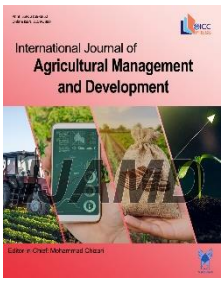

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A Comparison of Healthy Crop Cultivation Behavior based on Demographic Variables (Case Study: Rural Beneficiaries in Kermanshah Province in Iran)

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Abstract

As the world's population grows, food supply for the human community faces severe constraints, making farmers use chemical pesticides for two goals: first, to increase their production, and second, to fight against plant pests. Using toxins and chemical fertilizers has put people at a greater risk. Safe crop cultivation is a way to cope with this problem. In the present study, researchers compare the cultivation behavior of healthy crops based on demographic variables. This research was a quantitative, ex-post facto (causal-comparative research), and non-experimental study whose statistical population consisted of 80,304 rural stakeholders in Kermanshah province, out of whom 385 people were selected as the sample. Because of the dispersion of the statistical population, 400 questionnaires were distributed through multi-stage cluster sampling among the users. The results showed a significant difference between the mean scores of the stakeholders' behaviors regarding the cultivation of healthy products in Kermanshah province based on the variables of participation in educational and extension classes, role models, age, work experience, educational level, and monthly income. Only marital and gender variables were not significantly different. Success can be achieved by holding extension classes in this field, introducing exemplary and successful farmers as role models, and giving financial rewards to them. The government and the Agricultural Extension and Education Organization play a significant role in achieving this goal.

Keywords: behavioural comparison; demographic variables; healthy crop cultivation; Kermanshah Province; organic farming

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INTRODUCTION

Healthy crop farming is one of the sustainable agricultural strategies (Din Panah and Akhavan, 2014) which relies on natural methods of pest and disease control and in which the use of synthetic pesticides and herbicides, chemical fertilizers, hormones, and antibiotics is prohibited as much as possible (Keshavarz and Mosavi, 2018; Khosravi et al., 2022). Healthy farming is considered one of the most essential alternative farming systems to produce healthy crops without chemicals (Jazayeri et al., 2023; Pirozeh et al., 2022; Dadashi et al., 2017). Official statistics and calculations provided by researchers on Iran's natural resources and environment are very disappointing (Rasoli and Taheryfar, 2015). Iran ranks second in terms of the rate of erosion and destruction of fertile arable lands and natural resources after Australia. The rate of

soil destruction and erosion is 33 tons per hectare, one of the main reasons for which is the overuse of fertilizers and chemical pesticides in the agricultural sector (Rasoli and Taheryfar, 2015; Pirozeh et al, 2023). Like other innovations, the cultivation of healthy crops depends on a wide range of individual, social, economic, and cultural factors (Negahdari et al., 2023; Pannell et al., 2006). A healthy crop in the *Implementing Regulations of Article B (61)* of the *Fourth Development Plan Act* in Iran is said to be a crop that is free of toxic and pollutant elements or compounds or produced with the maximum permissible residue. By this definition, a healthy crop can be said to be the product of organic production which is free of toxic and pollutant elements and compounds, or the poisonous elements and compounds present in the crop do not exceed the maximum permitted. Healthy crop cultivation behavior is a growing global trend that encourages policies to treat land properly. In conventional farming, fertilizers are used in large quantities, regardless of the results, contaminants, and toxins produced, leading to many problems (Pourjavid et al., 2020; Chakrabarty et al., 2014), including the accumulation of more than 2 million tons of toxins in the ecosystem annually (PAN, 2009). Polluted crops adversely affect the environment and human health, including both farmers and consumers (Costa et al., 2014). The land use policy aims to reduce the application of fertilizers and poisoning (Owens et al., 2010). To achieve this goal, farmers must be encouraged to cultivate healthy and organic crops (Yanakittkul and Aungvaravong, 2017).

