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### Modeling farmers' intention for safe pesticide use: the role of risk perception and use of information sources

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#### Abstract and Figures

Intention for safe pesticide use plays a crucial role in the mode of pesticide spraying, but several factors are involved in the formation of intention by farmers. This work focused on the levels of farmers' perception of pesticide risks (i.e., toxicity levels, health, and environmental effects) and utilization of information sources and examined their impact on intention for safe pesticide use in rural Iran. Most farmers (53%) showed low levels of risk perception by pesticide use and reported poor use of the available information sources about pesticides. Pesticide retailers were mentioned as the primary information point of farmers. In addition, almost half of the farmers (49.2%) expressed worryingly negative intention for safe pesticide use. Perception of pesticide risks and utilization of information sources were significantly correlated with age and spraying experience ( $P < 0.01$ ), while intention for safe pesticide use was significantly correlated with farming experience ( $P < 0.05$ ) and spraying experience ( $P < 0.05$ ). Analysis with structural equation modeling showed that perception of pesticide risks and use of information sources together explained 80% of the variability in farmers' intention. Moreover, perception of pesticide risks ( $P < 0.01$ ) and employment of information sources ( $P < 0.05$ ) had a positive relationship with intention for safe handling of pesticides, thus showing a predictive link with intention. Therefore, promoting farmers' perception of pesticide risks and providing credible information sources are essential for improving intention for safe pesticide use among farmers.



Theoretical framework of th... Farmers' groups according to a...

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## RESEARCH ARTICLE

# Modeling farmers' intention for safe pesticide use: the role of risk perception and use of information sources

Abolmohammad Bondori<sup>1</sup> · Asghar Bagheri<sup>1</sup> · Mojtaba Sookhtanlou<sup>1</sup> · Christos A. Damalas<sup>2</sup>

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## Abstract

Intention for safe pesticide use plays a crucial role in the mode of pesticide spraying, but several factors are involved in the formation of intention by farmers. This work focused on the levels of farmers' perception of pesticide risks (i.e., toxicity levels, health, and environmental effects) and utilization of information sources and examined their impact on intention for safe pesticide use in rural Iran. Most farmers (53%) showed low levels of risk perception by pesticide use and reported poor use of the available information sources about pesticides. Pesticide retailers were mentioned as the primary information point of farmers. In addition, almost half of the farmers (49.2%) expressed worryingly negative intention for safe pesticide use. Perception of pesticide risk and utilization of information sources were significantly correlated with age and spraying experience ( $P < 0.01$ ), while intention for safe pesticide use was significantly correlated with farming experience ( $P < 0.05$ ) and spraying experience ( $P < 0.05$ ). Analysis with structural equation modeling showed that perception of pesticide risks and use of information sources together explained 80% of the variability in farmers' intention. Moreover, perception of pesticide risks ( $P < 0.01$ ) and employment of information sources ( $P < 0.05$ ) had a positive relationship with intention for safe handling of pesticides, thus showing a predictive link with intention. Therefore, promoting farmers' perception of pesticide risks and providing credible information sources are essential for improving intention for safe pesticide use among farmers.

**Keywords** Chemical pest control · Pesticide risks · Structural equation modeling

## Introduction

Pesticides are a useful tool for farmers, which help them to cope efficiently with pests and plant pathogens in crop production. However, pesticides can affect the health of living organisms and can cause serious environmental pollution (Damalas 2009; Damalas and Eleftherohorinos 2011). Farmers directly involved in spraying are at high risk of exposure to pesticides through unsafe handling and disposal practices, along with pesticide residues on treated crops (Damalas et al. 2006; Damalas

and Koutroubas 2016; Manyilizu et al. 2017). Moreover, some of these agricultural chemicals leave behind residues on food (Mutengwe et al. 2016; Lapierre et al. 2019) and thereby can produce ill effects to consumers when concentrations exceed safe tolerance levels. Occupational exposure to agrochemicals is a serious hazard for farmers and farm laborers, particularly in the developing world, because these groups have higher cumulative exposures than do individuals in the general environment (Ghasemi and Karami 2009; Hashemi et al. 2012). Due to lack of training in the majority of farmers (Omari 2014; Sankoh et al. 2016), malpractice in agrochemicals use is commonly observed.

Understanding the extent of pesticide overuse and factors driving farmers to overuse pesticides in agricultural production is imperative to protect public health and promote agricultural sustainable development. To this end, studying perception of pesticide dangers and beliefs pertaining to the use of pesticides can be a first act for interventions to reduce pesticide use and associated risks in the rural community (Yuantari et al. 2015; Shams et al. 2015). Previous research in Iran showed that greenhouse holders viewed pesticides as

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... 6 In many developing countries, including Uganda, agro-input dealers (hereafter referred to simply as agro-dealers ‡ ) are the primary conduit of pesticides and a key source of plant health information to farmers. [7] [8] [9][10] Thus, agro-dealers can play an important role in mitigating the risks of pesticides to humans and the environment. While a few previous studies have investigated agro-dealers' role in pesticide risk reduction, they focussed mostly on pesticide knowledge and practices of agro-dealers and the advice they give to farmers. ...

