Research Article

The Level of Knowledge, Attitude and Practice Toward Organic Fertilizer Adoption among Almond Smallholder Farmers in Uruzgan, Afghanistan

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Abstract | This study examined the level of knowledge, attitude, and practice toward organic fertilizer adoption in Uruzgan, Afghanistan. A total of 116 structured questionnaires were distributed to almond smallholder farmers in the Tarin Kowt district. The results revealed a medium level of knowledge and attitude, and a high level of practice toward organic fertilizer adoption among the almond smallholder farmers. The finding showed that 97.4% of the farmers used cow manure and 20.7% used poultry manure. About 62.9% of the farmers used 0.67-1.08 tons of organic fertilizer per acre and all (100%) farmers used it in the fall season. The result further showed that friends, family members and radio are the main sources of information. The major problems limiting almond production were pests and disease, limited access to certified almonds varieties, limited access to organic fertilizers, lack of market availability for almonds and limited access to extension services. This research provides indicators of organic and inorganic fertilizer use, as well as insights for policymakers to better consider the sustainable application of organic fertilizer and its adoption among farmers in order to achieve sustainable development.

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Introduction

In order to address the issues of insufficient food supply to meet the need of the nation's ever-growing population, the adoption of organic fertilizer is inevitable. This will lead to an increase in crop and animal production through the use of synthetic fertilizers and other agrochemicals. The use of both chemical and organic fertilizers in crop cultivation is necessary in order to maintain the nutrient balance in the soil (Iqbal *et al*., 2014). Nevertheless, a number of side effects from the use of synthetic fertilizers and other agro-chemicals have been recorded that led to the widespread application and the endorsement of organic fertilizers and organic farming at large (Atoma *et al*., 2020).

Organic fertilizer has great potential because it is multifunctional and offers economic, environmental, and social benefits. It contributes to improving livelihoods, food security, resilience to climate change, increasing yields, mitigating financial risks, creating market opportunities, improving health and the environment, and combating desertification, among other numerous benefits (Terdoo and Adekola, 2014; Diallo *et al*., 2020).

However, despite the great potentials of organic cultivation in improving soil, environmental and human health as well as improving farmers' income, the adoption rate of organic fertilizer is slow with the major factor behind this reality being farmers' poor knowledge about organic cultivation (Farouque and Sarker, 2018). In addition, the current low agricultural productivity is mainly a result of low soil fertility combined with other independent factors such as inadequate input supply, e.g. low-quality seeds, lack of techniques and knowledge, inefficient management, labour shortage and poor infrastructure (Neuhoff *et al*., 2014).

The success of organic fertilizer adoption in growing crops is dependent on several factors, including farmers' awareness of environmental benefits and knowledge about organic fertilizer (Thapa and Rattanasuteerakul, 2011). Farmers must also demonstrate an understanding of the principles of soil quality improvement and how the use of organic fertilizers promotes productive and environmentally friendly agriculture (Dhar *et al*., 2018). In fact, organic fertilizer is knowledge-intensive and requires regular communications between extension officers/agents and farmers (Sodjinou *et al*., 2015). This is why a functional extension system is critical for distributing information and educating farmers on the technical aspects of organic farming and open discussion forum (Suvedi *et al*., 2017).

Attitude is another essential facet in addition to the knowledge that has an impact on farmers' behavioural adoption of organic fertilizer practices. David and Ardiansyah (2017), for instance, highlighted the importance of farmers' attitudes as the driving force behind the conversion to organic farming. In another discovery, Marsh *et al*. (2017) noted farmers changing attitude toward organic fertilizer practices as they seek a more environmentally friendly approach to cultivate organic crops i.e., reduced tillage and continuous use of poultry litter and other manures. Organic fertilizer practices, as described by Alyokhin *et al*. (2005), may help plants maintain a healthy nutritional balance and enhance their ability to withstand and tolerate herbivorous insects. The researchers further emphasized that farmers increasingly preferred organic fertilizer application since it is less susceptible to pest attack, which leads to farmers adopting the agronomic practice.

