

Training needs assessment of olive growers for the enhancement of olive production in District Attock, Punjab, Pakistan

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Abstract

Olive production has considerable potential to enhance farm income and contribute to Pakistan's domestic edible-oil supply. However, the substantial gap between the potential and actual yield of olive orchards indicates the need to strengthen farmers' knowledge and technical skills. Therefore, this study was conducted to assess the training needs of olive farmers to increase olive production in two tehsils; Pindi Gheb and Jand of district Attock, Punjab, Pakistan. A descriptive and exploratory survey research design was employed, and data were collected from 130 olive growers in District Attock, Punjab, Pakistan, selected through a multistage sampling technique. A very low technical knowledge was found in olive farmers for fertilizer selection. Farmers revealed that they needed training in the area of factors affecting water requirement and reasons for prevalence of insect pests and diseases. Most of the farmers (88.5% & 100%) were well aware of facilities provided by extension field staff in their areas. The use of lectures, farm visits and instruction materials by extension field staff were highly efficient training methods and these methods were similarly ranked

according to their effectiveness as 1st, 2nd, and 3rd with mean values of 3.07, 2.64 and 2.09, respectively. Over the past year, a large number of farmers (53.8%) participated in only one training. The key qualities of a master trainer were professionalism, in-depth technical knowledge, and self-confidence, which ranked first, second, and third, respectively, with mean scores of 3.51, 3.46, and 3.45. The main qualities of the training material were clear, useful and timely provided and these qualities were ranked as 1st, 2nd and 3rd with mean values of 3.83, 3.71 and 3.58. Similarly, for the establishment of olive farms, it was observed that many farmers needed training in the fields including planting methods (87.7%), irrigation applications (86.9%), maintenance of plant density (87.7%), fertilizer application (88.5%), insect pest and disease management (85.4%). The findings suggest the need for targeted and demand-driven training programs focusing on technical knowledge, practical skills, and effective orchard management practices. © 2026 The Author(s)

Keywords: Agricultural extension, Capacity building, District Attock, *Olea europaea*, Technology adoption, Training needs assessment

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Introduction

Olive (*Olea europaea* L.) belongs to Oleaceae family. It originates from Asia and holds the distinction of being one of the first trees deliberately cultivated by man. It has been cultivating for centuries for its medicinal and nutritional value. It is well known all over the world having valuable commercial role due to dietary as well as healing benefits gained from its ripe oil (Khaliq et al., 2020). It is a special long-lived evergreen tree with full of versatile characteristics. It is a subtropical plant that needs chilling for the fruiting stage. Hence, the efficiency of olive cultivars i.e., fruit yield, fruit size, oil percentage and quality may vary with location to location (Torres et al., 2017). It is native to the Mediterranean area. Currently, olives are cultivated all over the globe, yet the Mediterranean region leads with 98% of the world's total olive production (Ghanbari et al., 2012). As a horticultural crop, olives have a special place in production of edible oil all over the world (Torres et al., 2017). According to

estimates from the International Olive Council, 90 percent of the olives currently being harvested are destined for oil production. It is mostly grown in arid and semi-arid regions of the world. There are about 2500 olive varieties grown worldwide, 250 of them are characterized as commercial varieties by International Olive Council (Olive Oil Times, 2020). However, olive production faces significant risks including climate fluctuations, environmental challenges, and the threat of pests and diseases which affect its health, yield and oil quality. Olive beetle was first reported in Iran in 2004 and is now the most important olive worm (Allahyari et al., 2017).

Olive cultivation has emerged as an important component of Pakistan's agricultural economy. The crop is well adapted to marginal and degraded lands where many conventional crops cannot be grown successfully, thereby enhancing the productive use and economic value of such areas. To promote this sector, the Government of Pakistan, with financial support from the Government of Italy under the Debt Swap Agreement, launched the project

"Promotion of Olive Cultivation for Economic Development and Poverty Alleviation." The project has been implemented through the Pakistan Agricultural Research Council (PARC) in collaboration with provincial coordination networks across Punjab, Khyber Pakhtunkhwa, Balochistan, and the former Federally Administered Tribal Areas (FATA) (Jahangir's World Times, 2020). Olive is commonly recognized in Pakistan by several regional names, including "Zytoon" in Urdu, "Khat" in Brahavi, "Showan" in Pashto, and "Kahoo" in Punjabi and Saraiki. Owing to its drought tolerance and environmental adaptability, the olive tree is considered a suitable crop for cultivation in water-limited regions (Rapoport, 2014). Pakistan possesses considerable potential for expanding olive production. Suitable growing areas include Attock, Chakwal, Rawalpindi, Islamabad, Malakand, Kohat, Mardan, Cherat, Hazara, Zhob, Killa Saifullah, Khuzdar, Musakhail, Sinjavi, Barkhan, and Azad Jammu and Kashmir. It has been estimated that these regions contain approximately 45 million olive trees, highlighting the country's substantial production potential (Khaliq et al., 2020).

The increasing population of Pakistan has led to a steady rise in the demand for edible oils, including olive oil. Historically, domestic requirements have been met largely through imports from major olive-producing countries such as Spain and Italy. To reduce dependence on imported edible oils, Pakistan has prioritized the commercial cultivation of olive in arid and semi-arid regions, along with the development of local olive oil extraction facilities. According to a Geographic Information System (GIS)-based assessment conducted by the Pakistan Agricultural Research Council, nearly 15.44 million hectares of cultivated land in the Potohar region of Punjab, Khyber Pakhtunkhwa, Balochistan, and the former FATA have been identified as suitable for olive cultivation (Pakistan Agricultural Research Council [PARC], 2018). The country's diverse agro-climatic conditions further support the expansion of olive production across multiple ecological zones. Olives thrive in low humidity and warm summers with warm winters. At least two months of winter freezing is required for flower buds to start. However, it cannot withstand the freezing temperatures, which eventually lead to plant extinction. It can be cultivated effectively in areas with annual rainfall of 800-900 mm. It can withstand minor soil conditions, but dehydration conditions are detrimental to plant strength (Munir, 2009).

