International Journal of Agricultural Management and Development (IJAMAD)
Available online on: www.ijamad.iaurasht.ac.ir
ISSN: 2159-5852 (Print)
ISSN:2159-5860 (Online)

Seed Potato Management among Potato Growers in Freydunshahr County (Isfahan Province), Iran

Asghar Bagheri * ***and Mojtaba Sookhtanlou***

Received: 09 January 2017,
Accepted: 26 August 2017

Abstract

This study investigated the mechanisms of seed potato management by potato growers of Freydunshahr County in Isfahan province. Survey research method was used in this study. A sample of 250 potato growers (N=725) was selected for data collection. Stratified random sampling method was used. The research instrument was a questionnaire that was validated for face validity by a panel of faculty members and agricultural experts of Agriculture Jihad Organization in Freydunshahr County. For determining the reliability, Cronbach's alpha was estimated which turned to be higher than 0.7. Results showed that "a part of tubers produced by farmers" was the first priority of farmers as seed tuber source. Results showed that 89.6 percent of potato growers store and keep seed tubers in inappropriate conditions. Majority of the farmers did not have sufficient information on seed potato management and there was a positive and significant relationship between the farmers' education and potato yield per hectare, but a negative relationship was found for age. Based on logistic regression analysis, the predictive power of the model was 0.639 and the sensitivity of total model to determine the correct percentage was 86.0 percent. Among individual, professional and economic factors, variables of age, number of family labor, area of owned land, area of potato farming, potato yield per hectare, number of owned land parcels and knowledge and information level of respondents significantly impacted on the adoption and use of modern seed potato production systems.

Keywords:
Freydunshahr County, potato seed tuber, potato growers, seed quality

Faculty of Agriculture and Natural Resources, University of Mohaghegh Ardabili, Iran
** Corresponding author's email: a_bagheri@uma.ac.ir*

INTRODUCTION

Potato (*Solanum tuberosum* L.) is the fourth most important food crop after corn, rice and wheat. It is grown all over the world. The current world production of potatoes is about 321 million tons fresh tubers from 19.5 million hectares (Ebrahimi et al., 2015). In many countries in Asia, Africa and Central and South America, there is a need for increased production of stable potato to meet increasing demands for food from human population growth during a period of environmental (including climate) change. Potatoes with improved nutritional and health properties are desirable, but the overriding need is for increased and stable yields to eradicate human hunger and poverty (Vreugdenhil et al., 2007). Potatoes are grown worldwide under a wider range of altitude, latitude, and climatic conditions than any other major food crop-from sea level to over 4000 m elevation. No other crop can match the potato in its production of food energy and food value per unit area (Mohammadi et al., 2008). Potato growers in different parts of the world have the same problems. For example, the lack of yielding amendment and high quality of seed potato tubers and absence of resistance to pests and diseases are known as the main problems for the cultivation of potato in Cameroon (Deffo & Demo, 2003). Hirpa et al. (2010) cited multiple poor distribution systems and low quality of seed potato tubers as major problems among potato growers in Ethiopia. One of the main problems in the potato cultivation is the cost of potato seed production so that it constitutes 30 to 50 percent of the cost of potato cultivation depending on country or region (Bagheri, 2015).

Sthapit et al. (2008) have defined systems of seed production as the methods in which farmers produce, select, store and prepare seed. Globally, systems of local seed production have been categorized in various types as follows: formal and informal (Endale et al., 2008; Struik & Wiersema, 1999), official and local chains (World Bank, 2009), and formal and farmers (Almikinders & Louwaars, 1999). Louwaars (2007) defined the farmers' informal or local seed chain as a system where seed is chosen, produced and distributed locally and defined the formal chain as a system that seed production and distribution in various dimensions from seed system managing by well-defined methods to proliferation control is conducted by private sector specialists, in most cases under national laws and international standards. In Iran, a part of the harvested potato is saved as seed for farmers to prepare tubers for home consumption, and a part is stored as seed for cultivation in the next season (Majidi Harvan, 2003). Farmers who store seed potato without renewing the seed from a reliable source and use it for several consecutive cultivation seasons will face reduction in quality and performance (Gildemacher, 2012).