The KAP (knowledge, attitude and practice) is a behavioural intervention theory where knowledge is referred to as understanding any given topic, attitude as the feeling toward it along with predefined opinions and practice as to which people demonstrate knowledge and attitude through actions (Kaliyaperumal, 2004; Wang *et al*., 2019). The application of KAP in research has proven to be a valuable tool in examining the relationship between knowledge and attitudes or practices behaviour to understand the public's level of awareness about a particular issue or topic (Puspitasari *et al*., 2020; Lee *et al*., 2021). In the context of agricultural production, González-Morales *et al*. (2018) demonstrated the use of KAP in research in investigating the community's understanding of soil erosion. Khatun and Rahman (2020) also used the KAP to elucidate current farming practices adopted by farmers and their perspectives on the quality of crop production.

Hence, the present study aims to determine the level of knowledge, attitude, and practice toward organic fertilizer adoption among almond smallholder farmers and to determine the major problems faced by almond smallholder farmers in almond production in Uruzgan, Afghanistan. Specifically, the study sought out to address the following objectives:

1. To examine the level of knowledge, attitude, and practice toward organic fertilizer adoption among almond smallholder farmers in Uruzgan, Afghanistan.
2. To determine the major problems of almond

smallholder farmers in almond production in Uruzgan, Afghanistan.

Materials and Methods

Study area

The Uruzgan province lies in south-central Afghanistan, covering 11,473.7 km^2 of the total land area of the country. It has seven administrative districts: Tarin Kowt (the center of the province), Dehrawod, Chora, Charchino, Gizab Chinartu, and Khas Uruzgan. Some mountain passes range in elevation from 1460 m to 2500 m. The climate of the area is subtropical, continental, and the actual weather depends on the elevation of the mountainous terrain, with an average precipitation of 200–600 mm per year (Department of Agriculture, 2019).

Agriculture and animal husbandry are the key economic activities. About 51,127 ha of land are irrigated, 1647 ha are rain-fed, and 15,8827 ha are non-arable land. Most of the land has potential for irrigation, largely thanks to the rivers that cross all districts. The population of the province recorded in 2018 was 420,964. Just over 3.5% of the population lives in the main towns of Tarin Kowt, Dehrawod, Khas Uruzgan and Gizab. Outside the cities the population lives in small (family) villages along the rivers and about 80% of the population work in agriculture (Department of Agriculture, 2019). A wide range of agricultural products are produced, such as figs, pomegranates, almonds, wheat, maize, etc. The Tarin Kowt district was specifically chosen as the location of the study because of the high almond production.

Data collection

The study employed primary data collected using a multi-stage sampling approach. First, the Tarin Kowt district was purposively selected due to the high almond production, followed by a purposive selection of five villages in the district. A registered list comprising 164 almond smallholder farmers was obtained from the Department of Agriculture. The sample size was calculated using the formula, $n= N/1+N(e)^2$ by Yamane (1967), where n denotes sample size, N is the population, and e represents the level of precision. Using the confidence of 95% and a margin of error of 5% (0.05) yielded a total of 116 almond smallholder farmers being surveyed. Structured questionnaires were used to collect the information, with face to face interviews being conducted with the farmers.

Data analysis

The data were cleaned, coded and then subjected to analysis using Statistical Package for Social Science (SPSS) software version 26. Descriptive statistics were applied, and all quantitative variables were expressed as means, percentages, and standard deviations.

Results and Discussion

Socio-demographic profile of the respondents

A total of 116 almonds smallholder farmers participated in this study as shown in Table 1. The result indicated that most of the almond smallholder farmers (94.0%) used both organic and inorganic fertilizers. The result showed that almost all of the farmers are using combined fertilizer (animal manure and chemical fertilizer) as their primary practices. Yasar *et al*. (2017) found that 46.7% of the farmers involved in their study were using chemical fertilizer with animal manure. Most of the sampled farmers, with 93.1%, were married. In terms of level of education, most of the almond farmers (43.1%) are illiterate, 33.6% have primary school education and 1.7% have university education. The finding of this study indicates that majority of the almond farmers are non-literates, which indicate that the farmers most likely to have limited ability to seek and use information from a variety of sources. Similar findings were reported by Osei *et al*. (2017) where about 38% of the farmers have no formal education.

