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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(9): 60-63

www.thepharmajournal.com
Received: 22-06-2023
Accepted: 30-08-2023

Sandeep Deshmukh
Subject Matter Specialist, Department of Agricultural Extension, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth-Krishi Vigyan Kendra, Lanja, Ratnagiri, Maharashtra, India

Monica Singh
Subject Matter Specialist, Department of Agricultural Extension, ICAR-Central Costal Agricultural Research Institute-Krishi Vigyan Kendra, North Goa, Old Goa, Ella, Goa, India

Corresponding Author:
Sandeep Deshmukh
Subject Matter Specialist, Department of Agricultural Extension, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth-Krishi Vigyan Kendra, Lanja, Ratnagiri, Maharashtra, India

Farmer's intention regarding pesticides application in Alphonso mango

Sandeep Deshmukh and Monica Singh

Abstract
This study explores mango orchardists' intentions regarding pesticide application in Alphonso mango cultivation. Despite diverse pest control methods, chemical intervention remains prominent, raising environmental and health concerns. The Indian pesticide sector's growth accentuates the need for understanding farmers' perspectives on pesticide usage. Using the Theory of Planned Behavior (TPB), this research analyses factors shaping farmers' intentions. The study covers Ratnagiri and Sindhudurg districts, selecting respondents for comprehensive insights. Findings reveal mixed engagement in extension activities, highlighting the need for targeted knowledge sharing. Examining pesticide-related aspects, attitudes, intentions, subjective norms, perceived control, risk perception, and pesticide knowledge exhibit varied responses. Farmers' intentions span 'low' to 'high,' reflecting diverse motivations. Attitudes range from 'unfavourable' to 'favorable,' indicating complex viewpoints. Positive moral norms and perceived control suggest potential for responsible pesticide practices. Implications involve tailored training for knowledge enhancement and promoting sustainable pest management. Acknowledging individual perspectives is vital for effective pesticide usage. The study offers insights for informed and eco-conscious pesticide application, aligning with sustainable agriculture goals. In summary, this study illuminates' farmers' intentions, attitudes, and pesticide practices in Alphonso mango cultivation. By addressing knowledge gaps and considering varied viewpoints, stakeholders can foster responsible pesticide use and contribute to a sustainable agricultural future.

Keywords: intention, pesticides, mango, Alphonso, extension

Introduction
Plant pests are notorious for inflicting significant losses in global crop production (Damalas, 2017; Jena *et al*., 2018) [1, 2]. A variety of methods have been devised to counter these pests, ranging from host plant resistance, physical barriers, botanical pesticides, biological control, biotechnological interventions, to synthetic pesticides. Despite the array of options available, the predominant approach in practical field scenarios remains chemical intervention. This involves the use of synthetic pesticides to safeguard crop yields due to their effectiveness and consistent ability to shield crops. Although pesticides play a pivotal role in modern agricultural systems, they are also associated with serious repercussions. These include the rise of pest resistance, the depletion of natural predators, environmental pollution, adverse effects on non-target organisms, and health risks to humans.

With an anticipated compound annual growth rate (CAGR) of 8.3%, the Indian pesticide sector is poised to expand from its 2017 valuation of USD 2.53 billion to approximately USD 4.09 billion by 2023. In the context of India, around 1814 MT of insecticides were likely consumed by fruit orchards during the 2020-21 period. Experts propose that the initial stride towards formulating strategies to mitigate chemical hazards lies in the assessment of farmers' perspectives on pesticide application in agriculture (Bondori *et al*., 2018; Bagheri *et al*., 2018) [3, 4]. In the absence of fundamental insights into farmers' behavior and the diverse determinants impacting it, the feasibility of orchestrating widespread pesticide usage regulations is compromised. Employed across various scientific domains to delineate a wide array of purpose-linked human behavior, the Theory of Planned Behavior (TPB) has been adopted to scrutinize the motivations underlying farmers' adoption of pesticides (Chin *et al*., 2016; Grilli and Notaro, 2019) [5, 6].

Horticulture serves as the primary pillar upholding India's agricultural economy, constituting a significant 30.0 percent of the overall agricultural output's value. India boasts global leadership in fruit production, notably of diverse fruits like mango, banana, lime, lemon, papaya, and fenugreek (Horticulture Statistics, 2018). Despite its association with tropical climates, the mango, including varieties like Alphonso, defies convention by thriving in subtropical regions. The distinguished Mango (*Mangifera indica* L.), belonging to the Anacardiaceous family, reigns as India's foremost commercially cultivated fruit crop. Originating in the Indo Burma region nestled within the Himalayan foothills, the mango is bestowed with the titles of "The National Fruit of India" and the esteemed "King of Fruits." Renowned globally, the mango is celebrated for its exceptional nutritional and medicinal attributes. Particularly hailed among its many varieties, the Alphonso mango stands out as superior. Bolstered by geographical indicators (GI) in Ratnagiri and Sindhudurg, the Alphonso Mango stakes its claim to exclusivity, safeguarding its unique product identity. Nevertheless, the Alphonso variety remains susceptible to the adverse impacts of climate change, resulting in heightened vulnerability to pests and insects. This susceptibility has led to substantial infestations in mango crops. While modern techniques and insecticides offer potential solutions for increased production, the indiscriminate use of insecticides by farmers poses challenges. A potential way forward lies in farmers adopting innovative practices, complemented by a judicious application of insecticides. To this end, acquiring direct insights into farmers' perspectives on pesticide use becomes pivotal. Extension personnel can leverage this knowledge to effectively foster the adoption of cutting-edge mango farming methods. Through this, the study aims to uncover the intricate socio-economic and agroecological facets of mango growers, shedding light on their inclinations toward pesticide utilization. This investigation anticipates offering comprehensive insights into mango cultivation, serving as a cornerstone for enhancing both practices and outcomes.