The main components of a seed production system can be referred to as: 1) seed production and storage, 2) seed tubers quality, 3) seed availability and distribution, and 4) the flow of knowledge (Hirpa et al., 2012). Seed production and storage management refers to all activities conducted in order to produce seeds at any time of planting period. It includes all stages of production and storage (Weltzien & Vombrocke, 2000). Seed tuber quality also includes seed health, physiological age, condition, size, purity and genetic quality (Struik & Wiersema, 1999). Healthy, viable seed of the preferred variety needs to be available at the right time under reasonable conditions so that farmers can use their land and labor resources with the best yield expectations. The wrong variety, sown at the wrong time with infected seed of poor germination potential, will seriously limit a farmer's expectation of production and productivity. Thus, any seed system has multiple functions to be fulfilled for a range of farmers, farming conditions, and crops in a village, region, or country. A seed system can be assessed at any time according to how well it fulfills these functions. Conditions, situations, groups of farmers, or crops can be identified under which the specific system works well. Similarly, factors that constitute stresses to a particular system can be revealed in terms of these four functions (Weltzien & Vombrocke, 2000).

Mathoni and Nyamongo (2008) found that while a formal seed system exists in Kenya,

majority of farmers rely on an informal seed system for planting most agricultural commodities, and often continue to recycle seed, resulting in persistent low yields. Major crops as well as commercial crops are dominated by the formal seed system, whereas orphaned crops as well as poor farmers have no place in the formal system. According to Hirpa et al. (2010), three seed potato systems, i.e., informal, alternative and formal seed systems, co-exist in Ethiopia. The informal system, with low quality seed in terms of health features, physiological, physical and genetic attributes is dominant. The formal system in which seed tuber is produced by reliable professionals from the private sector and cooperative institutes is too small to contribute significantly to the improvement of that situation. Major challenges of seed systems of Ethiopia were identified as lack of proper linkage between different actors involved in seed systems, inadequate supply of good quality seed at affordable prices, focus on few crops (maize and wheat) in the formal system and other beneficial crops (such as pulses and oilseeds) remain orphans, low level of private sector involvement in the formal system, inefficient seed promotion, distribution and marketing mechanisms, and weak variety release and seed quality assurance system (Atilaw & Korbu, 2010). Oladele (2010) examined farmers' information seeking and utilization pattern on seeds and planting materials in Lagos and Ogun states. Farmers were exposed to many sources of information on seeds and planting materials. The results suggested the relevance of use of improved seeds and planting materials among farmers. They also suggested the relevance of the characteristics of information sources as drivers of use of improved seeds and planting materials.

In an investigation on seed potato production systems in East Africa, Gildemacher (2012) stated that less than five percent of the seed potatoes used in East Africa sourced from specialized chains and more than 50 percent from farmers' seed storage (local chain) derived from farmers' own farm products. Oyekale et al. (2014) found that compared with other agricultural inputs (fertilizers, pesticides, etc.), high-quality seed management plays the most important role in improving productivity. The availability of suitable new seeds, along with appropriate training to farmers can play the most important role in the success of seed management systems. Development and optimal performance of seed management is influenced by several factors such as farmers' weak technical potential, poor market mechanisms to provide new seeds, lack of supportive legislation for seed management, inappropriate flow of knowledge and information among farmers, insufficient investment and less use of innovations in seed management. Results of a study on the adoption of mini-tuber seed potato in Ardabil province of Iran (Bagheri, 2015) revealed that higher yield was the farmers' main reason for the adoption. On the contrary, higher seed cost and lack of technical knowledge about mini-tuber cultivation were the main reasons for non-adoption. According to the results, adopters had more mechanized farms. Also, the number of parcels held by a farmer, age and years of farming experience were negatively associated with the adoption. On the other hand, farm size, education level and number of literate persons in the farmer' household was positively associated with adoption.