The tendency toward organic crops is increasing at an annual rate of as high as 20-30%, mostly in the EU, US, and Japan, so that in 2013, organic crop revenues amounted to 72 billion dollars (IFOAM, 2017). Various factors are involved in the acceptance of healthy crop cultivation behavior. In this study, we compared the cultivation behavior of healthy crops based on demographic variables. In other words, the research aimed to answer the question as to whether there was a significant difference in different aspects of demographic factors in accepting healthy crop cultivation behavior.

In a study on the willingness and behavior of farmers to apply integrated pest management (IPM) using the extended theory of planned behavior, Molaee et al. (2015) revealed a significant and positive relationship between the number of IPM training sessions and behavior. In an attempt to explore the factors underpinning farmers' attitudes toward organic cultivation, Ghadimi et al. (2012) concluded that attending organic farming and education classes positively affects farmers' attitudes, thereby promoting a positive attitude and accepting crop production. Motiey Langrodi & Khorasani (2010) studied opportunities and threats of healthy crop production in Iran and reported that lack of knowledge of healthy crop production management systems, land fragmentation, low income, and weak governmental support were the weaknesses in healthy product production. Sikandar Azam and Banumathi (2015), who studied the role of demographic factors in organic farming acceptance using the logistic model, concluded that education, age, and gender had a positive role in the acceptance of organic farming by farmers, whereas land ownership and family size had no significant effect on the dependent variable. Hoseini and Ajoudani (2012) focused on factors affecting organic farming adoption and showed that economic and education-promoting factors accounted for up to 31% of respondents' acceptance, but there was no significant relationship between technical factors and acceptance. Okoedo-Okojie and Aphunu (2011) showed that despite farmers' poor knowledge of plant nutrition, the acceptance and application of fertilizers were at a high level. However, admission was affected by lack of access to fertilizer, costs, lack of capital, and more. On the other hand, access to credit facilities, increased contact with the extension system, training, and practical demonstration of plant nutrition technologies were needed to improve and change the situation in fertilizer application.

Zhou et al. (2010), who explored factors influencing farmers' decision on fertilizer in a case study in North China, showed that it positively impacted reducing fertilizer use. Strong friendly and intimate relationships can improve access to unique information. Oladipo et al. (2009) state that the role of farmers' production experience in fertilizer use cannot be accurately talked about, but some older and more experienced farmers may feel that more extensive fertilization has adverse effects on environmental quality. Therefore, they tend to use green manure or fertilizer in accordance with scientific principles (Zhang and Jiang, 2009). In a study on female farmers' attitudes toward sustainable land management practices in Southwest Nigeria, Fakoya et al. (2007) concluded that age was essential in influencing fertilizer use decisions. Younger farmers were more inclined to reduce environmental pollution and use organic fertilizers.

Adesina and Zinnah (1993) adopted the Torbit model to explore technological indicators, farmers' viewpoints, and decision-making in Sierra Leone and found that young farmers were more inclined to sustainable farming, considering the optimal use of fertilizers and pesticides. In his study of cultivation in the African forests, Kerhoft (1990) found that the environment (ecological area) of income, age, and level of education had a significant impact on the decision to grow organic crops.

Accordingly, we aimed to compare the cultivation behavior of healthy crops based on demographic variables to answer this question: Which demographic variables have a significant relationship with healthy crop cultivation behavior?

METHODOLOGY

The research, which was a quantitative, ex-post facto (causal-comparative), non-experimental, and applied study in methodology and purpose, was carried out in the rural areas of Kermanshah province, Iran. The research instrument was a researcher-made questionnaire with Likert spectrum options whose validity was confirmed by a panel of experts and whose reliability was confirmed by Cronbach's alpha, which was estimated at 0.77. The data were analyzed by the SPSS19 software package. The statistical population included rural beneficiaries in Kermanshah province, amounting to 80303 people. The sample size was determined at 385 by using Cochran's formula. Due to the population size and the irreversibility of the questionnaire, 400 questionnaires were distributed among farmers in Kermanshah province using multi-stage cluster sampling (Table 1).

The normality of the behavioral component was evaluated using the Kolomogorov-Smirnov test (Table 2). Then, the difference between the mean of the dependent variable of the research about the behavior of the farmers regarding the cultivation of healthy crops based on demographic variables was examined by the comparison of means.

