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THE ROLE OF AGRICULTURAL EXTENSION SERVICES IN INTEGRATED PEST MANAGEMENT ADOPTION BY IRANIAN PISTACHIO GROWERS

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A B S T R A C T

New technologies has major role toward plant productions. Integrated Pest Management is a farm technology which reduces pesticides in agricultural systems. Agricultural extension services should be considered as the main diffusion technology instrument so that success in many new technologies adoptions depended on this services function. Investigating role of agricultural extension and educational services on integrated pest management adoption by Iranian pistachio growers was the main objective of this study. Kerman province which is located in south west of Iran is the main area of pistachio growers. Those farmers who produce pistachio in that province were the research statistical society. Sample group were selected by using two stage cluster sampling method and questionnaire was used for collecting data. Findings revealed agricultural extension services have the main role in IPM adoption by farmers. Also, those pistachio growers who have more benefited of those services had more IPM adoption. Finally, an experiential model has been presented based on the research results which can be applicable for improving the rate of IPM technology adoption by pistachio growers.

Keywords: Agricultural extension services, integrated pest management, adoption, pistachio growers, Iran.

INTRODUCTION

Global environmental policy recently emphasized on reduced chemical application agricultural production process because excessive usage of chemical fertilizers and pesticides are documented one of the major environmental pollution resources. There are many researches in agriculture which have showed green revolution input for example chemical fertilizers and chemical pesticides can threat animal and humans health. Therefore, research institutes researching on new agricultural technology deeply pay attention on sustainability of technology (Chizari*et al*., 2000). IPM, biological fertilizers are selected as sustainable technologies instead of chemical input in agriculture (Bartlett, 2005). Extension services are one of most important cause about chemical pesticides using by farmers because extension services have focused on chemical pesticide diffusion in developing countries for long time (Orr, 2003). Agricultural extension and education missions newly focus on to improve farmer's production with environmental preservation approach. Many researchers believe that participatory methods can be more effective in IPM technology adoption by farmers as success of farmer's field school (FFS) method is evident (Asiabaka, 2002). Continuing the applying IPM and its farmers beneficiation education makes reduced using farmers pesticides because farmers are motivated to use biological, mechanical and low chemical pest control methods Instead of old method which mainly focus on chemical pesticides (Povellato and Scorzelli, 2006).

Researches carried in Sri Lanka declared IPM most promising pest control method because this method has flexibility strategy for insect control and its performance was followed environmental preservation objectives (Sanderson et al. 2002). Braun et al. (2000) showed that using variation tools in IPM education to farmers has increase farmers IPM adoption and can make informal educational method effective on farmers IPM knowledge and active farmers observation skills

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used in FFS enhanced farmers tendency to adopt IPM (Khisa et al., 2005). Enrichment of farmer's skills to applying sustainable method and technology should be done by rural extension services as main advisory activities which have been related with farmers (Karami, 1995). Den Biggelaar and Suvedi (2000) founded that farmers support by extension services can successfully effect on their IPM adoption. Critical knowledge development, participatory methods, informal educational environment, active observation, Holistic perspective, group discussion, continuously learning, facilitation, using farmers experience, exploratory Learning, farmers oriented learning and innovation are those factors which can be useful for farmers IPM knowledge enhancement according to Ahmadvand (2008) findings (Figure 1).