Materials and Methods

The present research was conducted within the geographical confines of Ratnagiri and Sindhudurg districts. In Ratnagiri district, specific focus was placed on Ratnagiri and Rajapur tehsils, while in Sindhudurg district, Devgad and Malwan tehsils were singled out. This selection resulted in a total of four distinct tehsils being included in the study. Within these tehsils, a systematic process of random selection was employed to choose twelve representative villages. From this collection of twelve villages, a further step of random selection was undertaken, resulting in the identification of 10 respondents from each village who would participate in the research study. In summation, a cohort of 120 respondents was assembled for the study's comprehensive examination. The pivotal data acquisition process took the form of personal interviews, which were skilfully conducted utilizing a pre-structured Interview Schedule designed to ensure consistency and depth in the data collection process.

Results and Discussion

Access to extension organizations

The data presented in Table 1 highlights that a substantial percentage (85.0%) of the respondents occasionally engaged in frontline demonstrations. This was followed by participation in group discussions (84.16%), and a noteworthy proportion had also attended farmers' melas/rallies on occasion (67.50%). Conversely, the majority of respondents (95.83 percent) had never taken part in training programs, and an equally significant portion (90.0%) had never been present at mango festivals. Similarly, a significant majority (89.16%) affirmed that they had never participated in field days, exposure visits, or study tours (80.0%), which were sponsored by diverse extension organizations. Remarkably, not a single respondent had attended any mango workshops.

Table 1: Distribution of the respondents according to their frequency of participation in different extension activities.

Sl. No.	Extension activities	Frequency of participation		
		Always	Sometimes	Never
1.	Group discussions	14 (11.66)	101 (84.16)	5 (4.16)
2.	Trainings	00 (0.0)	5 (4.16)	115 (95.83)
3.	Frontline demonstrations	08 (6.66)	102 (85.00)	10 (8.33)
4.	Workshops	00 (0.0)	00 (0.0)	120 (100.0)
5.	Farmers mela/Rally	21 (17.50)	81 (67.50)	18 (15.00)
6.	Field day	03 (2.50)	10 (8.33)	107 (89.16)
7.	Mango festival/Exhibition	00 (00)	12 (10)	108 (90)
8.	Exposure visits/Study tour	5 (4.16)	19 (15.83)	96 (80.00)

Farmer's intention regarding pesticides application in mango

Various dimensions of the extended theory of planned behavior were assessed using scales previously developed by researchers. Subsequently, the gathered data underwent analysis and is displayed in Table 2.

Table 2: Distribution of the respondents according to their response to constructs under extended TPB

Sl. No	Particular	Frequency	Percentage
a.	**Intention (I)**		
i.	Low (Up to 5.75)	22	18.34
ii.	Medium (5.76 to 16.25)	68	56.66
iii.	High (16.26 and above)	30	25.00
	Mean= 11, Max= 20, Min= 5, SD=5.25		
b.	**Attitude (A)**		
i.	Unfavourable (Up to 6.42)	20	16.67
ii.	Neutral (6.43 to 16.44)	79	65.83
iii.	Favourable (16.45 and above)	21	17.50
	Mean=11.43, Max= 20, Min=5, SD=5.01		
c.	**Subjective Norms (SN)**		
i.	Very good (Up to 2.36)	12	10.00
ii.	Good (2.36 to 13.92)	85	70.83
iii.	Average (13.93 and above)	23	19.17
	Mean= 8.14, Max= 20, Min= 5, SD=5.78		
d.	**Perceived behavioural control (PBC)**		
i.	Very good (Up to 5.36)	40	33.34
ii.	Good (5.37 to 16.92)	42	35.00
iii.	Average (16.93 and above)	38	31.66
	Mean= 11.14, Max= 20, Min= 5, SD=5.78		
e.	**Moral Norms (MN)**		
i.	Very good (Up to 9.32)	24	20.00
ii.	Good (9.33 to 19.6)	62	51.66
iii.	Average (19.7 and above)	34	28.34
	Mean= 14.46, Max= 25, Min= 5, SD=5.14		
f.	**Risk Perception (RP)**		
i.	Low (Up to 1.78)	17	14.16
ii.	Medium (1.79 to 12.22)	71	59.16
iii.	High (12.23 and above)	32	26.66
	Mean= 7, Max= 15, Min= 5, SD=5.22		
g.	**Pesticide Knowledge (PK)**		
i.	Low (Up to 6)	26	21.66
ii.	Medium (7 to 18)	70	58.34
iii.	High (18 and above)	24	20.00
	Mean= 12, Max= 20, Min= 5, SD=6		

The data presented in Table 2 clearly indicates that a significant portion (56.66 percent) of mango orchardists exhibited a 'medium' level of intention with regards to pesticide application in mango cultivation. Following this, 25.00 percent and 18.34 percent of respondents fell into the 'high' and 'low' categories of intention, respectively. In terms of attitude, the majority (65.83 percent) of respondents demonstrated a 'neutral' stance. Additionally, 17.50 percent and 16.67 percent of respondents were categorized as having a 'favourable' and 'unfavourable' attitude, respectively.

