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Factors Affecting Tomato Farmers' Tendency to Use Iran Good Agricultural Practices (Iran GAPs) in Ardabil Province

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Abstract

The implementation of Iran GAPs standards in tomato production can have a very important impact on reducing harmful contaminants to achieve a healthy and safe product. The present study investigates the factors affecting farmers' tendency to use Iran GAPs during tomato production operation in Ardabil province, Iran. So, based on Bartlett et al. (2001), 310 tomato farmers were selected from three counties of Parsabad, Kowsar, and Bilesvar using the multi-stage random sampling method. Iran GAPs standards were collected according to the list of standards of the National Standards Organization of Iran for tomatoes. The results show that the majority of farmers (61.3%) are at a low level of the tendency to apply Iran GAPs standards in the tomato production operation. In this regard, the activities of “using minimal chemical pesticides”, “using personal protective equipment”, and “not using empty cans and tanks of pesticides and fertilizers and their safe disposal” were among the last priorities for farmers. Also, the most important factors differentiating farmer groups are observability (0.271), GAPs training courses (0.269), complexity (0.219), farm size (0.198), and relative advantage (0.178), respectively. Establishing a marketing and sales unit in the agricultural centers of the studied counties, holding "farm day" programs and farmers' visits to successful farms, and creating a "Seed Bank" for tomatoes can increase the tendency of farmers to use Iran GAPs.

Keywords:
Ardabil province; healthy crop; Iran GAPs, tomato production operation

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INTRODUCTION

Today, increasing attention to food safety and crop health for consumers has posed major challenges to food production (Sookhtanlou & Allahyari, 2021). In developing countries, about one-third of the food produced is lost each year, and one of the most important reasons for food wastage is a decline in the production and availability of healthy, non-contaminated food (Rezaei et al., 2018). In fact, the existence of various food contaminants from the farm to the fork, such as microbial, parasitic, chemical, biological agents on the one hand and increasing the consumption of additives, antibiotics, toxins, heavy metals, pesticides, fertilizers, and hormones on the other, endangers the quantity, quality, health, and ultimately safety of food products (Sanjabi et al., 2020; Oo & Usami, 2020). Food safety is one of the most important factors in relation to public concerns related to food products that can harm consumer health and also reduce demand for the crop (Broke et al., 2014; Abedi Sarvestani & Avarand, 2019).

Enforcement of food safety rules is required in the entire process of production, preparation, transportation, and even consumption in order to further increase the quality characteristics of the final product due to its significant effects on consumer health (Sookhtanlou & Allahyari, 2021). This has led to the development of standards for the production of a healthy product, called Good Agricultural Practices (GAPs). GAPs cover all stages of crop production from field preparation and seed sowing to crop harvesting (Sanjabi et al., 2020). The use of GAPs encourages or compels manufacturers to set up a complete monitoring and control system. Therefore, the standard of GAPs is suitable for farmers who control and monitor the crop production process from preparation to harvest. The first and most important step in achieving food safety and healthy crop production in the form of GAPs is to pay attention to safe crop production at the farm level (Nayak et al., 2015; Ko, 2010). In other words, the most important and obvious role in the process of reducing or avoiding crop pollution depends on the behavior of farmers and their practices during crop growth at the farm level (Zhou et al., 2016; Scheinberg, 2013). However, farmers' poor knowledge and understanding of GAPs can seriously affect the production of a healthy crop (Hamerezaee et al., 2016). For example, in the study of Panahzadeh Parikhani et al. (2015), increasing knowledge and information by training courses and improving their attitudes and financial support to low-income farmers are found to be effective in using GAPs among farmers. They report that the lack of personal protective equipment at the production and harvest stages, low knowledge of GAPs, and farmers' poor educational levels have been among the most important obstacles to the use of GAPs among farmers.

