Factors Affecting Avoiding the Use of Pesticides to Greenhouse Vegetables in Bandar Abbas District (Iran)

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Abstract

Despite huge environmental, economic, health, and social costs of pesticides, evidence revealed that farmers in developing countries would continue to use pesticides. The root of the problem appears to be related to the way of farmers' decision making. As such, it is crucial for policymakers to understand how farmers think and behave with regard to these inputs. Therefore, the aim of this research was to accrue empirical evidence about greenhouse owners' attitudes and intention toward avoiding using pesticides in Bandar Abbas District using the Theory of Planned Behaviour (TPB). TPB was tested using a survey to understand greenhouse owners' attitude and intention. The study sample consisted of 110 greenhouse owners selected through a random sampling method. Data were collected with a structured questionnaire to assess the central variables of the theory. The questionnaire's internal reliability and validity were confirmed by a panel of experts. Results indicated that the greenhouse owners' moral norm was the main predictor of their intention to avoid pesticide application followed by the variables of self-identity and attitude, respectively. Furthermore, adding moral norm and self-identity as additional constructs to the theory significantly improved the explanatory power of the standard model.

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INTRODUCTION

The population has more than doubled since 1960, yet the global supply of food calories per capita rose from 2420 Kcal per day in 1958 to 2808 Kcal in 1999 (Gilland, 2002). In this regard, pesticides are widely used for the protection of crops, foodstuffs, and other agricultural products against pests as well as for the control of disease vectors (Koh & Jeyaratnam, 1996; Sharifzadeh et al., 2019). They are, in fact, perceived by farmers as a component of economic safety against the uncertainties of agricultural production (Waichman et al., 2007).

Pesticides play an essential role in food production among farmers (Waichman et al., 2007), especially greenhouses owners because of their involvement in agricultural pest management (Monfared et al., 2015). Thus, pesticide sale has soared in the world since the 1970s (Atreya, 2007). However, this has entailed a wide range of environmental and social problems worldwide (Ibitayo, 2006; Sharifzadeh et al., 2019).

Despite the environmental, economic, health, and social costs of pesticides, researches argue that farmers in developing countries will keep using pesticides (Abadi, 2018; Yazdanpanah et al., 2015b). However, pesticides in developing countries are used in an unsafe manner or even, they are misused (Ibitayo, 2006).

Iran is one of those countries in which the agricultural sector is highly dependent on the consumption of chemical inputs (Monfared et al., 2015). As a result, the use of pesticides has spread rapidly and has become an indispensable part of agriculture for Iranian farmers (Monfared et al., 2015). The present annual rate of pesticide use in Iran is about 24,000 tons, of which the highest amounts are related to insecticides, herbicides, and fungicides (Plant Protection Organisation, 2014). Recently, the Health Ministry officials have stated that Iran has the highest rate of stomach cancer in the world (Monfared et al., 2015). Based on this statistic, 70,000 people are diagnosed with cancer annually, and the

blame can be put on the use of agricultural crops with pesticide residues for one-third of them (Yazdanpanah & Forouzani, 2015).

The problem is seemingly rooted in how farmers make decisions (Heong et al., 2002; Monfared et al., 2015; Yazdanpanah et al., 2012). While Wilson (1999) believe that the economic factor influence farmers' decisions, other argue that social-psychological factors are more influential on their decisions (Bozorgparvar et al., 2018; Heong et al., 1994; Heong et al., 2002; Monfared et al., 2015). Since perceptions of pest status influence farmers' decisions more than economic factors (Heong et al., 1994), a deeper understanding of social psychological factors can help influence decisions (Heong et al., 2002; Yazdanpanah et al., 2009). In other words, studies on human judgment and choices have shown that economic models have been unable to account for how people actually make decisions (Slovic et al., 1977). Thus, to better understand the determinants of farmers' insecticide-use decisions, models have been adopted from psychology (Boazar et al., 2019; Escalada et al., 2006). As such, the aim of the present study is to understand the psychological factors that influence farmers' decisions regarding pesticides. To achieve this goal, we use the Theory of Planned Behavior (TPB), developed by Ajzen (1991), to identify psychosocial factors that affect farmers' decision on pesticide use (Yazdanpanah et al., 2011).