With respect to the importance of seed management especially in potato farming that consumes 3-4 tones seed tubers per hectare, considering 180 thousands hectares of potato acreage and relatively low potato production yield (22 tons per hectare) in Iran (FAO, 2008), seed potato management system needs to be studied. Furthermore, Isfahan province, especially Freydunshahr County, is of the main potato producing regions of the country that serves as a seed source for other potato producing provinces (Bagheri, 2015). However, the problem is that there is no formal seed system in the county and no study has been conducted on seed potato management system among potato growers of the county. This is an exploratory study to find the strengths and weaknesses of the seed potato management system in Freydunshahr County of Isfahan province as one of the main potato farming regions and a good representative of seed potato system in Iran. Conceptual framework of the study is presented in Figure (1).

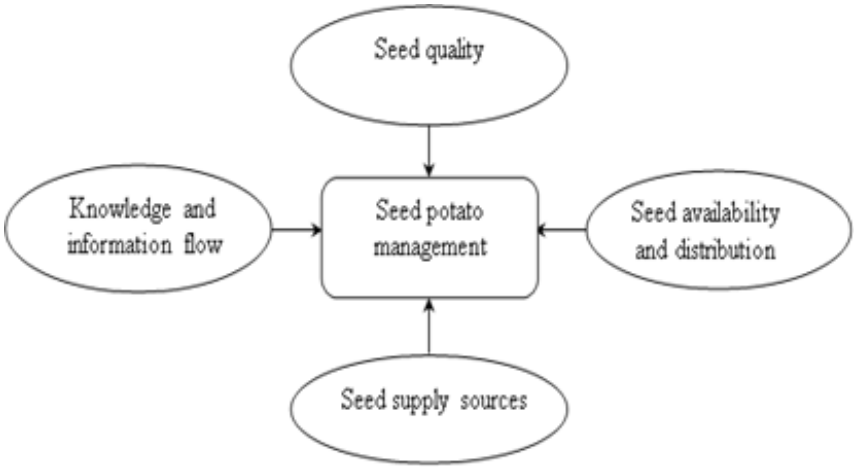

Figure 1: The conceptual model of study for potato seed management

It summarizes the results of previous studies. To examine the seed potato management systems in relation with formal and informal systems (Louwaars, 2007; Sthapit et al., 2008; World Bank, 2009), the following components are studied:

Variables related to seed supply sources, seed quality (including seed tubers purity, size and health), variables related to the availability and distribution of seed tubers (the ease of access seed tubers), and variables related to the knowledge flow (including the knowledge of farmers, information resources and information that farmers seek). So, the main purpose of this study is to investigate seed potato management mechanisms in Freydunshahr County of Isfahan Province. Bearing this reason in mind, demographic and socioeconomic status of the respondents, potato growers' seed supply sources, their agricultural knowledge and information on potato seed management, association of information and knowledge with individual variables and their socio-economic status, and factors affecting adoption of new seed management system were examined.

MATERIALS AND METHODS

The study area

Isfahan province is located in the central part of Iran with an area of 214,503 km^2. It lies within the latitudes of 30.6N and 34.58N and the longitudes of 49.6E and 55.5E. The area has a semi-arid climate with a limited amount of precipitation (130 mm) which generally occurs in winter from December to April. About 3% of total area is cultivated (609,250 ha) from which 95% is assigned to the irrigated lands and 5% is assigned to rain-fed lands (Keshavarz et al., 2014). Freydunshahr County is one of the main potato producing regions which was selected for the study. It is located in the western part of the province (Figure 2). The county has two districts and two cities (Freydunshahr and Barf-Anbar) and 96 villages. It occupies a total land area of 2236.15 km^2, or 2.08 percent of the total land area of the province. It is 175 kilometers far from the province center (Isfahan city). In term of farming population, the county has 4626 farmers or 3.2 percent of total farmers in the province to account for this section and in horticulture sector, 3161 farmers of this county composed of 2.9 percent of all gardens of the province. Potato is the most important crop in the county. In cropping year of 2013-14, potato acreage of the county was equal to 2100 hectares with a production of 44,100 tons meaning 21000 kg per hectare (Weather Bureau of Freydunshahr, 2016).