Pakistan currently produces some 1400 tons of olive oil which is predicted to increase 1600 tons by 2027 (GoP, 2019). Pakistan possesses a substantial population of olive trees, with cultivation potential concentrated primarily in the country's arid and mountainous regions. Despite the favorable ecological conditions, the expansion of olive cultivation has been constrained by several factors, including the limited availability of planting material, inadequate access to superior genetic resources, poor survival and establishment of grafted plants, and insufficient awareness among farmers regarding the crop's economic benefits. These challenges have slowed the widespread adoption of olive cultivation. At present, conventional oilseed crops such as sunflower, mustard, groundnut, and maize remain the principal sources of edible oil in Pakistan. However, domestic production from

these crops is insufficient to satisfy the increasing national demand, resulting in a heavy reliance on imported edible oil and the expenditure of substantial foreign exchange each year (Iqbal et al., 2019).

Although olive cultivation has a relatively short history in Pakistan, its importance has increased considerably over the past decade because of its economic and social benefits. Under the Olive Promotion Project, supported by the Federal Government of Pakistan, more than 3,166 acres in the Potohar region and approximately 2,800 acres outside the Potohar region, comprising about 280,004 olive plants, were brought under cultivation, reflecting the country's growing commitment to expanding olive production (Iqbal et al., 2019). During the past decade, significant efforts have been undertaken by federal and provincial institutions, in collaboration with progressive private growers, to promote olive cultivation in Pakistan. These initiatives have facilitated the introduction of numerous indigenous and exotic olive cultivars from different olive-producing regions of the world. Many of these introduced cultivars have successfully adapted to local environments and are now cultivated across several agro-climatic regions of the country. Large-scale olive plantations have been established in the Potohar region, including Chakwal, Attock, Rawalpindi, and Jhelum, as well as in Quetta and Qila Saifullah in Balochistan, parts of Azad Jammu and Kashmir, and Khyber Pakhtunkhwa, particularly in Swat and Peshawar. As a result of these introduction programs, both genetically characterized and yet-to-be-characterized olive germplasm are currently distributed across diverse ecological zones of Pakistan (Sumrah et al., 2022). Recognizing the region's suitability for olive production, the Government of Punjab has designated the Potohar region as the country's Olive Valley. In addition, several commercial olive orchards have been established in the districts of Chakwal, Rawalpindi, and Attock. Field observations indicate that both local and exotic olive genotypes exhibit satisfactory vegetative growth under Pakistani conditions. However, considerable variation exists among cultivars with respect to fruit yield, oil content, and oil quality, even when grown under similar environmental conditions. Therefore, the systematic collection, conservation, and characterization of olive genetic resources are essential for identifying superior cultivars and supporting scientifically based breeding and cultivation strategies aimed at improving olive production in Pakistan (Iqbal et al., 2019).

Pakistan is the fourth largest importer of edible oil in the world. It imports 90% of the total edible oil to meet the country demand due to which imports bills become huge. Only 10% domestic oil requirement is met with local production (Cultivation Ag, 2026). Olive oil is a high-value product widely appreciated for its nutritional, cosmetic, and industrial uses. While Pakistan previously depended on imported olive oil and related products, domestic production has expanded in recent years, creating new marketing opportunities for local growers and processors. The Barani Agriculture Research Institute (BARI), Chakwal, has played a significant role in this development by establishing approximately 473,265 olive trees and supporting farmers through the Olive Valley Project.

In addition to supplying quality planting material, the institute provides technical guidance on orchard management and facilitates the adoption of water resource development and drip irrigation systems (Juned, 2017). The individual should be good at using modern farming techniques in relation to the needs of the farmers (Munawar & Khalid, 2025).

There is a big difference between the actual production of farmers and the yield obtained. In order to reduce this gap, more concentration should be given to train farmers in various fields of olive cultivation. The farmer training and development program has five phases: need assessment, teaching objectives, planning, implementation and review. To be effective and efficient, all training programs should begin with a needs assessment (Jones, 2023). Training provides respondents with many opportunities to acquire latest information and skills. Training is a form of education that is not for knowledge but to behave in different ways that is to learn a skill (Al-Shadiadeh, 2007). Olive cultivation requires highly experienced and highly focused people to protect the plants. Although there has been little improvement in these areas, farmers need to be trained in the transfer of modern technology to start olive groves. The main factor in low productivity is lack of technical knowledge and expertise. Therefore, considering the potential of olive cultivation to enhance productivity and farm income, and the existing knowledge and skill gaps among growers, the present study was undertaken to systematically assess the training needs of olive farmers in District Attock, Punjab, Pakistan, and to identify priority areas for capacity building and improved adoption of recommended olive production practices.

Materials and Methods

Universe of the study

The study was held in district Attock. District Attock has common boundaries with Chakwal to its South, Mianwali to its South West, Rawalpindi to its East, and Kohat to its West, Nowshera to its North West and Swabi and Haripur to its North. The reason behind selection of district Attock for this study is that it located in Pothohar region and this area is declared as olive valley by Govt of Punjab.

Sampling technique and sample size

District Attock comprises upon 6 tehsils; Attock, Jand, Pindigheb, Fatehjang, Hassan Abdal and Hazro. To select the sample size, multistage sampling technique was used. In the first stage, district Attock was selected. Only two tehsils, namely Jand and Pindi Gheb, were selected from the Attock district through random sampling technique. After that, six union councils (three from each tehsil) were selected randomly. In the second stage, total 26 villages were selected and 5 farmers selected from each village and total number of farmers were 130 (Table 1).

Sampling design

The sampling design for this study involved selecting four villages from each of the four union councils and five villages from each of the remaining two union councils. This approach ensured geographic representation and diversity within the sample, as it included a range of socio-economic and demographic characteristics present across the different union councils. By selecting a proportionate number of villages from two union councils (the aim was to mitigate biases that could arise from overrepresentation or underrepresentation of certain areas. Moreover, more villages from the two particular union councils (Khaur and Langer) were selected as disproportionate sampling where more number of farmers were growing olive. This enabled the researcher with deeper understanding of their distinct characteristics and dynamics, potentially uncovering insights not evident with fewer samples.