Rogers (2003) argues that innovations that have more relative advantages, compatibility, trialability, and observability by the recipient and are less complex are more easily and quickly accepted than other innovations. Relative advantage is how much advantage an innovation brings for farmers over previous methods or existing methods and conditions (Rogers, 2003; Rodriguez et al., 2005). Complexity indicates the degree of difficulty and ambiguity in applying innovation in practice (Rodriguez et al., 2018; Marak et al., 2019). Compatibility shows the degree to which innovation adapts to the values, experiences, needs, and environmental conditions of users (Rogers, 2003; Oo & Usami, 2020). Observability indicates how tangible and visible the results of an innovation are to innovators and others (Rogers, 2003; Rodriguez et al., 2018). The trialability factor also means the extent to which an innovation is experienced on a smaller scale before it can be applied on a larger scale (Marak et al., 2019; Oo & Usami, 2020). In several studies, including Rodriguez et al. (2018) and Oo and Osami (2020), Rogers's theory of diffusion innovation has been used to determine farmers' tendency to use GAPs.

In Clements and Bihn (2019), the role of farmers' attitudes toward GAPs is emphasized in the greater effectiveness of training programs to use GAPs indicators. Oo and Osami (2020) showed that GAPs had a relative advantage and observability for Myanmar rice farmers. The variables of gender, farm size, agricultural income, and education were also found to be effective in the tendency to use GAPs. Therefore, several studies have emphasized the effect of age, level of education (Vu Thi et al., 2019; Nguyen, 2016; Loan et al., 2016), farm size, farm income (Annor et al., 2016; Loan et al., 2016), and the history of participating in training courses (Lippe & Grote, 2016) on the tendency of farmers to use GAPs. For instance, Hoang (2020), who studied VietGAP acceptance by Vietnamese livestock farmers, revealed that age, level of education, farm size, training, and farm income had an effect on the tendency to accept GAPs. According to Sanjabi et al. (2020), potato farmers in Kermanshah province are involved in poor agricultural operations (BAP) and are at an unfavorable level in terms of the use of Iran GAPs. But, among the standards of Iran GAPs used by farmers, soil conservation, proper irrigation, compliance with fertilization time, setting fertilizer and spraying equipment, timely harvest, and separation of soil and weeds from the crop were the priorities of farmers. Health facilities and occupational health and safety education are other standards that were found to be less observed in this area.

National GAPs standards, such as Myanmar GAPs, Mexico GAPs, Chile GAPs, and Kenya GAPs, which are implemented in different countries of the world, have a global GAPs origin and are mainly managed by private institutions without government participation (Amekawa et al., 2021; Van Der Valk & Van Der Roest, 2009). Special production and agricultural conditions in Iran have led to the development of Iran GAPs standards in line with the global GAPs to be more closely related to Iran's environmental, economic, and climatic conditions. Therefore, the implementation of Iran GAPs standards, as a solution to control the production process to the safe supply of agricultural products and food, can contribute to reducing physical, chemical, and microbiological contaminants and achieving the goal of food safety and security in the food chain (Sanjabi et al., 2020). Iran GAPs have been launched in some parts of Iran, including Ardabil province. Tomato (*Solanum lycopersicum* L.) is considered the most important crop in the group of vegetables in Ardabil province, whose cultivation process in the province has been growing steadily. Due to the growth of processing industries in this province and an increase in consumption, as well as the development of tomato exports, attention has been drawn to the production management of healthy crops as a special priority. But, concerns about the effects of pesticides on farmers' health and the environment have been growing in recent years. So far, no research has been conducted on tomato and farmers' capabilities to use Iran GAPs in Ardabil province. In particular, this study directly measures the use of GAP standards codified by the National Standards Organization of Iran among farmers and explains the most important variables affecting farmers' tendency to use Iran GAPs. Tomato is known as one of the important potentials of agricultural economy in Ardabil province for export. But, in this regard, the current standards for its production are far from the global GAPs standards. Therefore, while exploing priorities, this study examined technical and operational factors of farmers' tendency to use Iran GAPs. Obviously, the results can be an important step for more accurate planning in order to improve tomato production standards, enter global markets, and produce a healthier product.