The dominant approach in this study was survey and field study was used in data gathering for cropping year of 2015. In terms of variables control, it is a cross-sectional descriptive and none-experimental research method. Besides using face to face approach to fill out questionnaire, in-depth interviewing and key informants were used for data collection.

The main instrument of this study was a researcher designed questionnaire in five parts: the first part was related to personal and socio-economic characteristics of potato growers (18

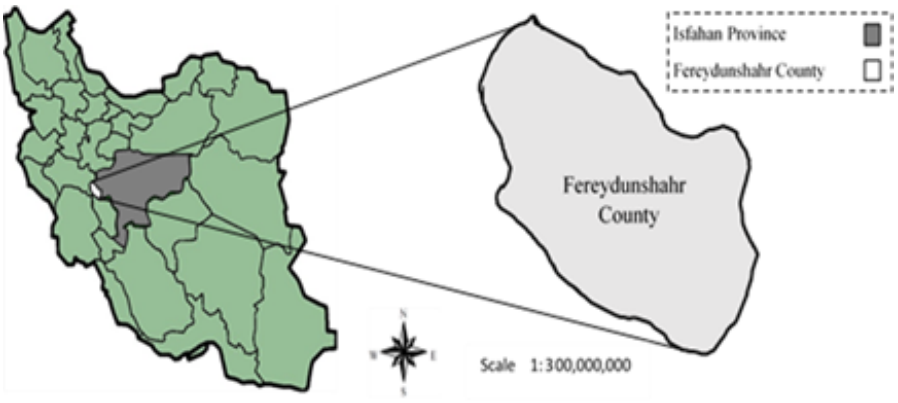

Figure 2. Area of study (Freydunshahr County, Isfahan Province, Iran)

items). Parts 2 to 4 were studied the main components of the seed potato management. These components (according to Atilaw & Korbu, 2010; Bagheri, 2015; Gildemacher, 2012; Hirpa et al., 2010; Louwaars, 2007; Oladele, 2010; Oyekale et al., 2014; Sthapit et al., 2008) included seed supply sources (7 items), availability and distribution of seed (5 items), seed tubers quality (3 items) and flow of knowledge and information (5 items). They were measured by a five-point Likert type scale (1 = very low, 2 = low, 3 = average, 4 = high, 5 = very high). The fifth section of the questionnaire examined the potato growers' barriers to use suitable seeds that had 8 items. Face validity of the instrument was confirmed by a panel of faculty members and agricultural experts of Agriculture Jihad Organization in Freydunshahr County. The statistical population of the research included all potato growers in the crop year 2015 (N=725) in Freydunshahr County of Isfahan province. A sample of 250 potato growers was determined by Cochran's formula. Proportional stratified random sampling was used in this study. For this purpose, based on the geographical location and population distribution in proportion to the distribution of potato growers, population was divided into two separate sectors and samples were taken (Barf Anbar and Freydunshahr regions, rural district of Ashayeri, rural district of Cheshmeh Langan that are among the areas where mini-tuber potatoes are not cultivated). Within each sector, sample farmers were selected using simple randomization method. To ensure reliability, Cronbach's alpha was used and the alpha was obtained to be higher than 0.7 implying the high reliability of the instrument.

$$n = \frac{N * z^2 * \sigma^2}{d^2(N-1) + (z^2 * \sigma^2)}$$

where: n = sample size; N = statistical population; Z = confidence coefficient; = variance; d = percentage of error

To categorize knowledge and awareness of respondents in relation to seed potato management, interval of standard deviation from means (ISDM) was used (Khoshnodifar et al., 2016; Qamar, 2002):

- Low: Min ≤ A < Mean-SD
- Medium: Mean-SD ≤ B < Mean-
- High: Mean ≤ C < Mean+SD
- Very High: Mean+SD ≤ D < Max

Also, to determine factors affecting adoption of modern seed potato production system, logistic regression analysis was used.