In terms of subjective norms, it was observed that 70.83 percent of the respondents fell into the 'good' category, with 19.17 percent and 10 percent categorized as 'average' and 'very good' respectively. Moving to the construct of perceived behavioral control, 35.00 percent of the respondents were classified as 'good,' while 31.66 percent and 33.34 percent were distributed into the 'very good' and 'average' categories in terms of perceived behavioral control concerning the application of pesticides. Similarly, 51.66 percent of the respondents exhibited 'good' moral norms, while 28.34 percent and 20.00 percent displayed 'average' and 'very good' moral norms when it came to applying pesticides in mango cultivation. Furthermore, a significant percentage (59.16 percent) of respondents reported a 'medium' level of risk perception, whereas 26.66 percent and 14.16 percent acknowledged 'high' and 'low' levels of risk perception respectively. In terms of pesticide knowledge, the majority (58.34 percent) of respondents expressed a 'medium' level of understanding, while 21.66 percent and 20 percent possessed 'low' and 'high' levels of knowledge respectively, regarding pesticide application in mango farming.

Consequently, it can be inferred that a considerable portion of mango orchardists held a 'medium to high' level of intention regarding the application of pesticides in mango cultivation. Their attitudes toward pesticide usage for pest management in commercial mango production ranged from 'neutral to favorable.' In addition, they perceived a 'medium to high' level of risk associated with pesticide application in mango farming, which might be attributed to the prevalence of pests and insects, possibly linked to climatic variations.

Addressing pest issues through the use of insecticides emerged as a challenging endeavour for most individuals. Nonetheless, the judicious and necessity-driven application of pesticides in mango cultivation was strongly advocated. Furthermore, the majority of mango orchardists demonstrated a 'medium' level of perceived behavioral control in the context of pesticide application on mangoes. They also exhibited 'good' moral standards and subjective norms concerning pesticide use in mango cultivation. However, their knowledge regarding the appropriate application of pesticides to mangoes ranged from medium to limited.

Conclusions and implications

The study revealed that a significant proportion of respondents have been intermittently engaging in various agricultural activities such as frontline demonstrations, group

discussions, and attending farmers' melas/rallies. However, there appears to be a considerable lack of participation in formal training programs, mango festivals, field days, exposure visits, study tours, and workshops. This implies the need for a more concerted effort by extension organizations and stakeholders to bridge this gap in terms of knowledge dissemination and skill enhancement opportunities. Turning to the intention, attitude, subjective norms, perceived behavioral control, risk perception, and pesticide knowledge aspects of pesticide application, it is evident that mango orchardists possess a varied spectrum of sentiments and understandings. While a substantial percentage exhibit a 'medium' level of intention and a 'neutral' attitude towards pesticide usage, a notable percentage leans towards 'high' intention and 'favorable' attitude. This points towards a diversity of views and readiness for pesticide use, necessitating tailored interventions based on individual orientations. The positive inclination towards 'good' moral norms and 'medium' to 'high' perceived behavioral control augurs well for fostering responsible and sustainable pesticide practices among mango growers. However, the gap in knowledge levels regarding appropriate pesticide application methods underscores the importance of targeted training and educational programs. Moreover, the recognition of a 'medium to high' level of risk perception suggests an awareness of potential hazards, signalling the need for strategies to mitigate these risks through informed decision-making and effective pest management strategies. Implications arising from these findings are multifaceted. Firstly, there is a pressing need for extension services and agricultural agencies to develop and promote training programs, workshops, and exposure opportunities for mango orchardists to enhance their knowledge and skills in effective pesticide use and integrated pest management techniques. Such initiatives can bridge the gap between intention and knowledge, enabling more informed and responsible pesticide application practices. Additionally, efforts should be directed towards addressing the challenges associated with pest control in the face of climatic variability. Promoting sustainable and environmentally friendly pest management practices, alongside the prudent use of pesticides, can contribute to mitigating the adverse impacts of climate change on mango cultivation.

Furthermore, considering the diversity in attitudes, intentions, and perceptions among mango orchardists, extension programs should adopt a tailored approach that considers the specific contexts, concerns, and motivations of individual farmers. This can facilitate the adoption of responsible pesticide practices while respecting varying viewpoints. The study highlights both the opportunities and challenges in promoting responsible pesticide use in mango cultivation. By addressing knowledge gaps, facilitating skill development, and tailoring interventions to individual needs, stakeholders can contribute to the development of a more sustainable and informed approach to pesticide application among mango orchardists.

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