METODOLOGY

Study area and sampling method

The total cultivated area of tomatoes is 5,550 hectares in Ardabil province, and the average tomato harvest is often about 45 tons per hectare. This study was conducted in

2021. The statistical population was composed of active tomato farmers in the province amounting to 1505 people. Based on Bartlett et al. (2001), the sample size was determined to be 310. Sampling was done by the multi-stage sampling method in three satges (Sookhtanlou & Allahyari, 2021). In the first stage in Ardabil province, counties were selected for tomato cultivation. Thus, *Parsabad, Kowsar,* and *Bilesvar,* which had the highest tomato production rates (95% of the total tomato cultivation in the province), were selected out of all tomato-producing counties in the province (Figure 1). In the second stage, 14 villages (seven villages in *Parsabad* County, four in *Kowsar* County, and three in *Bilesvar* County) were randomly selected among the counties in proportion to their farmer populations. Finally, in the third stage, final respondents were randomly selected from the villages (165 farmers from *Parsabad*, 82 from *Kowsar*, and 63 from *Bilesvar*) for which random numbers were generated based the list provided by the Agricultural Jihad Organizations and the sampling was performed.

The research instrument

The research instrument was a structured questionnaire that consisted of three main parts. The first part was related to the individual and economic characteristics of farmers (age, gender, level of education, agricultural experience in tomato cultivation, farm size, average annual income and off-farm income, and yield per hectare). The second part included items to measure the attitude and participation in training courses related to GAPs and 23 standards obtained at the tomato production operation according to the standards of the Iranian National Standardization Organization (2013) in the tomato production operation stage. The third part assesses the five characteristics of farmers' willingness to use Iran GAPs, including relative advantage (8 items), compatibility (7 items), complexity (10 items), trialability (7 items), and observability (6 items). The items for the measurement of the main research variables are prepared in a special order and equal weights on a five-point Likert scale (from 1 = very low to 5 = very high). More details of the questionnaire variables, the number of items, and how to measure the variables are presented in Table 1.