In terms of distance to extension office, majority of the farmers (78.4%) are located around 1-11 km away from the extension office. Such distance can be considered as relatively near, and it indicates that most farmers can easily benefit from the advice and trainings made available by the extension service department. It was found that the average distance to extension offices was 7.75 km. This indicates that when the distance to extension office increases the farmers will be deprived of the extension programs since longer distance imposes a limitation to them. The finding is in agreement with Suvedi *et al*. (2017) where the farmers with a mean average distance of 12.298 km from extension office are non-participant in extension program. Distance to the extension offices not only limit farmers' participation in the extension activities but also creates difficulties in the

Table 1: *Socio-demographic profile of smallholder farmers (n=116).*

Respondents Profile	Frequency (f)	Percentage (%)	Mean
Smallholder farmers			
Organic farmers	4	3.4	
Inorganic farmers	3	2.6	
Organic and Inorganic farmers	109	94.0	
Marital status			
Single	8	6.9	
Married	108	93.1	
Level of education			
Illiterate	50	43.1	
Primary school	39	33.6	
Secondary school	18	15.5	
High school	2	1.7	
Vocational	5	4.3	
Bachelor	2	1.7	
Distance to extension office (km)			7.75
1-11	91	78.4	
12-21	25	21.5	
Income			
Below 50000 AFN	10	8.6	
50000-100000 AFN	6	5.2	
100000-150000 AFN	48	41.4	
150000-200000 AFN	18	15.5	
Above 200000 AFN	34	29.3	
Family size (members)			13
3-11	40	34.5	
12-20	67	57.8	
21-30	9	7.9	
Workload			
High	24	20.7	
Average	58	50.0	
Low	15	12.9	
Manageable	19	16.4	
Farm size			
1 Jerib	4	3.4	
1-3 Jerib	19	16.4	
4-6 Jerib	51	44.0	
7-10 Jerib	24	20.7	
11-14 Jerib	10	8.6	
15-18	4	3.4	
Above 20	4	3.4	
Produced almond last year			
Yes	110	94.8	
No	6	5.2	
Yield of almonds last year (yield by kg)			1109.37
113-1876	104	90	
1877-3640	9	7.8	
>5400	3	2.7	

Source: *Survey, 2021, 5 Jerib equals to 1 hectare, USD 1= 78 AFN.*

transportation of the almond produced to the nearest markets (Aryal *et al*., 2018). Around 41.4% earned 100,000-150,000 Afghani (AFN) in annual income, which is generally low compared to labors working in other sectors. This is supported by UNODC (2004) findings on the average annual income where non-poppy farmers typically earned US$670, which is equivalent to 52,260 AFN.

In terms of family size, more than half (57.8%) of the farmers have 12-20 members in each family, while 7.9% had 21-30 members in each family. According to Merrill *et al*. (2006), the extended size of family serves as a support system, both economically and socially, accommodating three to four generations including the male head of family and his wife, his brothers, several sons and their families, cousins with their families, as well as all unmarried and widowed female, and elderly grandparents.

Half of the respondents (50.0%) described the workload as average, while 20.7% and 12.9% were rated high and low, respectively. This finding implies that due to the respondent's average workload they can improve their production by using more advanced methods on their farms. In terms of farm size, about 44.0% of almond farmers have 4-6 jerib farmland and very few (3.4%) have more than 20 jerib farm. This finding indicates that most of the almond smallholder farmers operate an average farmland size of about 1 ha, which is small. Additionally, it can be implied that farmers can conveniently utilize organic fertilizers as well as other adoption of new technologies. Findings on the size of farmland are in line with the World Bank (2011) that small-scale producers have farm sizes of 2–5 jeribs or about 0.5–1.0 ha, with grapes, almonds, other types of vegetables and wheat as the commonly cultivated crop types. Large-scale producers, on the other hand, have farmland of 5 to10 jeribs or 1–2 ha, and their production is more intensive. The fact is that the report covered all of Afghanistan while this study merely covered the Uruzgan province.