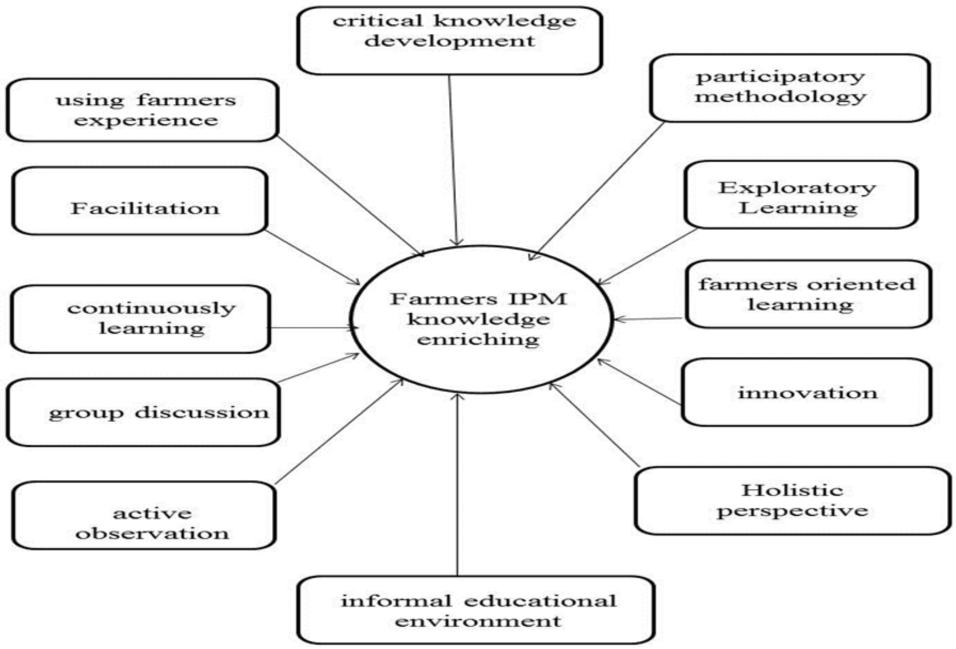

Figure 1. Useful factor for farmers IPM knowledge. (Source: Alimovahedi *et al*., 2012).

Mancini *et al* (2011) conducted research in India showed that lack of extension services increased pesticides application among farmers because they were having inadequate education regarding précised IPM application. Previous studies about role of extension services on farmers IPM adoption emphasized on four important notes:

- Agricultural extension services have effected on farmers IPM adoption by increasing IPM knowledge.
- IPM/FFS is used as main educational method for farmers.
- Although agricultural extension services can have improving function in IPM adoption by farmers but incomplete using of these services can reduce IPM adoption. Therefore, attention to other educational technology is necessary.
- IPM technology is considered as a sustainable agricultural technology which can reduce using of pesticides by farmers.

Therefore, determination and comparing agricultural extension services role on IPM adoption by pistachio growers and investigating factors affecting on that process were the main objective of this study.

MATERIAL AND METHODS

Kerman is the second broad Iran province where is located in middle of the country (Figure 2). Pistachio is the main agricultural production in Kerman province and it is the most important pistachio region in the world. According to Iranian Department of Agriculture Statistics there are around 6000 pistachio growers who have adopted IPM program in Kerman. They are distributed in four districts (Rafsanjan, Sirjan, Kerman and Bardsir). Sample group was selected as 306 pistachio growers by using Morgan Table sample size. Two-stage cluster sampling was used as sampling method (Figure 3).

Questionnaire was used for data collection. There were two parts in questionnaire. Part one was made for individual information collecting (Age, educational level, farm experience , farmers main job and farm land using, soil texture type and type of irrigation) and second part was included qualification of using extension services which those were divided to number of using advisory services in field, amount of participation in extension classes and workshop, studying of technical texts, watching educational movies, participation in asking and answering meeting and using mobile phone for agricultural advising (Table 1). Questionnaire face validity was evaluated by a panel of related experts and specialists. Ten open-ended questions were designed for better determinate of IPM adoption by pistachio growers as dependent variable which it was made of land size of applying IPM, using IPM time and number of IPM technology (yellow carts, mechanical control, pheromone traps, biological control).

Theoretical framework of this research has been shown in Figure 4. According to the assumption, individual factors such as age, educational level, farm experience, farmer's main job, orchard size, soil texture type and type of irrigation can affect on extension services using by farmers. Those services are contained: number of using advisory services in field, amount of participation in extension classes and workshops, studying educational texts, watching educational movies, participation in asking and answering meetings and using mobile phone for agricultural advising.

Figure 2. Research area.