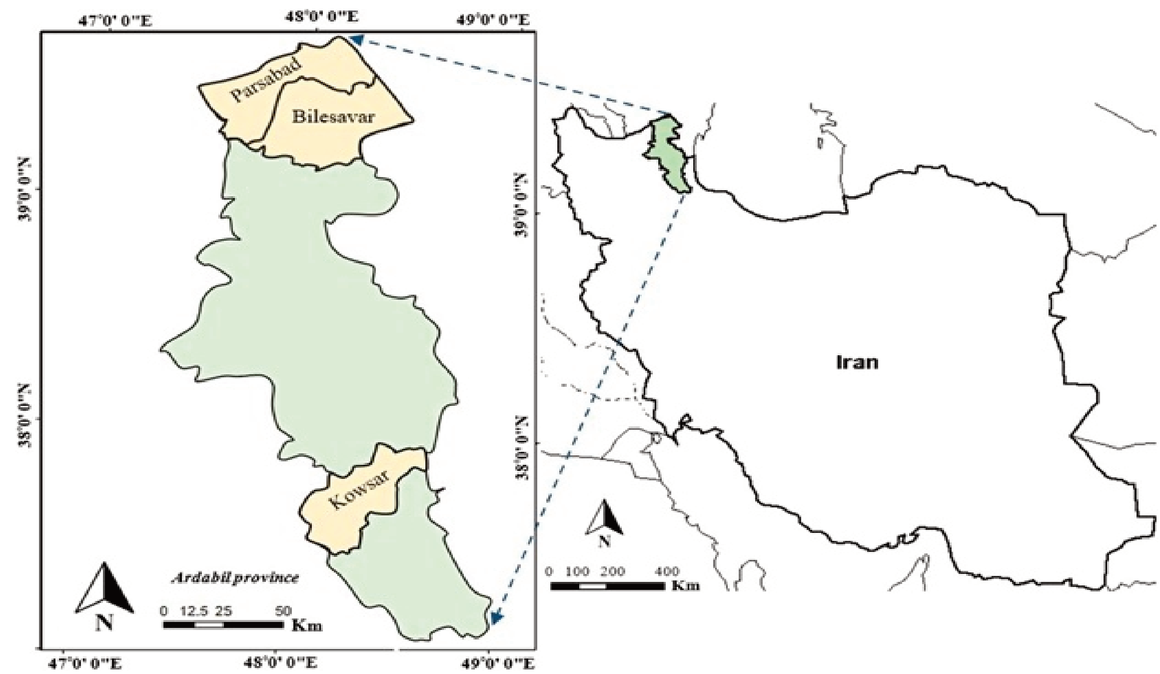

Figure 1. Map of study areas

Table 1
Summary of the Determinant Variables in Applying Iran Gaps

Variables	Number of items	Explanation
Age (years)	1	Age of each tomato farmer: Open-ended question
Experience of farming (years)	1	Experience of farmers in tomato cultivation: Open-ended question
Level of education (years)	2	Number of years of formal education: Open-ended question
Annual farm income (million IRR*)	1	Average annual income of farmers from agricultural activities: Open-ended question
Farm size (ha)	1	Total area of farmland: Open-ended question
GAPs training courses	1	The number of hours that the tomato farmer has participated in training courses related to GAPs: Open-ended question
Attitude towards GAPs	9	The variable in nine items (on a Likert scale from 1 = very low to 5: very high) was asked about the attitude of farmers towards the environmental, economic, and agricultural importance of applying GAPs in tomato production activities.
Relative advantage	8	The variable in eight items (on a Likert scale from 1 = very low to 5: very high) was asked about the benefits that may be created by applying Iran GAPs.
Compatibility	7	The variable in seven items (on a Likert scale from 1 = very low to 5: very high) was asked about the environmental and agricultural compatibilities involved in applying Iran GAPs standards.
Complexity	10	The variable in ten items (on a Likert scale from 1 = very low to 5: very high) was asked about the complexities involved in applying Iran GAPs standards.
Trialability	7	The variable in seven items (on a Likert scale from 1 = very low to 5: very high) was asked about the ability to test Iran GAPs standards on the farm, before using them comprehensively.
Observability	6	The variable in six items (on a Likert scale from 1 = very low to 5: very high) was asked about the visibility of the results of applying Iran GAPs standards in the production process.

*1 US dollar ≈ 250,000 Iranian Rials (IRR) in 2021

The validity of the research instrument was confirmed based on the review and application of collective opinions of faculty members in the fields of agriculture at Mohaghegh Ardabili University and Agricultural jihad experts of *Parsabad*, *Kowsar*, and *Bilesvar* counties. The reliability of the research instrument was acceptable as Cronbach's alpha was calculated to be >0.7 for the main variables. The k-means cluster method was used to group farmers in terms of the use of Iran GAPs (Davari Farid et al., 2018). Also, a diagnostic analysis method was employed to identify and explain the variables that determine farmers' tendency to use Iran GAPs.

RESULTS AND DISCUSSION

The research findings showed that all respondents were male. The average age of the respondents was 40.71 years. The highest frequency of farmers (31.3%) was 31 to 40 years. In addition, their predominant level of education was at the diploma level (54.2%). Most of the respondents (34.7%) had less than 5 years of agricultural experience (tomato cultivation) and the average agricultural experience was 10.5 years. The average annual income from agriculture was 1122.774 million IRR while the majority of farmers (31.3%) earned less than 500 million IRR per year from agriculture. The average off-farm income (annual) was 193.644 million IRR and most farmers' off-farm income (31.6%) was less than 150 million IRR. The average yield of tomatoes was 49.98 tons per hectare. In terms of ownership of agricultural machinery, most farmers (38.4%) owned at least one machine. In addition, the farm area of most farmers (45.8%) was less than 3.5 hectares and the average participation of farmers in GAPs-related training courses was 2.98 hours.