TPB assumes that attitudes, subjective norms, and perceived behavioral control are important determinants of farmers' intention to avoid pesticide application, and behavior is, in turn, affected by perceived behavioral control and intentions (Yazdanpanah et al., 2014).

The TPB is an important social cognitive model that aims to explain variance in volitional behavior (Ajzen, 1991) and has proven successful in doing so (Kaiser, 2006). According to TPB, behavior is determined by an individual's intention to perform the behavior, so intention is seen as the most proximal pre-

dictor of behavior (Arvola et al., 2008; Bissonnette & Contento, 2001).

TPB has extensively and successfully been applied in the context of pro-environmental behaviors (Abrahamse & Steg, 2009; Arvola et al., 2008; Bayard & Jolly, 2007; Bonnes & Bonaiuto, 2002; Cary, 2008; Clark & Finley, 2007; Dolnicar & Hurlimann, 2010; Gilg & Barr, 2006; Nancarrow et al., 2008; Salari et al., 2019; Trumbo & O'keeffe, 2005; Wauters et al., 2010; Whitmarsh & O'Neill, 2010; Yazdanpanah et al., 2015ade; Yazdanpanah & Forouzani, 2015; Yazdanpanah et al., 2011, 2014).

TPB was developed as an extension of the Theory of Reasoned Action (TRA) (Bakhtiyari et al., 2017; Fishbein & Ajzen, 1975; Valizadeh et al., 2019). TRA is a social psychological model that claims that an individual's actual behavior in performing a certain action is directly guided, as a central factor, by his or her behavioral intention, which in turn is jointly determined by the subjective norms and attitude towards the behavior (Fishbein & Ajzen, 1975; Yazdanpanah & Zobeidi, 2017). Attitude refers to "the degree to which an individual evaluates the behavior in question to be favorable or unfavorable" (Ajzen, 1991). Attitudes are, in turn, the product of beliefs about the outcome of the behavior and the individual's evaluation of the outcome (Bissonnette & Contento, 2001). Subjective norms refer to "the perceived social pressure to perform or not to perform a behavior" (Ajzen, 1991; Arvola et al., 2008) and the individual's motivation to comply with these pressures (Bissonnette & Contento, 2001). TRA assumes that behavior is entirely voluntary (Liao et al., 2007). In the early 1980s, there have been some criticisms of TRA. Critics believed that the model performed poorly when looking at behavior over which people have incomplete volitional control (Burton, 2004; Liao et al., 2007). In response, Ajzen (1985, 1991) addressed the limitations of the original model by adding "perceived behavioral control" (PBC) which influences intention and behavior directly

(Figure 1) and TRA was renamed TPB (Yazdanpanah & Forouzani, 2015). PBC refers to "an individual's perception of ease or difficulty of performing the behavior of interest" (Ajzen, 1991, 2002); or "the extent to which individuals perceive the behavior to be under their volitional control" (Fielding et al., 2008). Ajzen (2002) suggested that PBC "should be read as perceived control over the performance of a behavior". In contrast to TRA, TPB assumes that behavior as a concept should comprise both voluntary and involuntary aspects (Yazdanpanah & Forouzani, 2015). In so far as PBC is a proxy for actual control, it may also have a direct impact on behavior (Fielding et al., 2008).

Although TPB has been proven to be effective in behavior prediction (Kaiser, 2006; Liao et al., 2007; Nigbur et al., 2010), the theory has not stopped evolving, and researchers of various disciplines have suggested that the inclusion of other variables might increase the predictive utility of the model for some behaviors and contexts (Yazdanpanah et al., 2015ac).

There is mounting evidence for the inclusion of moral aspects in the original TPB (Ajzen, 1991; Arvola et al., 2008; Burton, 2004; Conner & Armitage, 1998; Kaiser & Scheuthle, 2003). However, some researchers (e.g. Arvola et al., 2008) argue that the inclusion of moral norms would be important only in understanding behavior which is construed in moral terms. In the extended TPB (ETPB), moral norms refer to an individual's personal beliefs about what is right or what is wrong to do (Simsekoglu & Lajunen, 2008; Yazdanpanah et al., 2015be).