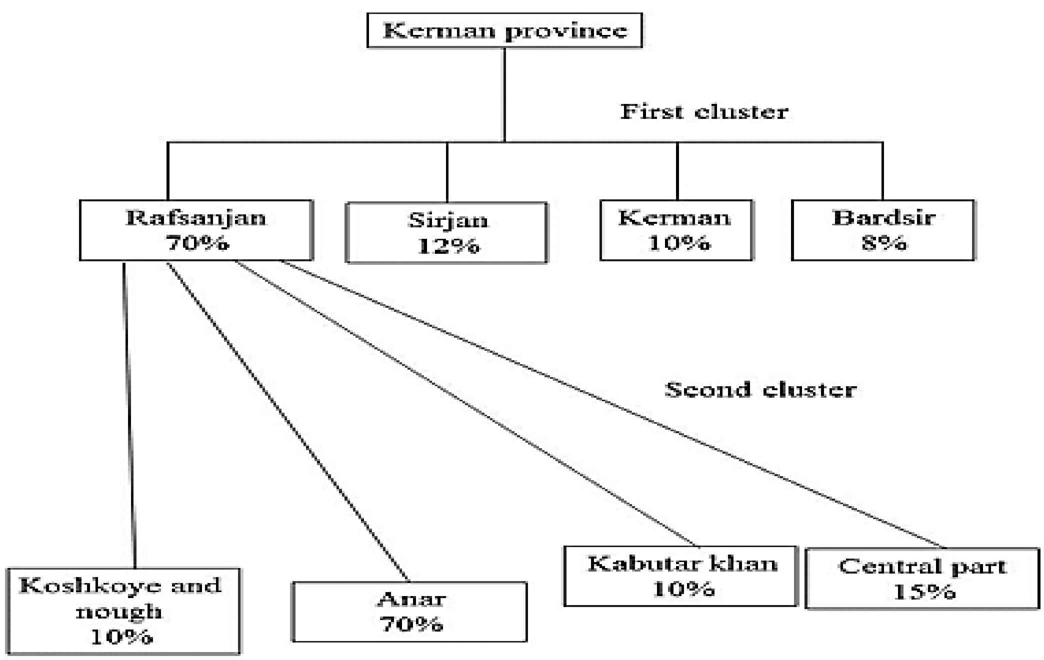

Figure 3. Two cluster sampling process.

Table 1. Questionnaire part making.

Part 1: individual information	Part2 : member of using extension services
• Age(years)	• Number of using advisory services in field
• Educational level (years)	• Participation in extension classes and workshops
• farm experience (years)	• Studying educational texts
• Farmer's main job (agriculture, others)	• Watching educational movies
• Farm size (Ha)	• Participation in asking and answering meetings
• Soil texture type (sandy , loamy, clay)	• using mobile phone for agricultural advising
• Type of irrigation (drip irrigation, surface irrigation)	