According to the research findings (Table 2), planting and seedling activities at the right time, observing the crop rotation of tomatoes with other crops in the field, and adjusting seeding rate with local experts' recommendations were the first to third priorities of tomato farmers. Meanwhile, the activities of using chemical pesticides to control pests and diseases minimally, using personal protective equipment of farmworkers or farmers in accordance with the standard instructions of health and safety at the planting stage, and not using empty cans and tanks of pesticides and fertilizers and their safe disposal were among the last priorities of farmers. Therefore, according to the results of Sanjabi et al.

Table 2

Ranking of the Application of Gaps Standards

Items	Mean	SD	Rank
At the right time, seeds or seedlings are planted.	3.522	1.246	1
Tomato crop rotation with other crops in the field is observed.	3.213	1.218	2
The seeding rate is adjusted based on the recommendations of local experts.	3.193	1.323	3
Seedlings or seeds that are free of any visible signs of pests or diseases are used.	3.005	1.496	4
Fertilizers are not stored with chemical pesticides and in humid environments.	2.912	1.460	5
Continuous assessment is performed for the possibility of environmental hazards and review of environmental-agricultural records at the tomato planting site.	2.701	1.383	6
The amount of fertilizer required and the appropriate time of fertilization is determined based on the recommendations of experts and periodic soil tests.	2.657	1.273	7
Only well-composted organic fertilizers are used in tomato fields.	2.508	1.423	8
Tillage is done as a protected operation (such as plowing) in the field.	2.490	1.134	9
Crop operations are carried out to minimize soil erosion (such as crop operations perpendicular to the slope of the land, preservation of plant debris, etc.).	2.371	1.436	10
Irrigation is based on pressurized irrigation methods and according to the water requirements of the plant.	2.352	1.138	11
Mechanized fertilizer application is done using standard and adjusted fertilizers.	2.206	1.289	12
Pest and disease-resistant cultivars are used according to the conditions of the region.	2.183	1.297	13
Certified seeds or completely healthy seedlings are used.	2.170	1.380	14
Soil is disinfected before planting the tomato crop.	2.063	1.220	15
Human wastes and sewage are not applied to tomato fields.	1.623	1.415	16
The type and rate of pesticides are determined according to the recommendations of experts and a complete analysis of tomatoes.	1.581	1.361	17
Personal protective equipment is kept separate from fertilizers and pesticides.	1.431	1.332	18
Pesticides and fertilizer spraying devices are calibrated and disinfected annually.	1.212	1.391	19
Chemical pesticides that are less toxic (for the environment and humans) are put in priority.	1.176	1.396	20
The minimum amount of chemical pesticides is used for pest and disease control.	0.890	1.039	21
Farmworkers or farmers at the stage of planting and holding and use of chemical inputs are equipped with safety equipment in accordance with standard health and safety instructions.	0.689	1.042	22
Empty cans and tanks of pesticides and fertilizers are not reused and are disposed of safely.	0.512	1.107	23

Scale: 1- Very low, 2- Low, 3- Medium, 4- High, 5- Very high

(2020), the study findings showed that the activities related to safety behavior in the use of chemical pesticides were the last priorities of farmers regarding their tendency to apply Iran GAPs.