There is also growing evidence for the inclusion of self-identity (how one perceives oneself) as being predictive of behavioral intention in TPB (Burton, 2004; Nigbur et al., 2010; Pelling & White, 2009; Yazdanpanah & Forouzani, 2015). Stryker (1968) argued that self is influenced by a wider social structure and is, in turn, an active creator of social behavior. The concept of self-identity comes from Stryker's theory of identity (Stryker &

Burke, 2000). Therefore, self-identity is generally interpreted as a label that people use to describe themselves, as well as something that is expected to have an important influence on intention (Cook et al., 2002). In our study, self-identity was, therefore, expected to be another independent predictor of intention.

The overall purpose of this paper was three-fold: (1) to identify factors determining greenhouse owners' intention to avoid pesticide application; (2) to examine the use and efficacy of TPB in avoiding pesticide application, and (3) to improve the explanatory power of TPB by adding two new constructs: moral norm, and self-identity.
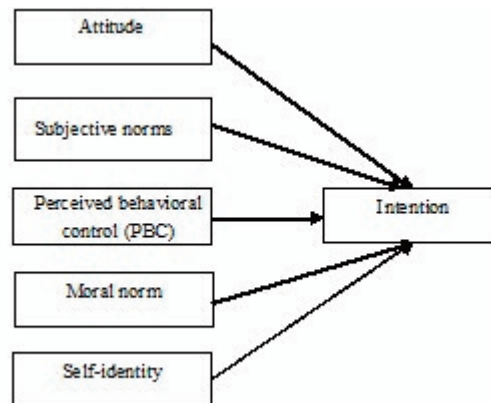

Figure 1. The extended TPB framework
(Yazdanpanah & Forouzani, 2015)

METHODOLOGY

The study was designed as a cross-sectional survey through a questionnaire. The questionnaire was developed on the basis of the literature review of TPB variables, and multiple items were developed to measure each of the psychosocial variables. It is important to note that to assess the TPB variables, we used items that closely followed the measurement of these constructs used in previous studies and applied a five-point scale for all variables in order to reduce the statistical problem of extreme skewness. Before the large-scale survey, the validity of the questionnaire was approved by a panel of experts and was pre-tested in a pilot study with 30 greenhouse owners. The questionnaire's internal reliability was investigated using the coefficient of Cronbach's alpha. All scales indicated acceptable-to-excellent reliability; generally, 0.61 to 0.95 (Table 1).

It is important to note that, in this study, the population of interest consisted of greenhouse owners in Bandar Abbas District (N=300). Based on the sampling (Krejcie &

Morgan, 1970), our study consisted of 110 greenhouse owners who were selected through a simple randomization method. Also, we used the multiple linear regression analysis to assess the relative influence of the factors on intentions of greenhouse owners to avoid pesticide application (Table 3). We performed a two-step multiple regression analysis to determine the extent to which our selected variables predicted intentions of greenhouse owners to avoid pesticide application.

RESULTS
Descriptive analysis and relationship between variables

Descriptive analysis of the data revealed that the age of the participants ranged from 26 to 70 years, with a mean of 36 years (SD=7.42). The sample consisted of 96 male greenhouse owners (87.3%) and 14 female greenhouse owners (12.7%). Some (2.8%) had middle school and 14.6% had a high school degree or equivalent. Most of the participants (82.6%) had a higher than diploma

degree. The findings also showed that the newest greenhouses were 1-year-old and the oldest was 13 years old (M=5.16; SD=2.67). Furthermore, the smallest greenhouse had a planting area of 2000 m and the largest had a planting area of 45,000 m (M=8487.25; SD=10469.99). Finally, the results showed that the minimum distance of the greenhouses from pesticide store was 1 km and the maximum was 160 km (M=17.48; SD=22.59).