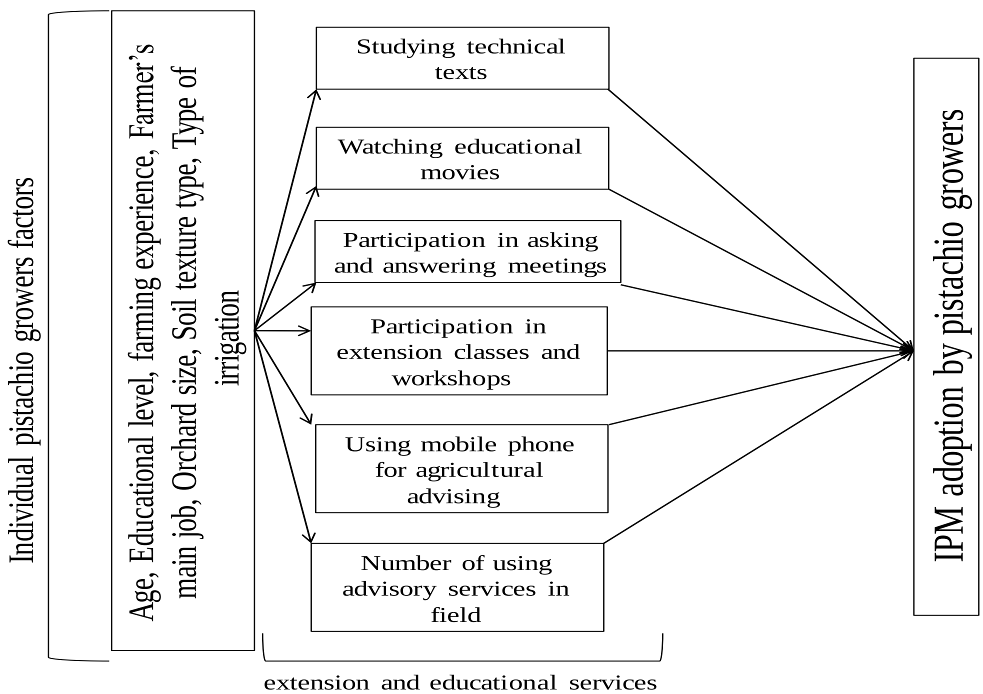

Figure4. Research theoretical framework.

RESULTS AND DISCUSSION

Pistachio grower's mean age appeared 45.55 years followed by average educational level of 8.76 years. Findings imply thatpistachio growers were having low education and this factor impeded new technology adoption. Pistachio grower's farm experience mean was 22.76 years. Their average orchard size was 3.22 hectare (Table 2). Agriculture was 88% of pistachio growers main job and 12% of them had other jobs. About 36% of pistachio growers had clay soil texture and 64% of them had soil texture with compound types.

Table 2.Individual variables means.

Variables	Mean	Max	Min	St.d
Age (year)	45.55	20	84	12.57
Educational level	8.76	0	16	4.05
Farm experience	22.76	7	50	12.57
Orchard size (Ha)	3.23	0.25	18	2.46

Source: research Finding

Only 10% of them have been used of drip irrigation that it is a threat for agricultural water resource at the future regarding recent drought threats. Average number of using advisory services in field was 2.62 per year. Mean of farmer's participation in extension classes and workshops was 1.23 per years and study technical texts mean was 0.4 which show using educational texts among pistachio growers is very low. Watching educational movies mean was 0.33 per year. Mean of participation in asking and answering meeting was 0.81 per year. Also, using mobile phone for agricultural advising mean was 2.33 per year. In addition, the number of using advisory services in field was the first and the most extension services which was used by pistachio growers and mobile phone for agricultural advising was the second service.

According to findings (Table 3), lack of studying technical texts by pistachio growers, Watching educational movies and participation in question and answering meetings can be attributed to low researches and support by extension services in Kerman province. Although, such result can not exactly show that extension services are weak to provide these three techniques in IPM diffusion for pistachio growers but to pay attention to these creative methods which can be useful for IPM technology adoption. Because, IPM is made of integrated methods so emphasis to more than one extension method is necessary. Mean of pistachio growers IPM adoption was 56.9 which shows adoption of this technology is in medium level of diffusion (Table 4, Chart 1). Anderson *et al*. (1996) described that IPM adoption happened to be on an average by farmers in the first five years. A research conducted in Indonesia explained that IPM adoption process caused to average adoption by farmers in first year (Smith *et al*.,1996). In addition, new agriculture technology frequently was adopted in middle level at the first by farmers because farmers prefer to use older technology being used from over the time and growers exert resistance to accept and adopt new technologies (Ahmadvand and Karami, 2008; Horne and Page,2008; Devine and Furlong, 2007; Orr,2003).

Table 3.Agricultural extension and education services variable means.