RESULTS AND DISCUSSION

According to the results, the mean age of the users was 31.72, with a standard deviation of 11.39 years. It was found that 299 (75.3%) of the farmers were male, and only 24.7% were females. Also, 33.7% of the surveyed farmers with the highest frequency earned between three and four million per month, and 1.6% reported that their revenues were more than five million per month. Based on the findings, 25.6% of the studied farmers had a diploma, which was the most abundant, whereas only 4 (1%) were illiterate. In addition, 310 people (78.9%) had not participated in training programs on the cultivation of healthy crops (e.g., organic crops). However, only 21.1% (83) had attended such training courses.

The results in Table 2 support the research hypothesis regarding the non-normality of the distribution of data on behavioral variables among the villagers of Kermanshah province. Therefore, nonparametric tests (Mann-Whitney and Kruskal-Wallis) were used to compare the average behavior of farmers in cultivating healthy crops based on their individual and professional characteristics.

For this purpose, the Mann-Whitney nonparametric test was used to compare the behavior of farmers based on gender, marital status, participation in training-extension courses, and role modeling. In addition, the Kruskal-Wallis nonparametric test was used to compare the behavior of farmers regarding the cultivation of healthy crops based on variables of age, work background, education level, and monthly income. Table 3, shows a comparison of the behavior of the villagers based on gender.

The results in Table 3 indicate no statistically significant difference between the mean scores of farmers' behavior regarding the cultivation of healthy crops in Kermanshah province based on gender. In other words, it can be stated that there is no statistically significant difference between the behavior of women and men in Kermanshah province regarding the cultivation of healthy crops. Table 4 shows the comparison of the behavior of rural farmers based on marital status variables.

Table 4 reveals no statistically significant difference between the mean scores of the farmers' behavior regarding the cultivation of healthy crops in Kermanshah province based on marital status. So, it can be stated that there is no statistically significant difference between the behavior of married and single farmers in Kermanshah province regarding the cultivation of healthy crops. Table 5 compares farmers' behavior based on the variable of participation in training-extension courses.

Based on the results in Table 5, there was a statistically significant difference between the mean scores of villagers regarding the cultivation of healthy crops in Kermanshah province based on the variable of attending training-extension classes. Based on the mean rank, it can be stated that the farmers who participate in training-extension classes on the cultivation of healthy crops (such as organic) have a stronger attitude than those who don't. In other words, it can be stated that attending promotional classes improves the behavior of the users to cultivate healthy crops. Table 6 compares the behavior of the farmers in terms of role model variables.

The results in Table 6 indicate a statistically significant difference between the mean scores of farmers' behavior regarding the cultivation of healthy crops in Kermanshah province based on the role model. Based on the mean ranking, it can be stated that users who have role models in the cultivation of healthy crops (such as organic crops) have stronger behavior than those who don't. In other words, it can be stated that having role models in the cultivation of healthy crops improves farmers' behavior for the cultivation of healthy crops. Table 7 shows the comparison of farmer behavior based on the variable of age.

Table 7 shows that there was a statistically significant difference between the mean score of the studied villagers' behavior regarding the cultivation of healthy crops based on the variable of age. It can be stated that younger farmers have a stronger attitude towards cultivating healthy crops than older farmers in Kermanshah province. In other words, as farmers get old, their behavior regarding the cultivation of healthy crops becomes weaker and vice versa. Table 8 shows a comparison of the behavior of the villagers based on the variables of their experience.