Pearson's correlation test was used to investigate the relationship between all variables. The results revealed a significant relationship between intention to avoid pesticide application and attitude, self-identity and moral norms. Moreover, the results revealed that subjective norms and PBC were not significantly correlated with intention not to use pesticides (Table 2).

Table 1
Constructs Included in the Questionnaire

Constructs	Questions	Value of Cronbach's alpha
Attitude	I think that it is important to stop or reduce using pesticides. I think that it is wise to stop or reduce using pesticides. I think that it is beneficial to stop or reduce using pesticides. I think that it is favourable to stop or reduce using pesticides.	0.77
Subjective norms	My close friends, whose opinions regarding pesticide use are important to me, think that I should not use pesticides. My close friends tend to reduce pesticide use in crop production. It is also important for me how other farmers/greenhouse owners control pests.	0.61
PBC	If I do not use pesticides, my performance will go down sharply. People tend not to buy organic products. People do not have necessary knowledge to purchase organic products. People are not willing to pay a higher price to buy organic products.	0.62
Moral norms	When I use pesticides, I feel guilty. When I do not use pesticides, I feel I'm a better greenhouse owner. When I do not use pesticides, I think I'm doing good job.	0.88
Self-identity	The use of pesticides has been a part of my farming. I'm not the one who can withstand the use of chemical pesticides. My production is tied to the use of pesticides.	0.73
Intention	I am willing to use less pesticide. I like to use less pesticide in the future. I want to use less pesticide in the future. I'm not going to change any amount of pesticide in the future.	0.95

Table 2
Pearson's Correlation Test Between All Variables

Variables	Attitude	Subjective norm	PBC	Self-identity	Moral norm	Intention
Attitude	1					
Subjective norms	0.11	1				
PBC	-0.26**	0.23*	1			
Self-identity	0.42**	0.24*	-0.25*	1		
Moral norms	0.48**	0.16	-0.25**	0.77**	1	
Intention	0.45**	0.04	-0.15	0.22*	0.59**	1

**P<0.01 *P<0.05

Regression analyses

This paper drew on a well-established so-cial–psychological model to examine deci-sions to avoid pesticide application among Iranian greenhouse owners. The findings of regression analysis to determine the factors affecting intention are shown in Table 3. The first regression analysis revealed that atti-tude (β=0.56, P<0.01) accounted for 30% of the variation in intention (F= 13.69, P< 0.01). The second regression showed that attitude (β=0.32, P<0.01), self-identity (β=-0.47, P<0.03) and moral norms (β=0.78, P<0.01) accounted for 48% of the variation in inten-tion (F= 17.09, P< 0.01).

Results suggest that the TPB framework is an effective tool for this policy question (sec-ond purpose). In a meta-analysis of the TPB, Monfared et al. (2015) and Yazdanpanah and Forouzani (2015) found that the TPB ac-counted for 39%, 53.9% and 56% of the vari-ance in intention. In our study, the explained variance of intention for the TPB was 30%. For the revised TPB (third purpose), predic-tive validity was even higher (48%) and self-identity and moral norms as new constructs can efficiently improve the explanatory power of TPB. As Table 3 shows, the variables of self-identity and moral norms add about 18% to the predictive power of the model. In other words, the results revealed that inten-tions regarding avoiding pesticide use were positively influenced by moral norms. As such, the inclusion of moral norms enhanced predictive power and produced a model with better fitness than TPB. Finally, our research revealed that the greenhouse owners' moral norms were the main predictor of their inten-tion to avoid pesticide application followed by self-identity and attitude.