According to the ranking of five characteristics in the tendency of farmers to use Iran GAP, the results in Table 3 indicate that in terms of relative advantage, the item "using GAPs reduces crop costs" was ranked first, and the item "crop production according to GAPs standards increases customers and improves the sales market" was ranked last. For compatibility, the item "implementation of GAPs standards is compatible with the financial capacity of farmers" was put in the first rank and the item "implementation of GAPs standards is compatible with the water and climate conditions of the region" was put in the last rank. In addition, for the complexity, trialability, and observability, the items "implementation of GAPs standards requires different planning", "tomato cultivation according to GAPs standards is possible on a small area of the farm" and "it is possible to observe rapid control of diseases and weeds by using the GAPs standard" were placed in the first rank, respectively while, the items "access to healthy seeds and desirable tomato cultivars", "control of tomato pests and diseases by GAPs standards is possible in small farms" and "increased sales and more favorable marketing can be seen by applying GAPs standards" were ranked last, respectively. According to Oo and Usami (2020), farmers do not have a favorable perception of improving the sales market, customer acquisition, and marketing during the process of applying Iran GAPs standards. They are also skeptical about preparing healthy seeds and cultivars for tomato cultivation and the possibility of implementing Iran GAPs standards in a wider area of the farm.

The values in Table 4 show the significant level of k-means cluster grouping based on the use of Iran GAPs by farmers. Since this value is very small (p<0.001), the assumption that clusters are the same is rejected (Davari Farid et al., 2018). In other words, three different clusters are obtained. According to the results, tomato farmers are divided into three groups with high (17.4%), medium (21.3%), and low (61.3%) levels of using Iran GAPs standards in the tomato production stage. Farmers with a low level of using Iran GAPs standards are most abundant. Therefore, according to Sanjabi et al. (2020), the results showed that the majority of farmers (61.3%) had a low level of tendency to use Iran GAPs standards in the tomato production stage.

To determine the differentiating variables of agricultural groups in the rate of using Iran GAPs, tomato farmers (according to the k-means cluster) were divided into three groups including (1) low rate, (2) medium rate, and (3) high rate. To explain the differentiating variables of these three groups in the use of Iran GAPs, 15 main research variables were entered into the analysis process. Wilkes's lambda test was performed to determine the significance and fit of the analysis. According to the results of Wilkes's lambda test (p<0.01; 0.787), the first diagnostic function can significantly identify the three groups of farmers acceptably and desirably. In another part of the findings, the canonical correlation, Chi-square, and percentage of variance were 0.458, 35.918, and 71.20, respectively, indicating acceptable discriminating power for analysis (Nadaf Fahmideh et al., 2017). According to the results in Table 5, among the 15 variables included in the diagnostic analysis, 10 variables distinguishing the three groups of farmers were significant. The three groups of farmers were distinguished by the variables of age, education, farm size, GAPs training courses, attitude towards GAPs, relative advantage, complexity, trialability, and observability at the p <0.01 level and by the variable of compatibility at the p <0.05 level. According to the data obtained in the structure matrix, the strongest distinguishing variables of the three groups of farmers included observability (0.271), GAPs training courses (0.269), complexity (0.219), farm size (0.198), and relative ad-