RESULTS AND DISCUSSION

Demographic characteristics of respondents

Based on the results, respondents' average age was 50.45 years. The most frequency (38.6%) was related to 50-59 year group. Their average farming experience was 27 years. In terms of education level, about 9 percent of potato growers were illiterate and 32 percent were literate in which the highest frequency (21.6 percent) was related to guidance school (8 years of education). 27.2 percent of them had a farmland area of 11-15 ha. Results also showed that 70 percent of respondents had, on average, five ha of rented land. Respondents'

Table 1
Ranking of Seed Potato Supply Sources among Respondents

Potato seed supply sources	Mean	SD	Rank
A part of potato harvested from their own farms	3.41	0.99	1
Seed potatoes bought from other potato growers	2.99	1.01	2
Local markets	2.50	1.03	3
Tuber planted as seed for next year	1.84	1.16	4
Specialized seed producers	1.79	1.23	5

Table 2
Storage Methods of Potato Seed Tubers

Storage methods	Frequency	Percentage
Stored in gunnysacks	123	49.2
Stored in local warehouses	101	40.4
Delay in harvesting time	15	6
Stored in well ventilated and light places	11	4.4
Total	250	100

Table 3
Availability of Potato Seed Tubers for Potato Growers

Availability	Frequency	Percentage
Not easy access	228	91.2
Easy access	22	8.8
Total	250	100

average potato cultivation area was 9.4 hectares, among which 68.6 percent had less than 5 hectares and only 2.8 percent had more than 16 hectares of potato cultivation land.

Investigation of potato varieties shows that six varieties including Agria, Santa, Marfona, Bamba, Rambos and Spirit are used with the domination of Agria (44.7 percent). The Marfona variety has been cultivated in the lowest acreage (1.2 percent of respondents). Average potato yield per hectare was 34.44 tons for 41.4 percent of respondents. It ranged from 21 to 30 tons while only 4.2 percent of respondents harvested more than 50 tons per hectare. Based on the findings, 55.6 percent of potato growers used both local and mini-tuber seed potatoes. Indeed, 22.8 and 21.6 percent used only local and mini-tubers, respectively.

Potato seed supply sources

As depicted in Table (1), six sources of seed tubers were identified and ranked based on mean and standard deviations. A part of tuber harvested from their own farms was the main source of seed tuber. Seed potatoes bought from other potato growers was their second seed tuber priority. Some potato growers prepared their seed tubers from local market. As shown in Table 1, tuber planted as seed for next year and seed bought from specialized seed producers were two last priorities of potato growers for seed tuber provision, respectively.

Storage methods of potato seed tubers

Results of Table 2 showed that 49.2 percent of potato growers stored seed potato tubers in gunnysacks at home and 40.4 percent stored them in local warehouses. Delayed harvest was another way to store seed potato that six percent of potato growers were used. Other farmers stored seed tubers in well ventilated and light places.

The availability of seed potato tubers

Respondents were asked to identify whether they had easy access to seed potato tubers or not. The results showed that 91.2 percent did not have easy access to seed tubers (Table 3).