Variables	Mean	Max	Min
Using advisory services in field	2.62	12	0
Participation in extension classes and workshops	2.05	11	0
Studying technical texts	0.4	5	0
Watching educational movies	0.33	6	0
Participation in asking and answering meeting	0.81	12	0
Using mobile phone for agricultural advising	2.33	13	0

Source: Research Finding

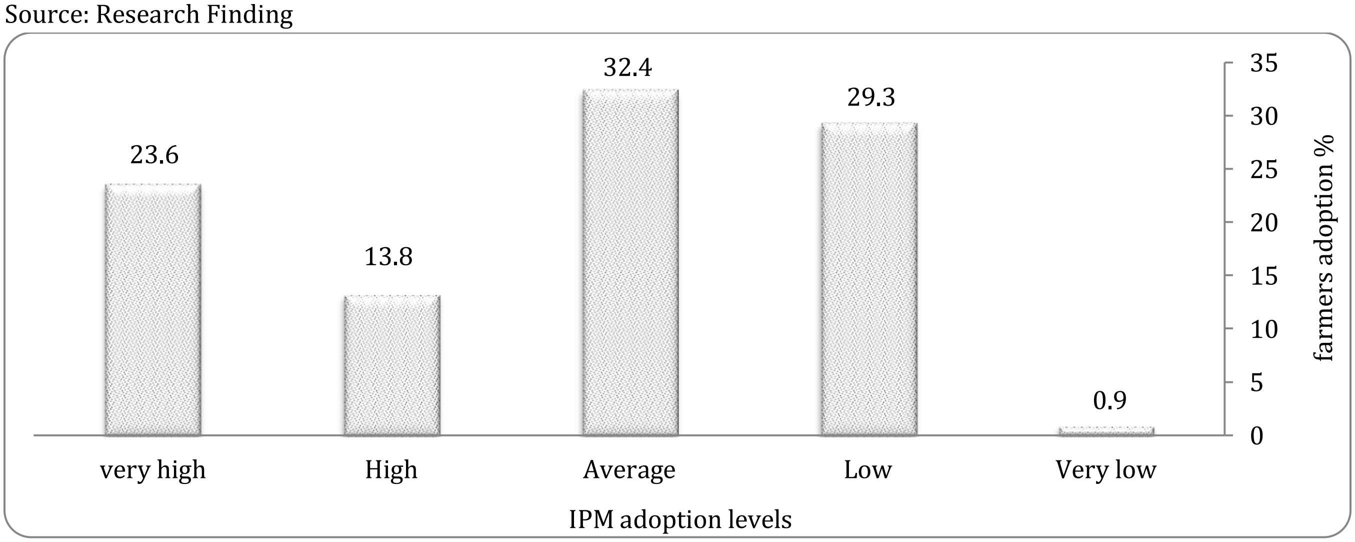

Chart 3. Distribution of pistachio grower's IPM adoption levels

First step: Investigating of relationship between individual factors with Agricultural extension and education services aspects: Pearson correlation analysis between individual factors showed that age have significant relationship with agricultural extension and education services aspects since that positive correlations between pistachio growers and studying technical texts, watching educational movies were obtained. Therefore, whatever pistachio growers age is or increasing, number of using educational texts and movies will increase, too.

Therefore, more educational texts and movies could be more attractive for older farmers and can have great educational function about IPM adoption.

Two negative relationship between age of pistachio growers with using advisory services in field and using mobile phone for agricultural advising which were found. Findings imply less usage of mobile by the old ages pistachio growers. Litsinger (1993) researches showed that applying new technology for more learning about IPM by younger farmers is more than others because many new educational technologies need academically education for using them. Also, there are no any relationship between age and participation in extension classes, workshops and participation in asking and answering meetings. Correlation coefficients between pistachio growers educational years with agricultural extension and education services aspects showed considerable positive relationship between educational level and using advisory services in field, participation in extension classes and workshops, using mobile phone for agricultural advising. Therefore, those pistachio growers who have higher educational level, have more benefited of advisory services in field, more participate in extension classes and workshops and more use of mobile phone for agricultural advising. Karami (1995) found that literacy is the most important factor for farmers who are participating in extension classes. Veisi (2008) found that farmers need improved literacy to gain successes in workshops which are provided for IPM diffusion by experts. Pistachio growers who have higher farm experience use more of movies for learning how applying IPM.

Finally, using mobile for IPM education was used mostly by those pistachio growers who had more land(Table 4).