Research design

A descriptive and exploratory survey research design was employed to assess the training needs of olive growers in District Attock, Punjab, Pakistan. The research design facilitated the systematic collection of data regarding farmers' perceptions, existing knowledge, skills, and training requirements related to olive production and orchard management.

Dependent variable

Training needs for the enhancement of olive production was the dependent variable.

Independent variables

Farmer's age, education level, size of land holding, income and orchard size of olive were independent variables in this study.

Existing knowledge concerning quality olive production

Normal training needs score

1. High 2. Medium 3. Low

Extent of training need

Normal training needs score

1 to < 1.80 1.81 to < 2.40 2.41 to < 3.00

Data analysis

In this study Statistical Package for Social Sciences (SPSS) software was used for data analysis, frequency, mean, percentage, weighted scores, standard deviation were calculated. To find out relationship between independent (training needs assessment of olive production) and dependent (farmers age, education, size of land holding, income, size of orchard) variables, multiple regression analysis was used.

Table 1 Sampling framework and distribution of sampled farmers in selected tehsils, union councils, and villages of District Attock

District	Tehsils	Union councils	Villages	Farmers
Attock	Pindi Gheb	Maira sharif	Maira sharif, Dhoke Taray Wali, Dhoke Pahar Kheli, Nilhad (4)	20
		Ahmadal	Ahmedal, Pind, Dhoke Shakra, Dhoke Kamial (4)	20
		Khaur	Khaur, Bora, Gujranwal, Ferozwali, Kakial (5)	25
	Jand	Chabb	Chabb, Lakarmar, Dhoke Jumdur, Kanjur (4)	20
		Pind Sultani	Pind Sultani, Domel, Mithial, Basal (4)	20
		Langer	Langer, Kot chaji, Dhak, Darbar, Chura Sharif (5)	25
Total	2	6	26	130

Results

Demographic attributes of the olive farmers

Demographic attributes including age, literacy level, farm size, tenancy status and economic status have a significant influence on the behavior of the olive farmers in terms of various agricultural aspects including the implementation of standard agricultural technologies (Fadare et al., 2014). Data mentioned in Table 2 shows that 14.6% of the olive farmers were between 21 to 35 years of age. However, 36.2% of the olive farmers were laid in age group of 36 to 50 years. While, almost half 49.2% of the olive farmers were above 50 years of age. Keeping in view the importance of education level and its impact on the behavior of the people, the olive farmers were asked about their level of education and five different categories were made in this regard to ensure better collection of data. Those five categories include illiterate, primary, middle, matriculation, and intermediate & above. Data mentioned in Table 2 indicate that only 8.5% of the sampled olive farmers were illiterate. While, 13.1% of the olive farmers had education up to primary level. One-fifth (20%) of the respondents had education at middle level and 26.2% were matriculate. About one third (32.3%) of the sampled olive farmers were educated at intermediate and above level. Farm size is considered as one of the highly important demographic attribute. Farmers having more land holdings are more likely to be progressive (Phambra et al., 2020). Therefore, it was important to discover about the farm size of the olive farmers. Three different categories were made including small size of land holding (less than 5 acres), medium size of land holding (5-25 acres) and large size of land holding (more than 25 acres) for facilitating the process of data collection. Table 2 reveals that a great majority (76.9%) of the sampled olive farmers were large land holder (more than 25 acres). While, only 6.2% of the sampled olive farmers had a small size of land holding less than 5 acres. Around 17% of the respondents had medium size of land holdings (5-25 acres). There are millions of people all over the globe who depend upon the agriculture as a main source of their income and livelihoods. Agriculture farming is multi-dimensional sector in terms of supporting millions of farmers all over the globe to earn their livelihoods (Azam & Shafique, 2017). Due to significance of this attribute, respondents were asked about their sources of income and two different categories were made in this regard considering farming only as a source of income and farming along with other occupations. Data mentioned in Table 2 describes that a majority of the olive farmers (81.5%) were associated with other occupation

along with farming. It was described by 18.5% of the respondents that they were generating their income from farming only. The adoption of advanced agricultural technology by farmers is influenced by their income (Mwangi & Kariuki, 2015). Similarly, Khan (2022) elucidated that there exists a significant correlation between farmers' annual income and their future utilization of mobile phones for accessing agricultural information. To explore this relationship further, farmers were surveyed regarding their income, and summarized responses are presented in Table 2. Table 2 shows that the majority (70%) of the olive farmers had high annual income more than 500,000, while 29.2% had medium annual income 250,000-500,000, and only one respondent had low annual income up to 250,000. In view of the area under olive cultivation, the respondents were categorized into three groups i.e. 0-2 acres, 3-5 acres and 6 acres and above. The data presented in Table 2 shows that majority (92.3%) of olive farmers had orchard size upto 6 acres and above, while 5.4% farmers had orchard size of (3-5) acres and only 2.3% olive farmers had orchard size up to 2 acres. There are three different types of farmers on the basis of tenancy status that include owner, owner-cum tenant and tenant. Owners are those having their own area for the orchard cultivation. Tenants do not have an agricultural land of their own and they borrow it from other to ensure cultivation. While owner-cum tenants have their own land and they also borrow orchard from others (Ali et al., 2022). Table 2 depicts distribution of the respondents according to their tenancy status. Table 2 describes that a majority (92.3%) of the olive farmers were owner and they had their own agriculture land. Only 4.7% olive farmers were owner-cum-tenant and only one farmer was tenant.

Training needs assessment for olive farmers in production technology

Table 3 describes olive farmers' existing knowledge concerning quality olive production. The data illustrate that farmers perceive a minimal need for training regarding orchard size, with a substantial portion (73.1%) indicating it as not needed, yielding a mean value of 2.63 ± 0.66 and ranking 1st in priority. Conversely, there is a higher perceived need for training in planting time and spacing, as evidenced by 50% of respondents indicating it as needed, resulting in a mean value of 2.28 ± 0.65 and ranking 2nd. Moreover, the findings suggest a demand for training in understanding climatic conditions and soil sample analysis, with mean values of 1.90 ± 0.57 and 1.78 ± 0.53 , respectively, ranking 3rd and 4th in priority. These results emphasize the importance of training programs to address

the specific knowledge gaps and requirements of olive farmers in enhancing their production practices.