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... The dark side of this movement was applied dramatically to polluted soil, water, and environment, leading to ecological and environmental problems and human health risks (Rodrigues et al., 2022;Sehrawat et al., 2022). Residues of chemical compounds in the environment have caused resistance of weeds, pest, and disease species to chemical toxic materials, severe soil destruction and erosion, water pollution, and threat to human health (in terms of skin diseases, different cancer types, neurological diseases, diabetes, respiratory diseases, fetal insufficiency and diseases, congenital malformation, fertility problems, and genetic problems; Recena et al., 2006;Fianko et al., 2011;Chen et al., 2013;Fan et al., 2015;Garcia-Garcia et al., 2016;Jallow et al., 2017;Bondori et al., 2019 Bondori et al., , 2021 Bondori et al., , 2023Bagheri et al., 2019bBagheri et al., , 2021Bagheri et al., , 2022Imani et al., 2021;Asante et al., 2023;Bawa, 2023;Dias et al., 2023;Imani et al., 2023;Terfe et al., 2023). However, in recent decades, consumers have become more aware and concerned about the side effects of agrochemicals, which have been highlighted in various studies [Lahlali et al. (2022) on fungicides; Carvalho (2017); Damalas and Eleftherohorinos (2011) on pesticides; Govindasamy et al. (1997) on pesticides, herbicides, fungicides, and insecticides; Önder et al. (2011); Bishnoi (2018) on chemical fertilizers; and Zhang et al. (2018) on chemical inputs used in agriculture]. ...

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... The socio-economic, demographic and biophysical attributes, such as age, gender, marital status, education, main occupation, household size, housing status, and length of residency, were also recorded. The above-mentioned methods have been used in previous studies of similar nature (Sreenath and Veerabhadraiah, 1993;Fan et al., 2015;Damalas and Abdollahzadeh, 2016;Rezaei et al., 2019;Sharifzadeh et al., 2019;Ali et al., 2020; Bondori et al., 2021; Ganaie et al., 2022). ...

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... Behavioral attitudes, subjective norms, and perceived behavioral control are distinct indicators that are interrelated and independent. According to Bondori et al. (2021) , the level of support that farmers and herders receive during the participation process is directly proportional to their perception of safety and their willingness to act. The relevant theory suggests that farmers and herders are rational economic agents whose implementation of desert management behavior is influenced by the goal of minimizing risk expectations. ...

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... Employment of information sources was positively related with farmers' intention to handle pesticides safely in Iran. 61 Similarly, information sources were among the main factors underpinning pictogram understanding on pesticide labels in Iran. 33 The main source of information for farmers of the study regarding pesticides was the pesticide retailers. ...

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... Risk knowledge, risk perception, and use of information were positively correlated with experience in spraying. Similarly, farming experience was significantly correlated with farmers' safe use of pesticides (Bondori et al., 2021). Experiencing risk in the face of natural hazard plays a major role in safety behavior because it makes people aware of their vulnerabilities, thus increasing their perception of risk (Terpstra et al. 2011; Bronfman et al., 2020). ...

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## Protective behavior in chemical spraying among farmers of northern Iran

May 2023 · Environment Development and Sustainability

Abolmohammad Bondori ·  Asghar Bagheri ·  Christos A. Damalas

Understanding farmers' protective behavior in the use of pesticides as well as inter-related factors affecting behavior is essential for improving safety in farming. The purpose of this work was to evaluate the levels of personal protection of farmers during pesticide handling, along with knowledge and perception of risks by pesticides, frequency of poisoning experience, use of information, and ... [\[Show full abstract\]](#)

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March 2019 · Environmental Science and Pollution Research

 Asghar Bagheri ·  Christos A. Damalas ·  Mohammad S. Allahyari ·  Naier Emami

Farmers' knowledge of pesticide use as well as their attitudes and perceptions concerning risks and safety play a crucial role in safe spraying operations in farms, but little is known for the inter-relationships among these variables and their impact on safety behavior. This study examined the levels of knowledge, attitudes, and perceptions of pesticide use among apple farmers (n = 200) of ... [\[Show full abstract\]](#)

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## Pesticide waste disposal among farmers of Moghan region of Iran: current trends and determinants of...

December 2018 · Environmental Monitoring and Assessment

Abolmohammad Bondori ·  Asghar Bagheri ·  Mohammad S. Allahyari ·  Christos A. Damalas

Unsafe disposal of pesticide waste at farms has serious consequences on the environment and public health. Investigation of disposal behavior of farmers towards pesticide waste after use helps to identify and improve their behavior. This study aimed to investigate how farmers dispose of pesticide waste and factors influencing their behavior. A sample of 400 farmers using by multistage random ... [\[Show full abstract\]](#)

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## Safety behavior in pesticide use among farmers of northern Greece: the role of information sources

July 2023 · Pest Management Science

Petros Tsakiris ·  Christos A. Damalas ·  Spyridon D. Koutroubas

BACKGROUND Farmers' compliance with common safety practices in pesticide use (i.e., keeping records of pesticide applications, reading the information of pesticide labels, and taking protective measures during pesticide handling) and the use of information sources about pesticides were studied in a simple random sample of farmers in Evros Province, northern Greece. RESULTS According to the three ... [\[Show full abstract\]](#)

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