Comparison means between pistachio growers' type of irrigation and using agricultural extension and educational services showed those pistachio growers who have used of drip irrigation, more use of extension services , Karami and Hayati (2010) found those farmers who have applied new technology in their agricultural production, more use of extension services as well (Chart 2).

Table 4. Pierson correlation coefficients between individual factors with agricultural extension and education aspects.

variables	using advisory services in field(r)	participation in extension classes and workshops(r)	studying technical texts(r)	watching educational movies(r)	participation in asking and answering meetings (r)	using mobile phone for agricultural advising(r)
Age(year)	-0.134*	There was no relationship	.0.124*	0.147*	There was no relationship	-0.145*
Educational level	0.366**	0.226**	There was no relationship	There was no relationship	There was no relationship	0.342**
Farming experience	There was no relationship	There was no relationship	There was no relationship	0.178**	There was no relationship	There was no relationship
Orchard size (Ha)	There was no relationship	There was no relationship	There was no relationship	There was no relationship	There was no relationship	0.122*

*.P<0.05 **.P<0.01 Source: Research finding.

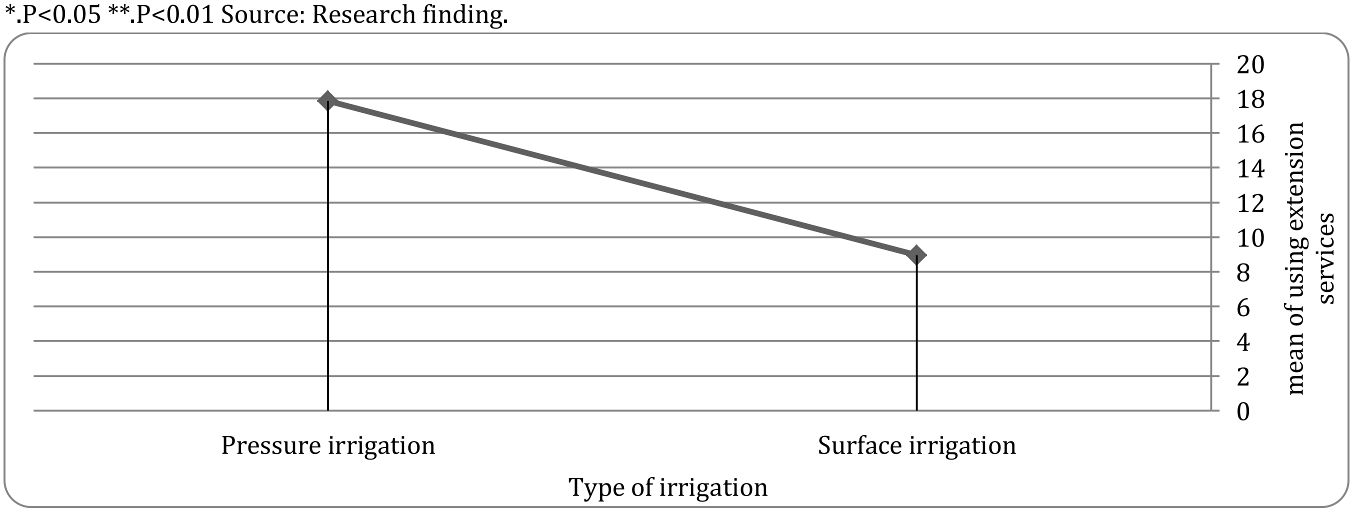

Chart 2. IPM adoption means comparison between two types of pistachio growers' type of irrigation.

Second step: Investigating of relationship between Agricultural extension and education services aspects, individual factors, and IPM adoption by pistachio growers: Pearson correlation coefficients revealed that amount of benefiting all agricultural extension and education services aspects have positive and direct correlation with IPM adoption (Table 5). In the other words, whatever pistachio growers have more used of extension services, IPM technologies have been more adopted by them. Cole and Horne (2006) in their study found that advisory services can be vital part of IPM educational program which have been presented by extension services and governmental support . Also, their research showed that advisory services in field can have more effect on farmers IPM adoption if that was used after first experimental IPM usage by farmers.