Table 1. Society Size and Statistical Sample of the Research Based on Seven Cities of Kermanshah Province

Row	Selected county	Farmer Grouping	Select a group	Statistical society	n
1	Kermanshah	1- Rainfed land 2-Irrigated land 3-Garden	Rained land	9014	142
2	Eslamabad Gharb	1-Rainfed land 2-Irrigated land 3-Garden	Rained land	8152	128
3	Sarpol Zahab	1-Rainfed land 2-Irrigated land 3-Garden	Rained land	2023	32
4	Gasreshirin	1-Rainfed land 2-Irrigated land 3-Garden	Garden	346	6
5	Kangavar	1-Rainfed land 2-Irrigated land 3-Garden	Irrigated land	1667	26
6	Harsin	1-Rainfed land 2-Irrigated land 3-Garden	Irrigated land	2329	37
7	Paveh	1-Rainfed land 2-Irrigated land 3-Garden	Garden	1820	29
Total				25351	400

The results in Table 8 indicate that there was a statistically significant difference between the mean scores of farmers' behavior regarding the cultivation of healthy crops in Kermanshah province based on the variables of the experience. Based on the average rank, it can be stated that farmers with less work experience have a stronger attitude towards cultivating healthy crops than those with more work experience. In other words, it can be stated that with increasing work experience, the behavior of farmers to cultivate healthy crops is weakened and vice versa.

According to Table 9, there was a statistically significant difference between the mean scores of farmers' behavior regarding the cultivation of healthy crops in Kermanshah province based on the educational level. So, farmers with lower education are less interested in cultivating healthy crops in Kermanshah province than those with higher education. In other words, it can be stated that as the educational level increases, the behavior of the farmers to cultivate healthy crops becomes stronger and vice versa. Table 10 shows a comparison of farmers' behavior based on monthly income level.

The results in Table 10 show that there was a statistically significant difference between the mean scores of farmers' behavior regarding the cultivation of healthy crops in Kermanshah province based on the monthly income (TUM). On the basis of the mean rank, it can be stated that with the increase in the monthly income of farmers in Kermanshah province, their behavior in the cultivation of healthy crops will increase. In other words, it can be stated that the farmers' income has a positive effect on their behavior regarding the cultivation of healthy crops.

The results indicated no significant difference in farmers' behavior regarding healthy crop cultivation in Kermanshah Province based on gender, which contrasts with the findings of Sikandar Azam and Banumathi (2015). Similarly, marital status showed no statistically significant effect on farmers' behavior. However, a significant difference was observed in relation to participation in training and extension classes. This suggests that involvement in such programs improves farmers' behavior toward cultivating healthy products, consistent with the findings of Molaee et al. (2015), Ghadimi et al. (2012), Salmani et al. (2021), Hoseini and Ajoudani (2012), and Okoedo-Okojie and Aphunu (2011). The variable of role models also showed a significant effect, indicating that having role models for healthy crops positively influences farmers' behavior, aligning with Oladipo et al. (2009). Age was another significant factor; behavior toward cultivating healthy crops declined with increasing age, supporting the results of Sikandar Azam and Banumathi (2015), Adesina and Zinnah (1993), Kerhoft (1990), Fakoya et al. (2007), Tohidimoghadam et al. (2023), and Valizadeh et al. (2021), though it contradicts Zhang and Jiang (2009). Work experience also had a significant effect,

with longer experience associated with weaker behavior toward healthy crop cultivation, which differs from the findings of Zhou et al. (2010), Fallah Haghighi et al. (2018), and Zhang and Jiang (2009). Educational level significantly influenced behavior, consistent with Sikandar Azam and Banumathi (2015) and Kerhoft (1990). Monthly income (TUM) was another significant factor; higher income was associated with a greater tendency to cultivate healthy crops, in line with Motiey Langrodi & Khorasani (2010). Given the potential environmental impact of farmers' practices, examining pro-environmental behaviors is essential, and in this study, healthy crop cultivation was treated as a protective behavior.

At the macro level—encompassing political and national activities such as laws and regulations—it can be stated that, due to the lack of specific government policies for planning and supporting healthy products in Iran, the potential for producing organic and healthy crops is limited. Therefore, government agencies should develop and implement targeted policies, such as allocating funds for production infrastructure development and expanding the market for healthy products. At the intermediate level, the focus is on institutions such as NGOs and development organizations. These entities emphasize educational services, the roles of the private and public sectors, the degree of privatization, and the expertise of institutional personnel. Institutions and organizations should adopt modern methods of information dissemination and service promotion—such as media outreach, online platforms, and awareness campaigns—to foster positive attitudes among farmers, particularly the younger generation, as most farmers in Kermanshah are young and more inclined toward cultivating healthy crops.