Table 3

Ranking of Components of Using Iran Gaps among Farmers

Features	Items	Mean	SD	Rank
Relative advantage	The use of GAPs reduces agricultural costs.	3.196	0.776	1
	The use of GAPs increases crop income.	2.989	0.654	2
	The use of GAPs improves the control of diseases and pests.	2.227	0.771	3
	The use of GAPs enhances the efficient use of water.	2.096	0.797	4
	The use of GAPs reduces soil erosion and improves tillage.	1.845	0.935	5
	The use of GAPs allows for the optimal use of fertilizers and pesticides.	1.386	0.845	6
	The use of GAPs improves crop quality and health.	0.357	0.664	7
	Crop production by GAPs standards increases the number of customers and improves the sales market.	0.183	0.539	8
Compatibility	The implementation of GAPs standards is compatible with the financial capacity of farmers.	3.812	0.423	1
	Implementation of GAPs standards is compatible with safety equipment and machinery available to the farmer.	3.594	0.434	2
	Implementation of GAPs standards is compatible with the skills and experience of the farmer.	3.145	0.945	3
	The implementation of GAPs standards is compatible with the farmer's knowledge and information level.	3.066	0.835	4
	Implementation of GAPs standards is compatible with farm conditions and farm soil.	2.856	0.844	5
	Implementation of GAPs standards is compatible with increasing product sales and marketing.	1.905	1.054	6
	The implementation of GAPs standards is compatible with regional water and climate conditions.	0.981	0.932	7
Complexity	Implementation of GAPs standards requires different and varied planning.	3.337	1.186	1
	Implementing GAPs requires a great deal of uncertainty.	3.325	1.143	2
	The use of GAPs requires different and complex equipment.	3.831	0.741	3
	Using GAPs requires special experience and skills.	2.736	0.918	4
	Using GAPs requires a lot of knowledge.	1.961	1.382	5
	Tillage and farm management operations are complex according to GAPs standards.	1.664	0.863	6
	The use of machinery and labor is complex according to GAPs standards.	1.466	0.857	7
	Fertilizer and pesticide use management is complex according to GAPs standards.	1.132	0.349	8
	Water consumption management is complex according to GAPs standards.	1.020	0.215	9
	It is difficult to prepare or produce healthy seeds and desirable tomato cultivars.	0.946	0.106	10
Trialability	Tomato cultivation by GAPs standards is possible in small farms.	4.211	0.554	1
	It is possible to compare tillage and water management methods (conventional cultivation method and GAPs method) in small farms.	3.691	0.690	2
	It is possible to compare the yield of two types of tomatoes (by conventional cultivation method and according to GAPs standards) in a small area of the field.	3.309	0.787	3
	It is possible to compare the quality of two types of tomatoes (conventional cultivation method and GAPs method) in a small area of the field.	3.150	0.579	4
	Analyses and tests can be performed according to GAPs standards on soil and water.	2.797	0.765	5
	It is possible to compare sales and marketing for two types of tomatoes (conventional cultivation method and based on GAPs standards).	1.944	0.576	6
	Control of tomato pests and diseases by GAPs standards is possible in small farms.	0.886	0.712	7
Observability	Quick observation of diseases and weeds is possible by using the standard GAPs.	4.689	0.565	1
	It is possible to see the production of a healthier and fresher tomato crop.	4.192	0.619	2
	It is possible to see an increase in tomato yield.	3.797	0.856	3
	Soil and water quality can be improved by applying GAPs standards.	2.973	0.895	4
	It is possible to improve the appearance quality of the tomato crop.	2.450	0.763	5
	Increased sales and more favorable marketing can be achieved by applying GAPs standards.	2.389	0.754	6

Scale: 1- Very low, 2- Low, 3- Medium, 4- High, 5- Very high

Table 4

Farmers' Grouping Based on the Application of Iran Gaps in Tomato Production Activities

Groups	Frequency	Percent	Cumulative percent
Low	190	61.3	61.3
Moderate	66	21.3	82.6
High	54	17.4	100.0
Total	310	100	-

Mean Square (Cluster)= 34971.114; F=1.442; Sig.=0.000

vantages (0.178), respectively. In addition, the prediction percentage of the groups in this analysis was equal to 69.7 percent (Table 5). Therefore, according to other researchers, such as Oo and Usami (2020) and Rodriguez et al. (2017), the variables of observability and relative advantage were determined as the most important differentiating variables of the three groups of farmers based on the tendency to use Iran GAP. Also, according to Oo and Osami (2020) and Huang (2020), farm size affects the tendency to use Iran GAP by farmers and is necessary in planning to implement Iran GAP in crop production, so priority should be given to small-scale farmers. In addition, according to Clements and Bihn (2019), Rodriguez et al. (2017), and Lippe and Grote (2016), participating in training courses on GAPs and the complexity of applying Iran GAP standards are very effective in increasing the tendency to use Iran GAP by farmers.