Table 2 Demographic attributes of the olive farmers (n = 130)

Demographic characteristics	Category	Frequency	Percentage
Age (years)	21–35	19	14.6
	36–50	47	36.2
	Above 50	64	49.2
Education level	Illiterate	11	8.5
	Primary	17	13.1
	Middle	26	20.0
	Matriculation	34	26.2
	Intermediate & above	42	32.3
Farm size	Small (Less than 5 acres)	8	6.2
	Medium (5–25 acres)	22	16.9
	Large (More than 25 acres)	100	76.9
Source of income	Farming only	24	18.5
	Farming & others	106	81.5
Annual income (000 PKR)	Low (Up to 250)	1	0.8
	Medium (250–500)	38	29.2
	High (More than 500)	91	70.0
Orchard size (acres)	Up to 2	3	2.3
	3–5	7	5.4
	6 and above	120	92.3
Tenancy status	Owner	120	92.3
	Owner-cum-tenant	6	4.7
	Tenant	4	3.0

Table 3 Olive farmers' existing knowledge concerning quality olive production

Table 3. Olive farmers' existing knowledge concerning quality olive production										
Indicator concerning quality olive production	Extent of training needs						WS	Mean	S.D.	Rank
	Not needed		Needed		Highly needed					
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%				
Orchard size	95	73.1	22	16.9	13	10.0	342	2.63	.66	1
Planting time & spacing	51	39.2	65	50.0	14	10.8	297	2.28	.65	2
Climatic condition	15	11.5	87	66.9	28	21.5	247	1.90	.57	3
Soil sample analysis	7	5.4	88	67.7	35	26.9	232	1.78	.53	4

f = Frequency; % = Percentage; WS = Weighted score; S.D. = Standard deviation

Training needs of olive farmers with respect to olive production technology

The data in Table 4 represents the assessment of training need of the olive farmers in the selection of varieties. Study outcome declared that majority of the respondents reported that they desperately needed training for selection of the best olive varieties with mean values ($2.13 \pm .75$) and ranked 1st. While olive farmers preference in knowledge about diseases/pests and resistant varieties ($2.09 \pm .69$) and knowledge about best varieties ($2.05 \pm .69$) were ranked as 2nd and 3rd, respectively.

Training needs of olive farmers with respect to fertilizer application

Sufficient knowledge about application of fertilizer is essential for farmers to produce quality seed, because fertilizer is a main input for healthier production of crop (Pan & Zhang, 2018). The well-timed and balanced use of fertilizer raises the yield. Fertilizer apply and management is of key value in irrigated production systems since yield potential is high, leading to an extensive removal of essential nutrients. As a result, the farmers were inquired concerning the use of organic manure, selection of fertilizer used, technique of fertilizer application and their

answers are given in Table 5. It represents the need for training of olive farmers in selection of fertilizer and fertilizer application. Mean values indicate that olive farmers needed more training in the selection of fertilizer ($2.02 \pm .66$) ranked first. The results of study revealed that the majority of respondents (56.2%) stated that they needed training in the field of fertilizer selection for olives. While the need for training in fertilizer application techniques ($1.65 \pm .79$) ranked second. However, a large number of olive farmers (54.6%) needed less training in fertilizer application techniques. The use of compost was ranked third with mean values ($1.33 \pm .66$). Hence, the farmers needed less training for the use of compost.

Training needs of olive farmers with respect to irrigation

The data for assessing the training need of olive farmers concerning irrigation was depicted in Table 6. Results showed that olive farmers needed training on factors affecting water loss with mean values ($2.30 \pm .56$) which was ranked 1st. Similarly, many olive farmers said they desperately needed training on water sampling with mean values ($2.27 \pm .55$) which ranked 2nd. Many farmers said they did not need much training for time of irrigation and irrigation method with mean values ($1.44 \pm .64$) which

ranked 3rd. Similarly, a majority of farmers never needed training on water requirement with mean values (1.38±.66) and ranked at 4th position.

Table 4 Assessing the training needs of the olive farmers in the area of variety selection, disease/pest knowledge, and resistant varieties

Indicator concerning selection of varieties	Extent of training needs						WS	Mean	S.D.	Rank
	Not needed		Needed		Highly needed					
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%				
Selection of best varieties	29	22.3	55	42.3	46	35.4	277	2.13	.75	1
Knowledge about diseases, pests and resistant varieties	26	20.0	66	50.8	38	29.2	272	2.09	.69	2

f = Frequency; % = Percentage; WS = Weighted score; S.D. = Standard deviation

Table 5 Assessing the training need of olive farmers with respect to fertilizer selection, application and use of compost

Application of compost & fertilizer of olive	Extent of training need						WS	Mean	S.D.	Rank
	Not needed		Needed		Highly needed					
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%				
Selection of fertilizer	27	20.8	73	56.2	30	23.1	263	2.02	.66	1
Fertilizer application methods	71	54.6	33	25.4	26	20.0	215	1.65	.79	2
Use of compost	101	77.7	15	11.5	14	10.8	173	1.33	.66	3

f = Frequency; % = Percentage; WS = Weighted score; S.D. = Standard deviation

Table 6 Assessing the training need of the olive farmers with respect to factors affecting water loss, water sampling, time of irrigation and irrigation method, water requirement of olive

Irrigation and drainage	Extent of training need						WS	Mean	S.D.	Rank
	Not needed		Needed		Highly needed					
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%				
Factors affecting water loss	7	5.4	77	59.2	46	35.4	299	2.30	.56	1
Water sampling	7	5.4	81	62.3	42	32.3	295	2.27	.55	2
Time of irrigation and irrigation method	84	64.6	35	26.9	11	8.5	187	1.44	.64	3
Water requirement of olive	94	72.3	23	17.7	13	10.0	179	1.38	.66	4

f = Frequency; % = Percentage; WS = Weighted score; S.D. = Standard deviation

Training needs of olive farmers with respect to insect-pests and disease management