Around 94.8% of the almond farmers had almond production last year while only 5.2% have no almond production due to their almond tree yet to attain physiological maturity. Of the almond smallholder farmers who produced the almonds last year, the majority (90%) had 113-1,876 kg yields, followed by 2.7% of the farmers who had 3,641-5,400 kg yield last year. According to the FAOSTAT, the average yield of the farmers recorded in 2019 was 13,083 kg/ha, implying that the almond farmers in this study had substantially low productivity, with an average of 1,109.37 kg. Nevertheless, it should be noted that the huge disparity can be attributed to the statistics reported by FAOSTAT encompasses the entire country of Afghanistan whereas the findings of this study only covered the Urozgan province.

Types of organic fertilizers

The types of organic fertilizers utilized by the almond farmers who participated in this study are presented in Table 2. Most of the farmers, with 97.4% are using cow manure and very few (2.6%) are using municipality waste in their farmland. The finding is similar to Muhereza *et al.* (2014) who found that all 100% of the farmers in the study used cow manure. Increased crop yields by 52.5%, a decrease in diseases by 30%, and reduced cost of manure was the main advantages of using cow dung 37.5%, and the researcher added that the least advantage was biogas as a source of energy 7.5 %.

Table 2: *The types of organic fertilizer utilized by almonds farmers (n=116).*

Organic fertilizer used	Frequency (f)	Percentage (%)
Animal manure (cow manure)	113	97.4
Poultry manure	24	20.7
Green manure	13	11.2
Sheep manure	13	11.2
Municipality waste	3	2.6

Source: *Survey 2021, Multiple choice question.*

Table 3: *Organic fertilizer amount/acre, and time of application (n=116).*

Organic fertilizer amount/acre			Time of application of organic fertilizer		
Amount/ton	Frequency (f)	Percentage (%)	Season	Frequency (f)	Percentage (%)
0.25-0.66	32	27.6	Fall	116	100
0.67-1.08	73	62.9			
1.09-1.5	11	9.5			

Source: *Survey, 2021.*

The result presented in Table 3 pertains to the amount per acre and time of organic fertilizers application. In total, 62.9% of the sampled farmers are using 0.67-1.08 tons per acre and all (100%) of the farmers had used the organic fertilizer in the fall season. The finding is in agreement with Shaibur *et al.* (2021) who found that for one acre of land to be used for the cultivation of grass, such as alfalfa, napier, etc. 2.2 tons/acre of organic fertilizer are needed and added that 200 Kg of chemical fertilizer per acre is saved by using around 2.2 tons of compost fertilizer.

Sources of information

Presented in Table 4 are the sources of information obtained by the respondents related to the fertilizer use for almond crops. About 93.1% of the farmers benefited from farmers to farmers interaction, 74.1% of the farmers obtained information from friends, 69.8% of the farmers utilized the information from family members, and 65.5% farmers benefited from the radio. As the findings revealed, interaction with other farmers emerged as the primary source of knowledge obtained by the farmers, indicating that farmers have fostered an existing good communication and interrelationship with other farmers. However, the farmers are deprived of technical knowledge and support from governmental or non-governmental organizations. A similar finding is also reported by Opara (2008) in terms of the proportion of source of knowledge where 71.2% indicated fellow farmers, 63.2% obtained information from the radio. Osei *et al.* (2017) stated that farmers are trying to acquire information related to fertilizer application using radio (89.0%), friends 64.0%, and 27.0% of the farmers receiving information from other farmers as a source of information. Kavi *et al.* (2018) noted that the source of agriculture information mostly used by the urban mushroom farmers is co-farmers. Therefore, it can be inferred that the primary criteria for information sources are easy to access and availability. Farmer to farmer information is an important source because interpersonal communication provides a strong built-in feedback mechanism.