Quality of seed tubers

Seed potato tubers were divided into three groups in terms of purity. Based on these categories, 13.2, 66.2 and 20.6 percent of respondents used

lowly, moderately and highly pure seed tubers in their farms, respectively. Results also showed that seed tuber size of 5.6, 39.2, 11.6 and 10 percent of potato growers was big, medium, small and very small, respectively. Also, 33.6 percent of them used mixed sizes (accessible) tubers. Regarding seed tubers health, 32.4, 66.4, and 1.2 percent stated that they used desirable, lowly desirable and undesirable seed tubers (Table 4).

Knowledge and information flow

Respondents were asked to indicate their knowledge and information sources and level of knowledge and information regarding seed potato management in 5-point Likert scale statements. Then, they were ranked using mean and standard deviation. Regarding knowledge and information sources as depicted in Table 5, other potato growers were the main information source for potato growers and it was placed in higher priority of their information seeking followed by local markets. Government organization of agriculture and specialized seed producers as the controlled and well managed services of seed tuber production were placed in two last priority of potato growers information and knowledge sources (Table 5). Self-stated knowledge and information level of potato growers

Table 4
Quality of Seed Potato Tubers Used by Potato Growers

Seed tubers quality	Scale	Frequency	percentage
Purity of potato seed tubers	Low	33	13.2
	Medium	165	66.2
	High	52	20.6
Seed tubers size	Big	14	5.6
	Medium	98	39.2
	Small	29	11.6
	Very small	25	10
	Mixed (accessible)	84	33.6
Tuber seed health	Desirable	81	32.4
	Lowly desirable	166	66.4
	Undesirable	3	1.2

Table 5
Knowledge and Information Flow Regarding Seed Potato Management

Cases	Items	Mean	SD	Rank
Knowledge and information Sources	Other potato growers	2.90	0.82	1
	Local markets	2.02	0.85	2
	Government organization of agriculture	0.64	0.90	3
	Specialized seed producers	0.51	0.91	4
Knowledge and information levels	New methods of production	2.47	0.99	1
	waste reduction Methods	2.43	1.12	2
	New potato varieties	2.31	1.01	3
	New methods of storing potato	2.27	1.03	4
	New methods of seed tubers supply	1.99	1.07	5

Mean range: From 1 (very low) to 5 (very much)

Table 6
Classification of the Level of Respondents' Knowledge and Information

Level of knowledge	Frequency	Percentage	Cumulative percentage
Low	43	47.3	47.3
Medium	33	37.2	84.5
High	12	12.7	97.2
Very High	2	2.8	100
Total	90	100	-

regarding seed potato management practices was also investigated (Table 5). As the results show, their highest level of knowledge and information was related to new methods of potato production followed by best methods of potato waste reduction. They were very poorly aware of new methods of seed tubers supply.

In order to classify the level of respondents' knowledge and information on seed potato management, ISDM method was used. Results of Table 6 using ISDM method indicated that near to majority of potato growers (47.3 percent) had low level of knowledge and information about seed potatoes management.

Correlation analysis

To evaluate the relationship between respondents' knowledge of potato seed management, correlation analysis (Pearson and Spearman) was used. Based on the results (Table 7), a significant and positive relationship was found between levels of education, potato production yield per hectare and respondents' knowledge. However, a negative and significant relationship was found between age and respondents' knowledge of potato seed management.

Logistic regression analysis

To determine factors affecting adoption of modern seed potato system, a logistic regression analysis was used. For this reason, respondents were divided into two groups of adopters and non-adopters (Table 8). According to Table 8, the predictive power of the logistic regression was 0.639 (Negelkerke R Square: 0.639). In the other words, the model predicted a high percentage of dependent variable values by variables included in the model and the adoption was accounted for by variables in the equation. -2 Log likelihood values that act as goodness of fit and decreases when model is well matched with data has appeared in one step. It was 174.651, confirming the goodness of fit of the model (Table 8). In another finding (Table 9), the sensitivity of the model for determining the correct percentage about those who did not adopt and use the modern seed potato system production obtained 92.9 percent. Also, for determining the percentage correct about those who adopted and used the modern seed potato system was estimated at 75.0. Overall, sensitivity of the total model to determine correct percentage was 86.0 percent. Based on the results (Table 10), among the individual, professional and economic factors, variables of age, number of family labor, area of owned land, area of potato cultivation, potato yield, number of owned land parcels and knowledge and information levels positively im-