The data presented in Table 7 signifies the assessment of training need of olive farmers with respect to insect-pests and disease. The results of study declared that majority (59.2%) of the olive farmers stated they needed more training on the cause of prevalence of insect-pests and spread of diseases with mean value (2.58±.5) which ranked 1st. Similarly, 53.8% of olive farmers stated that they are in die need of training on time-and method of controlling insect/pests and disease with mean values (2.47±.62) ranking 2nd. Likewise, 51.5% of study population needs training on detection of insect-pests and diseases with mean values (2.45±.61) which was ranked 3rd. In addition, 54.6% of olive farmers needed training for awareness of insecticide and pesticides uses in olive with a mean values (2.22±.65) which was ranked 4th. While a majority (61.5%) of olive farmers had knowledge about handling of insecticide and pesticides so they never needed training in this regard with mean values (1.55±.77) which was ranked as the lowest at 5th position.

Training needs of olive farmers with respect to harvesting and marketing

The data presented in Table 8 signifies the assessment of the training need of olive growers in the area of harvesting and marketing. Study findings declared that majority

(52.2%) of the olive growers reported that they were highly needed of training related to functions performed in marketing and ways to sold olive. Similarly, majority (57.7%) olive growers stated that they were needed of training in the field of time and method of picking fruits. Likewise, a substantial part (47.7%) of study population needed training in the field of market preferences and price. Mean values show that olive growers had more need of training in the field of functions performed in marketing and ways to sold olive (2.25±.65) and time and method of picking fruits (2.15±.64) and these fields are ranked as 1st to 2nd, respectively. Mean values of these training needs fell between needed and highly needed, but more tending towards highly needed. While, market preferences and price (1.89±.72) was ranked as lowest (3rd).

Acquaintance with training staff in the study area

The results from Table 9 illustrate the distribution of olive farmers regarding their familiarity with training staff in their area. Regarding the Director of Agriculture, 4.6% of respondents were acquainted solely through face-to-face interactions, while 40.8% were familiar only by name, and the majority (54.6%) were acquainted with the Director both by face and name. Conversely, none of the respondents were acquainted solely by face with the Deputy Director of Agriculture, with 26.2% knowing them only by name, and the majority (73.8%) being familiar with the Deputy Director both by face and name.

Similarly, none of the respondents were acquainted solely by face with the Agriculture Officer, while 11.5% knew them only by name, and the majority (88.5%) were familiar with the Agriculture Officer both by face and name. For the Field Assistant, all respondents were

familiar with them both by face and name. These findings indicate that olive farmers exhibit varying levels of acquaintance with different levels of training staff, with the majority maintaining some level of interaction, particularly through both face-to-face and by name communication.

Table 7 Assessment of training needs among olive farmers regarding insect-pests and disease management

Insect-pests and disease	Extent of training need						WS	Mean	S.D	Rank
	Not needed		Needed		Highly needed					
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%				
Reasons for prevalence of insect-pests and spread of diseases	2	1.5	51	39.2	77	59.2	335	2.58	.52	1
Time and method of controlling insect/pests and disease	9	6.9	51	39.2	70	53.8	321	2.47	.62	2
Pest scouting	8	6.2	55	42.3	67	51.5	319	2.45	.61	3
Awareness about the use of insecticide and pesticides in olive	15	11.5	71	54.6	44	33.8	288	2.22	.65	4
Handling of insecticide and pesticides	80	61.5	29	22.3	21	16.2	201	1.55	.75	5

f = Frequency; % = Percentage; WS = Weighted score; S.D. = Standard deviation

Table 8 Assessment of training needs among olive farmers regarding harvesting and marketing

Harvesting and marketing	Extent of training need						WS	Mean	S.D.	Rank
	Not needed		Needed		Highly needed					
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%				
Functions performed in marketing and ways to sold olive	15	11.5	68	52.3	47	36.2	292	2.25	.65	1
Time and method of picking fruits	18	13.8	75	57.7	37	28.5	279	2.15	.64	2
Market preferences and price	41	31.5	62	47.7	27	20.8	246	1.89	.72	3

f = Frequency; % = Percentage; WS = Weighted score; S.D. = Standard deviation

Table 9 Distribution of olive farmers based on their acquaintance with training staff in their area

Training staff	By face only		By name only		Both by face and name	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Director of Agriculture (DOA)	6	4.6	53	40.8	71	54.6
Deputy Director of Agriculture (DDA)	0	0.0	34	26.2	96	73.8
Agriculture Officer (AO)	0	0.0	15	11.5	115	88.5
Field Assistant (FA)	0	0.0	0	0.0	130	100.0

f = Frequency; % = Percentage

Table 10 Distribution of olive farmers according to their perceptions about frequency of visits paid by the training staff

Training staff	Weekly		Fortnightly		Monthly		Never	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Director of Agriculture (DOA)	0	0.0	0	0.0	4	3.1	125	96.2
Deputy Director of Agriculture (DDA)	0	0.0	0	0.0	11	8.5	119	91.5
Agriculture Officer (AO)	0	0.0	3	2.3	90	69.2	37	28.5
Field Assistant (FA)	15	11.5	43	33.1	71	54.6	1	0.8

f = Frequency; % = Percentage

Visits of the training staff

The results presented in Table 10 reveal olive farmers' perceptions regarding the frequency of visits made by training staff. A majority of the respondents indicated that both the Director of Agriculture (DOA) and Deputy Director of Agriculture (DDA) rarely visited, with 96.2% and 91.5%, respectively, stating that they never or seldom visited. In contrast, 69.2% of the respondents reported that the Assistant Director (AD) visited on a monthly basis. Additionally, the majority of the study population, comprising 54.6%, perceived that Field Assistants made monthly visits. These findings suggest varying degrees of perceived engagement and accessibility of different levels of training staff among olive farmers, with ADs and Field Assistants appearing to have a more regular presence compared to DOAs and DDAs.