Table 3

Regression Analysis for Intention Regarding Avoiding Pesticide Application

Variables	B	S.E.B	β	*P*-value	R²
Attitude	0.54	0.09	0.56	0.01	0.30
Subjective norms	-0.15	0.10	-0.13	0.15	
PBC	0.04	0.08	0.04	0.65	
Constant= 8.51		*P*-values= 0.01		F= 13.69	
Attitude	0.31	0.09	0.32	0.01	0.48
Subjective norms	-0.08	0.09	-0.07	0.42	
PBC	0.04	0.07	0.05	0.54	
Self-identity	-0.31	0.09	-0.47	0.01	
Moral norms	0.79	0.14	0.78	0.01	
Constant= 6.02		*P*-values= 0.01		F= 17.09	

DISCUSSION

The extended TPB framework describes farmers' intention to avoid using pesticides based on five predictor components. In this regard, regression analysis was used to eval-uate the contribution of the predictors to the intention to avoid using pesticides. Our analy-sis results revealed that attitude was a strong predictor of intention. In the line with this finding, Clark and Finley (2007), Lam (2006), Lam (1999), Monfared et al. (2015), Trumbo and O'Keefe (2005) and Yazdanpanah and Forouzani (2015) found that attitude had a significant impact on intention. Attitude refers to "the degree to which an individual evaluates a behavior to be favorable or unfa-vorable'.

To increase greenhouse owners' intention to avoid using pesticides, it is imperative to have an understanding of the greenhouse

owners' attitudes towards avoiding using pesticides. We believe that in Iran, the success of many policy instruments will be limited unless we succeed in offering a more positive attitude to greenhouse owners towards avoiding the use of pesticides. To have a policy implication at this level, we should really understand farmers' attitudes toward pesticide use in order to reduce pesticide application.

Self-identity is a new construct that can efficiently improve the explanatory power of TPB. In other words, the results revealed that intentions regarding avoiding the use of pesticides were influenced by self-identity and the ability of self-efficacy influences intention negatively. As such, the inclusion of self-identity added to the predictive power and produced a model with better fitness than TPB. This variable was an important factor in the studies of Monfared et al. (2015), Yazdanpanah and Zobeidi (2017) and Yazdanpanah et al. (2015d) regarding the prediction of environmentally-oriented intention in Iran. Self-efficacy refers to a person's belief in her/his capability to perform a behavior (Bandura, 1977 cited in Yazdanpanah & Zobeidi, 2017). In other words, self-efficacy refers to the degree to which an individual feels that the performance of a behavior is under his/her volitional control. The perceived difficulty (or ease) of avoiding the use of pesticides is expected to impact the possibility of carrying out this behavior. Therefore, professionals who are more convinced that avoiding the use of pesticides and promoting education about them is easy and/or believe that the use of pesticides is under their control show greater intention. This factor is important in Iran where pesticide use is common.

Moral norms refer to an individual's personal beliefs about what is right or what is wrong to do. In the extended model, the findings showing the significant impact of moral norms on intention suggest that the more an individual feels it is a moral norm to avoid using pesticides, the greater his/her willingness to avoid their use. Similarly, Arvola et al. (2008), Bissonnette and Contento (2001), Kaiser (2006), and Yazdanpanah and Forouzani, (2015) found that moral norms had a significant impact on the intention. Moreover, our study unlike other studies (e.g. Kaiser & Scheuthle, 2003) revealed that moral norms had a significant negative impact on intention. In this regard, strategies that aim to decrease farmers' tendency to use pesticides could encourage them to embrace the identity of being organic farmers. Thus, the results of the present study have some practical implications that provide suggestions to the type of variables that should be targeted in intervention programs designed to encourage conservation behaviors among farmers.

CONCLUSIONS

The aim of the study was two-fold: 1) to examine the use and efficacy of TPB in terms of the intention to avoid pesticide application among Iranian greenhouse owners; and 2) to improve the explanatory power of TPB by adding two new constructs: moral norm and self-identity. The study led to three major findings. First, TPB is an effective framework to predict intentions towards avoiding pesticide application. Second, the results lent partial support for the usefulness of incorporating measures that capture moral norms and self-identity into the framework of TPB. The constructs of self-identity and moral norms seem to be useful in understanding and predicting intentions towards avoiding pesticide application. Our findings reinforce existing evidence for the importance of self-identity and moral norms in predicting environmentally-oriented intention. Third, our findings revealed that the greenhouse owners' moral norms were the main predictor of their intention to avoid pesticide use followed by self-identity and attitude. More research is needed to fully understand the processes by which moral norms and self-identity influence intention.

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