Table 7
Correlation of Knowledge of Potato Seed Management and Socioeconomic Variables

Variables	r
Age	- 0.384**
Experience of potato farming	0.139
Number of household members	0.235-
Number of family labor	0.051
Education	0.223*
Area of owned land	- 0.153
Potato production yield per hectare	0.304*
Area of rented land	0.205
Area of potato under cultivation	0.032
The cost of potato cultivation	0.146
The income of potato cultivation	0.151

* p < 0.05; **p< 0.01(2-tailed)

Table 8
Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	174.651	0.469	0.639

Table 9
Classification Table

Observed			Predicted		
			Adaption		Percentage Correct
			No	Yes	
Step 1	Adaption	No	143	11	92.9
		Yes	24	72	75.0
	Overall Percentage				86.0

Table 10
Logistic Regression for Adoption of New Seed Potato Systems

Variables	B coefficient	SD	Wald test	Exp (B)	p-value
Age (year)	-0.042*	0.292	3.997	0.958	0.046
Experience of potato farming (year)	0.036	0.019	3.556	1.037	0.059
Number of family labor	-0.409*	0.165	6.160	0.664	0.013
Number of household members	-0.072	0.095	0.571	0.931	0.450
Main job (0: non-agriculture, 1: agriculture)	0.264	0.540	0.240	1.303	0.625
Education (year)	0.082	0.128	0.409	0.922	0.523
Area of owned land (hectare)	0.133*	0.059	4.973	1.142	0.026
Area of potato cultivation (hectare)	0.372*	0.100	13.815	0.689	0.011
Potato production yield per hectare (ton)	0.096*	0.028	11.541	0.909	0.021
Number of owned land parcels	0.311*	0.098	10.073	1.365	0.032
Number of rented land parcels	-0.212	0.266	0.633	0.809	0.426
Knowledge and information levels (Pseudo-distance)	0.111*	0.049	5.091	1.117	0.024
Constant value	-3.188	1.361	5.486	24.235	0.019

* p< 0.05 (2-tailed)

pacted on the adoption and use of modern seed potato system. Moreover, the Wald statistic indicating the relative contribution of individual variables to the probability of adoption and use of modern seed potato system revealed that area of potato cultivation (13.815), potato yield (11.541) and number of owned land parcels (10.073) were the most important factors predicting the decision to adopt and use of system among potato growers.

CONCLUSION

Systems of seed potato production define the methods in which farmers produce, select, store and prepare seed (Sthapit et al., 2008). High-quality seed management plays the most important role in improving productivity. This study examined mechanisms of seed potato management among potato growers in Freydunshahr County of Isfahan province. Results showed that the main source of potato growers' seed potato supply was "a part of tubers harvested from their own farms". It implies that most potato growers provide seed potato from non-official or local chain. Potato seed tubers supplied by local and informal systems are poor in terms of health, physiological, physical and genetic features (Endale et al., 2008; Gildemacher et al., 2009; Lommen & Struik, 1994; Mulatu et al., 2005). Consistent with this result, Gildemacher et al. (2009) found that 98.7 percent of farmers in Ethiopia had provided seed potato tubers through informal and local seed systems. Based on the results, 91.2 percent of the respondents in the study region had difficulty to obtain seed tubers. Availability of seed means all farmers' access to appropriate seeds in right time.