At the micro level, the focus shifts to identifying the specific needs and priorities of farmers. Material and educational needs are the most critical factors to address. Extension organizations, with the assistance of change agents, can meet farmers' educational needs by organizing extension training programs.

Table 2. The Results of the Kolmogorov-Smirnov Test

Factor	Number of respondents	Z	*p*-value	Result
Behavior	400	–0.05	0.002	Acceptance of the hypothesis as to the normality of data distribution

Table 3. A Comparison of the Behavior of Farmers about the Cultivation of Healthy Crops based on Gender

Dependent variable	Independent variable	Category	Frequency	Mean rank	Z	*p*-value
Behavior	Gender	Female	98	188.38	–1.05	0.290
		Male	299	202.48		

Table 4. A Comparison of the Behavior of Farmers about the Cultivation of Healthy Crops based on Marital Status

Dependent variable	Independent variable	Category	Frequency	Mean rank	Z	*p*-value
Behavior	Marital status	Married	268	206.00	–1.49	0.137
		Single	131	187.73		

Table 5. A Comparison of the Behavior of Farmers about the Cultivation Of Healthy Crops based on Marital Status

Dependent variable	Independent variable	Category	Frequency	Mean rank	Z	*p*-value
Behavior	Participate in training	Yes	83	208.34	3.83** –	0.000
		No	310	154.66		

**$p < 0.01$

Table 6. A Comparison of the Behavior of Farmers about the Cultivation of Healthy Crops based on Role Model

Dependent variable	Independent variable	Category	Frequency	Mean rank	Z	*p*-value
Behavior	Role model	Yes	140	238.62	-5.57 **	0.000
		No	251	172.23		

**$p < 0.01$

Table 7. A Comparison of the Farmers' Behavior on Healthy Crops by Age

Dependent variable	Independent variable	Category	Frequency	Mean rank	χ^2	*p*-value
Behavior	Age (years)	25 and less	139	208.25	**19.27	0.001
		26-35	136	214.46		
		36-45	61	191.11		
		46-55	42	173.52		
		56 and more	19	102.34		

**$p < 0.01$

Table 8. A Comparison of Farmers' Behaviors on Healthy Crops based on Experience

Dependent variable	Independent variable	Category	Frequency	Mean rank	χ^2	*p*-value
Behavior	Experienced in work	12 years and less	259	210.33	17.27**	0.001
		13-24	70	211.77		
		25-34	45	161.49		
		45 years and more	25	129.30		

**p< 0.01

Table 9. A Comparison of Farmers' Behaviors on Healthy Crops based on Educational Level

Dependent variable	Independent variable	Category	Frequency	Mean rank	χ^2	*p*-value
Behavior	Educational level	Illiterate	4	20.63	41.76**	0.000
		Elementary	18	89.50		
		Intermediate	31	195.44		
		High school	72	198.00		
		Diploma	98	175.84		
		Associate degree	48	205.69		
		Bachelor	67	194.83		
		Master and higher	45	252.66		

**p< 0.01

Table 10. A Comparison of Farmers' Behaviors on Healthy Crops based on Income

Dependent variable	Independent variable	Category	Frequency	Mean rank	χ^2	*p*-value
Behavior	Income level	1million and less	54	145.01	32.19**	0.000
		1-2 million	107	179.49		
		2-3 million	42	190.17		
		3-4 million	129	195.80		
		4-5 million	45	252.66		
		5 million and higher	6	314.33		

**p< 0.01

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Authors Contribution

Marzie Moaref, Alireza Poursaeed, and Roya Eshraghi Samani were responsible for overseeing the research design, as well as the analysis and interpretation of the data. Poursaeed and Eshraghi Samani administered the research process and coordinated data collection efforts. Moaref contributed to the literature review and manuscript draft. All authors reviewed and approved the final version of the manuscript.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Conflict of interests

The authors state that there is no conflict of interest.

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