CONCLUSION

This study sought to investigate the factors affecting the tendency of farmers to use Iran GAPs in the tomato production operation. The results showed that the majority of farmers have a low level of the tendency to use of Iran GAPs standards in the tomato production stage. Also, activities related to safety behavior in the use of chemical pesticides were the last priorities of farmers regarding their tendency to apply Iran GAPs. Therefore, it seems that holding training courses on improving the safety behavior of farmers and providing personal protective equipment with the help of government subsidies should be considered the first steps by agricultural planners in the region to increase the desire to use Iran GAPs among farmers. Considering the importance of the variables of observability and relative advantage on increasing the tendency to use Iran GAPs, and the results as to the priority of these two variables, it seems that the establishment of a unit in the agricultural jihad centers of the studied counties for optimal interaction with the product sales market and better marketing and sales management for products obtained from Iran GAPs can increase the observability and relative advantage of farmers and ultimately, enhance their tendency to use Iran GAPs. Also, the use of placards and brochures, holding "Farm Day" programs, establishment of financial support funds for farmers, and farmers' visits to successful farms in compliance with Iran GAPs standards will increase the tendency to use Iran GAPs among farmers. Also, we found that farm size affects the tendency to use Iran GAPs among farmers and is necessary in planning to implement Iran GAPs in crop production in which priority should be given to small-scale farmers. In addition, participating in training courses on GAPs and the complexity variable in applying Iran GAPs standards is very effective in increasing the tendency to use Iran GAPs among farmers. In this regard, it is suggested that in addition to increasing training courses on GAPs, educational content that can explain how to implement Iran GAPs standards in a simpler language be prioritized. The use of local language and skilled farmers in training

Table 5
Result of Tests of Group Means Equality, Canonical Discriminant Function Coefficients

Independent variables	Wilks' Lambda	F	*p*-value	Standardcoefficient	Structurematrix
Age	0.896	17.772	0.000	-0.168	-0.097
Level of education	0.960	6.317	0.002	-0.105	0.079
Experience in agriculture	0.993	1.119	0.328	0.314	0.018
Farm size	0.944	9.053	0.000	0.297	0.198
Crop performance	0.985	2.383	0.094	0.138	0.013
Number of agricultural machineries	0.996	0.586	0.557	-0.009	-0.005
Farm income	0.988	1.798	0.167	0.109	0.003
Off-farm income	0.993	1.103	0.333	-0.253	-0.009
GAPs training courses	0.885	19.888	0.000	0.148	0.269
Attitude towards GAP	0.947	8.603	0.000	0.162	0.096
Relative advantage	0.958	6.811	0.001	-0.052	0.178
Compatibility	0.973	4.275	0.015	-0.261	0.071
Complexity	0.916	14.161	0.000	0.200	0.219
Trialability	0.964	5.687	0.004	-0.039	0.076
Observability	0.849	27.278	0.000	0.874	0.271

Eigen value = 0.266; Canonical correlation = 0.458; Wilks' Lambda = 0.787 and P-value: 0.000; Chi-square: 35.918 and df: 30; % of variance = 71.2069.7% of original grouped cases correctly classified.

courses can increase the effectiveness of these courses even more. Also, since the difficulty of preparing or producing healthy seeds and desirable tomato cultivars was the last priority of farmers in the complexity variable, it is suggested that by creating a “Seed Bank” about seeds approved by Iran GAPs standards, farmers can be provided with more access to healthy seeds and desirable tomato cultivars. One of the limitations of the research is that due to a wide range of standards for the use of Iran GAPs in tomato production, this research is limited to the standards introduced for the tomato production operation. It is, therefore, to focus on other Iran GAPs standards at various stages of crop cultivation in future research.

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CONFLICT OF INTEREST

The authors have not declared any conflict of interest.

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