Training methods and their level of effectiveness

The respondents were asked about the effectiveness of training method used by training staff and their responses are presented in Table 11. It was observed that 'lectures' method was ranked 1st with mean value (3.07±1.45). Mean value of this training method fell in the high group. However, field trips method with mean value (2.64±1.23) was ranked 2nd. Mean values of these training methods fell in the medium category. Study findings declared that demonstrations method with mean values (2.09±1.03) was ranked 3rd. White board (2.08±1.13) and audio visual aids (2.06±1.12) were ranked 4th to 5th, respectively. Mean values of these training methods fell towards low category. So, it is clear from results that some training methods such as lectures, field trips, demonstrations and audio visual aids were very effective in views of respondents.

Table 11 Ranking of respondents' perception about effectiveness of training method used by the training personal in the study area

Training methods	WS	Mean	S.D.	Rank
Lectures	399	3.07	1.45	1
Field trips	343	2.64	1.23	2
Demonstrations	272	2.09	1.03	3
White board	271	2.08	1.13	4
Audio visual aids	268	2.06	1.12	5

1 = Very high, 2 = High, 3 = Medium, 4 = Low, 5 = Very low; WS = Weighted score; S.D. = Standard deviation

Training attendance for olive production

The results presented in Table 12 showed the distribution of olive farmers based on their attendance at training sessions for olive production over the past year. Among the olive farmers, 33.2% reported not participating in any training during this period. A majority of farmers (53.8%) attended one training session, while a smaller proportion (11.5%) attended two sessions. Only a minimal percentage of olive farmers (1.5%) participated in three training sessions related to olive production in the previous year. These findings highlight varying levels of engagement with training initiatives among olive farmers, with a significant portion having limited or no participation, potentially indicating areas for targeted intervention or support to enhance agricultural practices and productivity in the olive sector.

Table 12 Distribution of olive farmers regarding their training attendance for olive production in the past year

Response	Frequency	Percentage
None	43	33.2
One session	70	53.8
Two sessions	15	11.5
Three sessions	2	1.5
Total	130	100.0

Perception about training needs in production technology

Study findings declared that a majority of the study population needed training in production technology such

as planting methods (87.7%), panting time (98.5%), fertilizer application (88.5%), maintenance of plant density (87.7%), irrigation application (86.9%), insect/pest/disease identification (83.8%), insect/pest/disease management (85.4%) and harvesting (83.8%). It means, olive growers required training in all indicators of production technology (Table 13).

Usefulness of training needs for production technology

The olive farmers were asked about their perception about extent of usefulness of training concerning production technology and their responses in this regard are shown in Table 14. The results showed planting methods (3.70 ± 1.13) and fertilizer application (3.50 ± 1.17) were ranked 1st and 2nd, respectively. Mean values of these production technologies fell in the good category. This means, training of these production technologies is very useful for olive production. However, maintenance of plant density (3.43 ± 1.20), irrigation application (3.09 ± 1.32), harvesting (2.52 ± 1.39) and planting time (2.30 ± 1.32) which ranked as 3rd, 4th, 5th and 6th, respectively. Mean values of these production technologies fell in the satisfactory group. This means, training of these production technologies is very useful for olive production. Whereas, insect/pest/disease management (2.20 ± 1.32) which ranked 7th. However, insect/pest/disease identification (2.17 ± 1.31) which ranked 8th. Mean values of these production technologies fell in the fair category. So, majority of the olive farmers were agreed that training will be very useful in the field of insect/pest/disease management and insect/pest/disease identification.

Table 13 Distribution of olive farmers regarding perception about training needs in production technology

Production technology	Training needs			
	Yes		No	
	<i>f</i>	%	<i>f</i>	%
Planting methods	114	87.7	16	12.3
Planting time	128	98.5	2	1.5
Fertilizer application	115	88.5	15	11.5
Maintenance of plant density	114	87.7	16	12.3
Irrigation application	113	86.9	17	13.1
Insect/pest/disease identification	109	83.8	21	16.2
Insect/pest/disease management	111	85.4	19	14.6
Harvesting	109	83.8	21	16.2

f = Frequency; % = Percentage

Qualities of master trainers

To make training very effective it is necessary to develop homogeneity among trainees and trainers. Training of people for better knowledge was based on the competency

of teachers (Rose, 2009). Learning practice was more effective when an instructor provided a variety of information. Table 15 represents the respondents' views about the attributes of trainers. In the light of trainees perception, trainers' involvement (3.51 ± 1.05) was ranked

1st. Mean value of this attribute of trainers fell between satisfactory to good category but more inclined towards good category. It means, trainers had more interest in training. However, depth of technical knowledge (3.46 ± 1.09), self-confidence (3.45 ± 1.07), cooperation (3.37 ± 1.10), devotion (3.29 ± 1.07) were ranked as 2nd to 5th,

respectively. Mean values of these attributes of trainers fell between satisfactory to good category but inclining towards satisfactory group. Whereas, communication skills (3.19 ± 1.07) was ranked as 6th. So, involvement, depth of technical knowledge and self-confidence were the major attributes of trainers.

Table 14 Assessment of olive farmers' perceptions regarding extent of usefulness of training needs in production technology

Production technology of olive	WS	Mean	S.D.	Rank
Planting methods	422	3.70	1.13	1
Fertilizer application	402	3.50	1.17	2
Maintenance of plant density	391	3.43	1.20	3
Irrigation application	349	3.09	1.32	4
Harvesting	275	2.52	1.39	5
Planting time	251	2.30	1.32	6
Insect/pest/disease management	244	2.20	1.32	7
Insect/pest/disease identification	237	2.17	1.31	8

WS = Weighted score; S.D. = Standard deviation

Table 15 Ranking of olive growers' rating the qualities of master trainers of Extension Department

Qualities of trainers	WS	Mean	S.D.	Rank
Involvement	355	3.51	1.05	1
Depth of technical knowledge	388	3.46	1.09	2
Self confidence	352	3.45	1.07	3
Cooperation	354	3.37	1.10	4
Devotion	316	3.29	1.07	5
Communication skills	341	3.19	1.07	6