Table 4: *Distribution of sources of information (n=116).*

Sources of information	Frequency (f)	Percentage (%)
Radio	76	65.5
TV	33	28.4
Internet	5	4.3
Family members	81	69.8
Friends	86	74.1
DOA (Department of agriculture)	43	37.1
NGO (Non-governmental organizations)	18	15.5
Other farmers	108	93.1

Source: *Survey, 2021 Multiple choice question.*

Table 5: *Distribution of problems of almond small holder farmers (n=116).*

Problems	Frequency (f)	Percentage (%)	Mean	Standard deviation	Ranks
Pest and disease	87	75.0	1.250	0.434	1
Limited certified varieties	60	51.7	1.482	0.501	2
Limited access to organic fertilizers	59	50.9	1.491	0.502	3
Unavailability of market	55	47.4	1.525	0.501	4
Limited access to extension services	51	44.0	1.560	0.498	5
No credit	48	41.4	1.586	0.494	6
Limited developed machinery	47	40.5	1.594	0.493	7
Weak extension workers	45	38.8	1.612	0.489	8
Transportation problems	45	38.8	1.612	0.489	9
Cheap prices of (Almonds)	42	36.2	1.637	0.482	10
Public unawareness	25	21.6	1.784	0.412	11
Limited certified medicine	25	21.6	1.784	0.412	12
Harvesting problem	15	12.9	1.870	0.337	13

Source: *Survey, 2021.*

Major almond farm problems in Uruzgan Afghanistan

The result presented in Table 5 revealed that the majority of almond smallholder farmers (75.0%) faced with different kinds of pests and diseases. It is followed by 51.7% of the farmers faced with a scarcity of certified varieties of almonds. Similar findings were also reported by Tripathi *et al.* (2020) that majority of the cucurbits farmers (73.0%) faced pests and diseases problems, limited certified seeds with 21.0%, and marketing problems with 5.0%. The result further showed that half of the farmers (50.9%) had no access to organic fertilizers. The finding is in line with Phuong *et al.* (2006) who reported that the increased application of inorganic fertilizer is due to a lack of organic fertilizer. Nearly half (47.4%) of the farmers claimed that the unavailability of the market is a critical problem, some of the farmers (44.0%) cited limited extension services, and 41.4% had no access to credit.

Level of knowledge, attitude and practice

The responses of the almonds smallholder farmers using five points rating Likert scale questions are presented in Table 6. The result shows that 44% of the farmers fall into the category of medium level of knowledge. As farmers recorded a medium level of knowledge toward organic fertilizer adoption, indicating that improved knowledge on the use of organic fertilizer is helpful to increase farmers' awareness of the benefits of improving crop productivity and is safe for the environment. The finding is similar to the work of Iqbal *et al.* (2014) where they found more than half of the farmers had a medium level of knowledge of organic and inorganic fertilizers. Oremo *et al.* (2019) also reported that most respondents in the Tsavo sub-catchment had average knowledge of the integrated water resource management principles, and a medium level of attitude.

Table 6: *Level of knowledge, attitude and practice of almond smallholder farmer.*

Factors	Level of factors	Score	Frequency (f)	Percent-age (%)
Knowledge	Low	3.48-3.98	17	14.6
	Medium	3.99-4.99	51	44.0
	High	4.50-5.00	48	41.4
Attitude	Low	1.91-2.79	12	10.3
	Medium	2.80-3.67	55	47.4
	High	3.68-5.00	49	42.3
Practice	Low	1.80-2.86	1	0.9
	Medium	2.87-3.93	11	9.5
	High	3.94-5.00	104	89.6
Organic fertilizer adoption	Low	1.20-2.46	1	0.9
	Medium	2.47-3.73	25	21.6
	High	3.74-5.00	90	77.5

It is followed by attitude, with nearly half of the respondents (47.4%) categorized as demonstrating a medium level of attitude toward organic fertilizer adoption. The finding is further supported by Muralikrishnan and Philip (2018) who found that farmers had a medium favourable attitude toward eco-friendly farming practices. Contrary, Laor *et al.* (2018) found that the respondents had the least positive attitude level toward municipal solid waste management.

