production in the study area. The high cost of improved seed and lack of clean and certified seeds may make farmers use seeds from their previous harvest which is not reliable and can jeopardize improved and sustainable productivity. This findings agrees with [13] who conducted a study on Economic Analysis of Irish Potato (*Solanum tuberosum*) Production Under Irrigation System in Katsina Metropolis, Katsina Local Government Area, Katsina State and their findings revealed that

constraints militating against the production of Irish potato in the area with poor storage facilities as first problem, followed by inadequate chemical and inadequate extension personnel among others. This finding also agrees with [14] who opined that pest and disease, inadequate chemical fertilizer, facilities and inadequate extension personnel and inadequate capital are responsible for causative factors of decline in cocoyam production in Ezeagu Local Government Area of Enugu State and its implications for sustainable food security.

**Table 1. Sources of information used by the respondents**

Source of information	Frequency	Percentage	Rank
Co-farmers, friends/relations	150	100	1 <sup>st</sup>
Extension Agents	147	98.0	2 <sup>nd</sup>
Mobile phone	87	58.0	3 <sup>rd</sup>
Radio/TV	50	33.3	4 <sup>th</sup>
Research institutes	38	25.4	5 <sup>th</sup>
Produce buyers	29	19.3	6 <sup>th</sup>
Inputs dealers	25	16.7	7 <sup>th</sup>
Internet	17	11.3	8 <sup>th</sup>
Print media	15	10.0	9 <sup>th</sup>

Source: Field survey (2018); \*Multiple responses

**Table 2. Level adoption of Irish potato production technologies by the respondents**

Technology	Frequency	Percentage	Rank
Cold room system	147	98.0	1 <sup>st</sup>
Use of herbicides for weeding	145	96.7	2 <sup>nd</sup>
Fungicide application	141	94.0	3 <sup>rd</sup>
Seed dressing	138	92.0	4 <sup>th</sup>
Use of improved varieties	132	88.0	5 <sup>th</sup>
Optimum rate of fertilizer application (NPK 15:15:15.	125	83.3	6 <sup>th</sup>
400 kg/ha)	125	83.3	6 <sup>th</sup>

Source: Field survey (2018); \*Multiple responses

**Table 3. Constraints to adoption of recommended Irish potato production technologies by respondents**

Constraints	Frequency	Percentage	Rank
Poor access to clean and certified seeds	137	91.3	1 <sup>st</sup>
The high cost of fertilizers and herbicides	134	89.3	2 <sup>nd</sup>
The high cost of improved seeds	133	88.7	3 <sup>rd</sup>
Lack of proper storage facilities	132	88.0	4 <sup>th</sup>
Lack of technical skills in using modern technologies	129	86.0	5 <sup>th</sup>
Poor transportation facilities	120	80.0	6 <sup>th</sup>
Inadequate land for large scale production	116	77.3	7 <sup>th</sup>
Poor access to credit facilities	109	72.7	8 <sup>th</sup>
The high cost of labour/tractor	69	46.0	9 <sup>th</sup>
Poor extension services	45	30.0	10 <sup>th</sup>

Source: Field survey (2018); \*Multiple responses



## 4. CONCLUSION AND RECOMMENDATIONS

### 4.1 Conclusion

Based on the findings of this research work it can be concluded that: Irish potato farmers were middle age farmers based on the mean age of 45 years in the study area. The results also revealed that farmers in the study area had low income implying that they are small scale farmers. Findings further revealed that farm size and farming experience were the main determinants of farmers' adoption of improved Irish potato varieties, while, the major constraints identified were the high cost of the improved varieties of the potato seeds and insufficient capital as were rated high at 89.4% by the respondents. Adulteration of seeds, fertilizers and other chemicals were rated 86.3% and 82.5%.

### 4.2 Recommendations

Based on the findings of this research work, it was recommended that:

1. Government/NGOs involved in seed multiplication and distribution should make clean and certified seeds accessible and affordable to the farmer for production.
2. Farm inputs such as fertilizer and other chemicals should be made available and affordable to farmers by input dealers.
3. Government through the extension workers should educate farmers on the availability of diffuse light storage technology developed by the National Root Crop Research Institute Kuru (NRCI).

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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