Scale: 1 = Poor, 2 = Fair, 3 = Satisfactory, 4 = Good, 5 = Excellent; WS = Weighted score; S.D. = Standard deviation

Qualities of training material

To enhance the effectiveness of training it is necessary to provide the clear information to the people. If elements of training are not clear, complete and accurate then given training cannot fulfill its basic purpose. Effective training depends on obvious and precise elements (Eades, 2014). The olive growers were asked about attributes of training contents provided by Extension Department and their responses in this regard were recorded. Table 16 represents the respondents' views about the qualities of training

material. In the light of respondents' views, the training material was clear ($3.83 \pm .97$), useful (3.71 ± 1.04) and timely (3.58 ± 1.11) and ranked as 1st to 3rd, respectively. Mean values of these training materials fell between satisfactory to good but more tending towards good category. Whereas, feasible ($3.23 \pm .97$) and comprehensive (3.17 ± 1.09) were ranked as 4th and 5th, respectively. Mean values of these training material fell between satisfactory to good category but more tending towards satisfactory category. It means, training material provided by Extension Department were clear, useful and timely.

Table 16 Ranking of olive growers' rating the qualities of training material provided by Extension Department

Qualities of training material	WS	Mean	S.D.	Rank
Clear	402	3.83	.975	1
Useful	390	3.71	1.044	2
Timely	376	3.58	1.116	3
Feasible	333	3.23	.972	4
Comprehensive	330	3.17	1.019	5

Scale: 1 = Poor, 2 = Fair, 3 = Satisfactory, 4 = Good, 5 = Excellent; WS = Weighted score; S.D. = Standard deviation

Training facilities provided by Extension Department

If the intended message does not effectively reach the target audience, its objectives cannot be achieved. Adequate physical funds and facilities are essential for successful communication and are essentially required for message delivery (Marbun et al., 2023). Farmers were inquired about facilities provided by Extension Department and the data in this regard depicted in Table 17. Data signifies the respondents' views about the rating of the training facilities provided by Extension Department. In the light of respondents' views, the Extension Department

had appropriate place ($3.85 \pm .96$), adequate seating arrangement ($3.73 \pm .99$) and conducive environment (3.53 ± 1.08) and ranked as 1st to 3rd, respectively. Mean values of these physical facilities fell between satisfactory to good but more tending towards good category. Whereas, availability of reference material ($3.33 \pm .97$) and availability of A.V. Aids (3.22 ± 1.12) were ranked as 4th and 5th, respectively. Mean values of these training facilities fell between satisfactory to good category but more tending towards satisfactory category. It means, training facilities during training provided by Extension

Department was appropriate and seating arrangement was adequate.

Table 17 Ranking of olive farmers regarding the training facilities provided by Extension Department

Training facilities	WS	Mean	S.D.	Rank
Appropriate Place	420	3.85	.96	1
Adequate seating arrangement	403	3.73	.99	2
Availability of reference material	353	3.33	1.03	3
Availability of audio-visual aids	345	3.22	1.12	4

Scale: 1 = Poor, 2 = Fair, 3 = Satisfactory, 4= Good, 5= Excellent; WS = Weighted score; S.D. = Standard deviation

Strengths and weaknesses of training

There are many different types of activities that involve training. A good training must be according to specific need and performed in a easy way so that each person may obtain advantage from it. The olive farmers were asked about strengths of trainings organized by Extension Department and their responses are shown in Table 18. Results declared the training staff is cooperative (3.88 ± 1.10), competent (3.75 ± 1.05) and trainees got timely information (3.72 ± 1.03) that were ranked as 1st to 3rd, respectively. However, Trainers use familiar and simple words ($3.66 \pm .97$) and trainers and trainees are regular and punctual (3.62 ± 1.12) were ranked 4th and 5th, respectively.

Mean values of above discussed strengths fell towards good category. Whereas, training's are need oriented (3.38 ± 1.08), variety of teaching methods is used (3.30 ± 1.10), availability of training material is ensured by training staff (3.18 ± 1.02) and every participant is given due attention (3.08 ± 1.16) were ranked as 6th and 9th, respectively. It means, training staff is cooperative, competent, trainees got timely information, trainers use familiar and simple words and trainers and trainees are regular and punctual. Farmers were inquired to recognize weak points in the training's carried out by extension departments. Table 19 signifies the respondents' views about the weakness of training organized by Extension Department.

Table 18 Ranking of olive farmers' views about strengths of training organized by Extension Department

Strength	WS	Mean	S.D.	Rank
Training staff is cooperative	438	3.88	1.10	1
Training staff is competent	428	3.75	1.05	2
Trainees got timely information	417	3.72	1.03	3
Trainers use familiar and simple words	381	3.66	.97	4
Trainers & trainees are regular and punctual	391	3.62	1.12	5
Training's are need oriented	355	3.38	1.08	6
Variety of teaching methods is used	333	3.30	1.10	7
Availability of training material is ensured by training staff	324	3.18	1.02	8
Every participant is given due attention	326	3.08	1.16	9

WS = Weighted score; S.D. = Standard deviation

Table 19 Ranking of olive farmers' views about weakness of training organized by Extension Department

Weakness	WS	Mean	S.D.	Rank
Trainings are not conducted regularly	525	4.45	.83	1
Preference is given to influential farmers	508	4.42	.56	2
Literature is not available to all farmers	478	4.19	.88	3
Training material is inappropriate	408	3.61	1.06	4

WS = Weighted score; S.D. = Standard deviation

Factors responsible for low production of olive

In this study the limitations disturbing capacity building of the farmers was investigated. Table 20 shows that majority of the olive farmers had thinking that lack of technical knowledge (86.2%) and noncooperation of extension field staff 65.4% were the major factors/constraints responsible for low quality olive. However, more than one-third of the study population (43.1%) reported that non availability of inputs were responsible for low quality production of olive. It was observed some other factors such as non-availability of true to type plants (32.3%), lack of investment (30.0%), high prices of inputs (26.9%), lack of credit facilities (26.2%), lack of irrigated water (25.4%), non-availability of fertilizer at suitable time (22.3%), and adulteration of pesticides and fertilizers (16.9%) were responsible for low quality production of olive.