A vast majority of the almond smallholder farmers (89.6%) fall into the category of a high level of practice toward organic fertilizer adoption. As the result showed that most of the respondents had a high level of practice in organic fertilizer adoption. Indeed, better practices of organic fertilizer application among almond smallholder farmers will result in a higher adoption rate of agronomic practices. The finding of the study is in line with the work of Nelson *et al.* (2019) in which they found that more than half of the farmers are practising organic farming technologies (fertilizer, and pesticides etc.) and added that positive attitude coupled with knowledge would lead to the enhanced practice of organic farming technologies.

In terms of organic fertilizer adoption, most of the almond farmers (77.5%) are categorized as high level of organic fertilizer adoption. According to the respondents' perspectives, adopting organic fertilizer is an essential step because it is free of dangerous chemicals, manufactured locally, requires little financial input, keeps soil fertile, is easily biodegradable, and does not pollute the environment. The finding of this study is in agreement with Kassie *et al.* (2009), where the use of organic fertilizer can lead to significantly higher yields. This means that using organic technology has numerous advantages, including lower production costs, environmental benefits, and results in greater yields.

This study has managed to underline the link between knowledge, attitude, and practice toward organic fertilizer. That is, a better understanding of organic fertilizer is a prerequisite to ensuring long-term soil productivity and high almond productivity. Policymakers and other organizations may utilize this information to create confidence and support for fertilizer application policies and sustainable practices. A reasonable starting point for any organic technologies intervention would be to raise knowledge and comprehension of fertilizer policies, improve farmers' participation in organic fertilizer preparation, and apply decision-making processes.

Conclusions and Recommendations

This study showed that almond smallholder farmers in the Uruzgan province had a medium level of knowledge and attitude and a high level of practice of organic fertilizer adoption. A number of problems have been identified that limit the almond farmers' operation and productivity at the farm, with pests and diseases as the major ones. Others include limited access to certified almond varieties, limited access to organic fertilizers, lack of market availability for almonds and limited access to extension services. All of these emphasize the importance of making the provision of quality extension services available to the farmers, particularly by the Department of Agriculture and pertinent organizations involved in agricultural crop production. Such services should also include but are not limited to, practical training on organic fertilizer and dissemination of other eco-friendly technologies that can further enhance the rate of organic fertilizer adoption among the farmers, as well as other activities that can help empower the farmers to improve almond productivity, improve the household economy, help protect the ecosystem, etc.

Finding ways to resolve the issues on and off the farm require wholesome participation, including from non-governmental organizations as well as the public. As discovered from this study, there is a need to address the pest and disease problem faced by the almond farmers, which presents an opportunity for scientists to undertake the research on it. Most importantly, the main goal of organic fertilizer application is to increase almond yield, prevent soil degradation, and increase smallholder farmers' income.

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Novelty Statement

Knowledge and practice found the most important factors in influencing organic fertilizer adoption among smallholder farmers and the pests and diseases are the most crucial problems in almond production in Urozgan, Afghanistan.

Author's Contribution

Abdul Hadi Wasil: Conceptualization, resources, data curation, writing-original draft preparation, writing-review and editing, investigation, funding ac-

quisition
Jasmin Arif Shah: Conceptualization, data curation, investigation, writing-original draft preparation, writing-review and editing, resources, supervision
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Sardar M. Hashimi: Conceptualization, data curation, resources, writing-original draft preparation, investigation
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All authors have read and agreed to the published version of the manuscript.

Conflicts of interest
The authors have declared no conflict of interest.

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