In terms of potato storage methods, 89.6 percent of potato growers store and keep seed tubers in

poor conditions. Only 4.4 percent of them store seed tubers in places with enough light and well ventilated conditions. Potato seed tubers stored in local warehouses with poor light, temperature and ventilation or in gunnysacks at home increase waste and decrease potato growers' income. Consequently, it discourages them for efficient management of seed potatoes. Due to the widespread area of potato cultivation in the region, poverty of farmers and lack of ability to build modern warehouses and due to improper maintenance practices of seed potatoes, governmental organizations, cooperatives or farmers' associations should construct standard warehouses.

Regarding quality of seed tubers, the purity of seed tubers used by about 80 percent of respondents was medium to low. 33.6 percent of respondents did not have enough considered the seed tuber size. They used accessible tubers as seed. Except 5.6 percent of potato growers who used adequately large size tubers, seed tuber size used by other potato growers was medium to small. It seems that the target of potato growers who selected small seed tubers as seed is often related to a reduction in seed costs (Endale et al., 2008; Gildemacher et al., 2009; Mulatu et al., 2005). Use of small seed tubers has two main problems: Delay in growing and low germination power because of little food storage (Lommen & Struik, 1994) and increased risk of disease outbreaks from mother seed tubers (Struik & Wiersema, 1999). Results also revealed that 32.4 percent of potato growers used healthy seed tubers and the rest of farmers used unhealthy and undesirable seed tubers for planting. With respect to problems mentioned above and the problem of weak health, physiological, physical and genetic characteristics, it can be concluded that current seed potato system in the region has local or informal nature and it did not develop to a specialized form.

Flow of knowledge includes issues such as farmers' access to knowledge about new varieties and seed sources, and knowledge and information that farmers are seeking for (Weltzien & Vombrocke, 2000). Results showed that majority of potato growers in the region had low level of knowledge of seed potato management. However, most of them were well informed about modern agronomic practices of potato production. Consistent with previous researches (Davoodi & Maghsoudi, 2012), results revealed that potato growers' knowledge and information was significantly correlated with education and potato yield per hectare. Major farmers, who form just a small group of farmers, are more educated and have better access to modern technologies, such as high yielding varieties, machineries and so on, thereby they have higher yield and more income as well as better access to agricultural information and knowledge sources. For this reason, the major group of small farmers who are beneficiaries of small and dispersed units of farm lands (the most arable lands of the country) with low access to modern technologies should be considered by agricultural policy makers and extension services for new knowledge, skills and technologies.

Based on the results of logistic regression model, among personal, professional and economic variables, age (in line sistent with Iqbal et al., 1999), number of family labor (consistent with Bagheri, 2015; Kafle & Shah, 2012; Waller et al., 1998), potato growers' knowledge and information level, number of owned land parcels and area of potato cultivation, potato production yield per hectare and area of owned land (consistent with Abebe et al., 2013; Bagheri et al., 2016; Ekwek & Onunka, 2006; Hirpa et al., 2010; Oladele, 2010) have significant effect on the adoption and use of new seed potato system. However, unlike previous studies, variables such as education, number of rented land parcels, rented land area, number of family members and primary occupation did not significantly determined the adoption of seed potato management practices. Based on the results, the following recommendations are presented:

- To promote production, storage, selection, preparation, certification and distribution of seed tuber, formal seed system should be created with participation of agricultural researchers and extension agents and farmers.
- Village based storehouse should be constructed with the cooperation of potato growers to store seed potatoes of the members in the best conditions for subsequent farming year.
- Extension educations should cover seed

management and train potato growers for seed management.

ACKNOWLEDGEMENT

The authors would like to thank University of Mohaghegh Ardabili (Ardabil, Iran) for financial support of this study. Also, we express appreciation to the respondents who kindly gave their time to make this research possible.

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How to cite this article:
Bagheri, A., & Sookhtanlou, M. (2017). Seed Potato management among Potato growers in Freydunshahr County (Isfahan Province), Iran. *International Journal of Agricultural Management and Development, 7(4), 497-508.*
URL: http://ijamad.iaurasht.ac.ir/article_533127_a9c6449c846efa361097ebb63358c95a.pdf