Second influencing aspect was using mobile phone for agricultural advising. Because, that technology has considerable positive correlation with IPM adoption. Mobile technology is used extremely by farmers recently, so this technology can has positive function about new technology adoption for example IPM by farmers. Padel (2001) found that new communication technologies such as mobile phone can increase farmers' participation toward IPM diffusion and emphasizing to using new communication devises which can be useful toward IPM adoption.

Participation in extension classes and workshops was the third influencing factor which had positive effect on IPM adoption. In fact, educational workshops can enhance farmers IPM operational knowledge (Kenmore 1997; Van den berg and Jigginz 2007; Feder and Savastano 2006; Orr 2003).

Participation in asking and answering meetings by pistachio growers has positive correlation with their IPM adoption and this aspect was selected as the fourth influencing factor. Many farmers share their IPM applying experience with others in condition that they attend in asking and answering meetings, actively (Kisha *et al*. 2005; Thijssen 2002; Braun *et al*. 2000; Povello and Deborah 2006). Although, watching educational movies by pistachio growers positively related with their IPM adoption but, this relationship correlation was lower than others extension services. A survey that was done on Indonesian farmers obtained that IPM educational movies effected on their IPM knowledge but whereas, the farmers mostly were in their farm lands, they had few time for watching such movies(Larsen *et al.* , 2002).

Studying technical texts was the last aspect because, it had weak positive correlation with IPM adoption. Lack of enough literacy level among farmers decreases their tendency toward reading technical texts. Also, lack of suitable extension publications which are designed for farmers conditions are the second major problem in many developing countries (Khan *et al*. 2006).

Table 5.Pearson correlation coefficients between agricultural extension and education aspects and IPM adoption by pistachio growers.

variables	(r)
Using advisory services in field	0.630**
Using mobile phone for agricultural advising	0.566**
Participation in extension classes and workshops	0.516**
Participation in asking and answering meetings	0.343**
Watching educational movies	0.200**
Studying technical texts	0.189**

*.P<0.05 **.P<0.01 Source: Research finding.

A stepwise multiple regression was used for better investigating agricultural extension and education services aspect effect on IPM adoption by pistachio growers and determination of those aspects ability to predict of pistachio growers IPM adoption. Regression findings revealed that four agricultural extension and education aspects (using advisory services in field, using mobile phone for agricultural advising, participation in extension classes and workshops, participation in asking and answering meetings) can predict 49.2% of IPM adoption variations. Whereas, number of using advisory services in field can predict about 40% of IPM adoption variations, it has considerable function in IPM adoption. Visible advisory services, which are provided by extension agents, is the best method because of many researches showed those farmers who have directly observed operational methods of IPM technology in field, have more tendency for IPM usage (Bartlett,2005).

Using mobile phone for agricultural advising as the second aspect can predict about 5.8% of variations toward pistachio growers IPM adoption. Mobile phone were used much by pistachio growers so using of this device for getting suitable advice from extension experts is a creative way. Also, easy access to other pistachio growers' experiences, made pistachio growers able to access better information toward IPM technology. Moreover, using mobile phone have been caused increasing farmers' participation for pest management in same time as one of the main precondition for integrated pest management (Orr,2003). Finally, participation in extension classes and workshops and participation in asking and answering meetings as third and fourth influencing aspects can predict 2.5 and 0.9% of IPM adoption, respectively (Table-6).

Table 5.step wise regression between agricultural extension and education aspects with IPM adoption by pistachio growers.

Independent variables		B	Se.B	Beta	Sig.t
Using advisory services in field		3.912	0.734	0.358	0.0001
Using mobile phone for agricultural advising		2.257	0.542	0.255	0.0001
Participation in extension classes and workshops		2.390	0.703	0.170	0.0001
Participation in asking and answering meetings		1.519	0.755	0.126	0.0001
Model	Step	Multiple R	R2	R2 adjust	R2 change
1	Using advisory services in field	0.632[a]	0.399	0.396	0.399
2	Using mobile phone for agricultural advising	0.676[b]	0.457	0.452	0.058
3	Participation in extension classes and workshops	0.695[c]	0.483	0.476	0.025
4	Participation in asking and answering meeting	0.701[d]	0.492	0.483	0.009

a. Predictors: (Constant), using advisory services in field
b. Predictors: (Constant), using advisory services in field, using mobile phone for agricultural advising
c. Predictors: (Constant), using advisory services in field, using mobile phone for agricultural, participation in extension classes and workshop
d. Predictors: (Constant), using advisory services in field, using mobile phone for agricultural, participation in extension classes and workshop, participation in asking and answering meeting

F=53.276 Constant=37.006

$$Y = 37.006 + 3.912x_1 + 2.257x_2 + 2.390x_3 + 1.519x_4$$

X1=using mobile phone for agricultural advising
X2=using mobile phone for agricultural advising
X3=participation in extension classes and workshop
X4=participation in asking and answering meeting

CONCLUSION AND RECOMMENDATIONS

According to research findings, we can conclude that pistachio growers' individual characteristics could affect on their behaviors toward using extensions services for IPM adoption. Age is one of them which has negative relation with using advisory services in field and using mobile phone for agricultural advising. Besides, their education level had constructive role toward their participation in field advisory services, using mobile technology and participation in classes and workshops. Those farmers who had more literacy could better engage to extension methods which were presented for enhancing IPM technology knowledge.

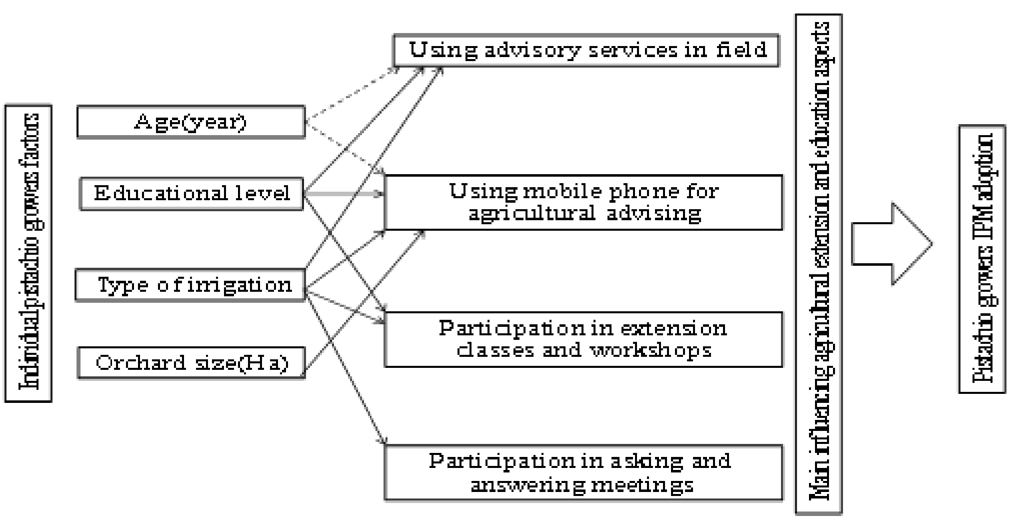

Figure5. Experiential model based on the research results.

Those Pistachio growers, who have used of new technologies such as drip irrigation, have more benefited of extension services. Also, they have preferred to more use of IPM technology. Moreover, those farmers who had more amount of orchard size, more used of mobile phone for advisory purposes. We can conclude those farmers who have larger orchard are in suitable production position in comparison to others and they have had more tendencies to use of new communication devices for advising.

Findings revealed four types of extension services which were presented to pistachio growers were important role toward IPM adoption. First and the most importantly, using advisory services in field; second, using mobile phone; third, pistachio growers' Participation in educational classes and workshops; and fourth, their participation in asking and answering meeting. In fact, IPM technology is an operational technology. Therefore, advisory services and other participatory methods such as workshops and asking and answering meetings, which are near FFS method, can be effective toward its adoption. The results have been presented in the shape of experiential model (Figure 5) which can be recommended for improving the rate of IPM technology adoption by pistachio growers.

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