Bi-variate analysis

Bivariate analysis was applied to examine the direction, strength, and statistical significance of the relationships between selected socio-economic characteristics of olive farmers and their training needs for enhancing olive production. Pearson's correlation coefficient (r) was used to determine whether variables such as age, education, landholding size, and annual income were significantly associated with farmers' training needs. This analysis helps identify which categories of farmers require greater training support and where extension and capacity-building interventions should be prioritized. Pearson correlation coefficient ($r = .327$) display a highly significant ($p = .000$) and positive relation among age of olive farmers and their training needs for the enhancement of olive production (Table 21). It means, aged olive

farmers needed more training for the enhancement of olive production. Pearson correlation coefficient ($r = -.511$) display a highly significant ($p = .000$) and negative relation among education level of olive farmers and their training needs for the enhancement of olive production. It means highly qualified olive farmers needed less training for the enhancement of olive production as compared to illiterate or primary passed olive farmers. Pearson correlation coefficient ($r = -.374$) display a highly significant ($p = .000$) and negative relation among size of land holdings of olive farmers and their training needs for the enhancement of olive production. It means, small olive farmers needed more training for the enhancement of olive production as

compared to large farmers. Pearson correlation coefficient ($r = -.465$) display a highly significant ($p = .000$) and negative relation among annual income of olive farmers and their training needs for the enhancement of olive production. It means, lower income olive farmers needed more training for the enhancement of olive production as compared to large farmers. Pearson's correlation coefficient ($r = -.213$) showed a significant ($p = .015$) negative relationship between orchard size and farmers' training needs for the enhancement of olive production (Table 21). This indicates that farmers with smaller olive orchards tended to have greater training needs compared with farmers having larger orchard sizes.

Table 20 Respondents' opinion regarding factors responsible for low production of olive

Factors/ constraints	Yes		No	
	<i>f</i>	%	<i>f</i>	%
Lack of technical knowledge/training	112	86.2	18	13.8
Non availability of inputs	56	43.1	74	56.9
Lack of irrigated water	33	25.4	97	74.6
Adulteration of pesticides & fertilizers	22	16.9	108	83.1
Lack of labor	34	26.2	96	73.8
Lack of investment	39	30.0	91	70.0
Non-cooperation of extension field staff	85	65.4	45	34.6
High prices of inputs	35	26.9	95	73.1
Non accessibility of fertilizer at suitable time	29	22.3	101	77.7
Lack of credit facilities	34	26.2	96	73.8

f = Frequency; % = Percentage

Regression analysis

Multiple regression analysis was carried out to investigate the relation of socio-economic status of olive farmers and other key variables with training needs for the enhancement of olive production (Table 22). The overall performance of the regression model was evaluated using the coefficient of determination (R^2), adjusted R^2 , and the F-test. The estimated R^2 and adjusted R^2 values were 0.385

and 0.360, respectively, indicating that the explanatory variables accounted for approximately 39% of the variation in the dependent variable. The F-statistic (15.54) was significant at the 1% level, confirming that the model was statistically significant and that the explanatory variables jointly explained the variation in the dependent variable. In this model, both the dependent variable and the explanatory variables were transformed into their natural logarithmic forms before estimation.

Table 21 Relationship between socio-economic status of olive farmers and their training needs for the enhancement of olive production

Socioeconomic indicators	Pearson correlation coefficient	P-value
Age of farmers	.327**	.000**
Education level	-.511**	.000**
Land holding size	-.374**	.000**
Annual income	-.465**	.000**
Orchard size	-.213*	.015*

Dependent variable: Training needs for the enhancement of olive production; * = Significant (at 5%), ** = Highly significant (at 1%) level of significance

Table 22 Multiple regression analysis of factors affecting the training needs of olive farmers for the enhancement of olive production

a) Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.621 ^a	.385	.360	.16325

b) ANOVA^a

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	2.070	5	.414	15.538	.000 ^b
Residual	3.305	124	.027		
Total	5.375	129			

a. Dependent Variable: Training needs for the enhancement of olive production

c) Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.116	.134		30.653	.000**
	Age of farmers	.082	.022	.289	3.686	.000**
	Education level	-.032	.015	-.205	-2.230	.028*
	Land holding size	-.052	.029	-.184	-1.990	.053*
	Annual income	-.100	.038	-.235	-2.617	.010*
	Orchard size	-.058	.042	-.106	-1.393	.166 ^{NS}

Dependent Variable: Training needs for the enhancement of olive production

Age

The coefficient for age variable is 0.082 with a positive sign. This coefficient is statistically significant at 1% level of significance. It means, old age olive farmers needed more training for the enhancement of olive production as compared to young age olive farmers.

Education level

The coefficient for education variable is 0.032 with a negative sign. This coefficient is statistically significant at 5% level of significance. It means, illiterate and primary passed olive farmers needed more training for the enhancement of olive production as compared to highly qualified olive farmers

Land holding

The coefficient for land holding size variable is 0.052 with a negative sign. This coefficient is statistically significant at 5% level of significance. It means, small farmers needed more training for the enhancement of olive production as compared to large farmers.

Income

The coefficient for annual income variable is 0.100 with a negative sign. This coefficient is statistically significant at 5% level of significance. It means, lower income farmers needed more training for the enhancement of olive production as compared to high income farmers.

Orchard size

The coefficient for orchard size variable is 0.058 with a negative sign. This coefficient is statistically non-significant at 5% level of significance. It means, orchard size of the olive farmers had no relation with training need for the enhancement of olive production. It means, size of orchard never influences on their training needs.

Discussion

Our findings depicted that the majority of the olive farmers were mature and experienced person. They were unaware of the innovative production technologies and modern olive production methods. Hence, they needed training to enhance olive orchard and production in the area. The mature population was normally reluctant to adopt modern technologies over the conventional methods already being

practiced in the area. Our findings are supported by a previous research study by Raza et al. (2021) that was conducted for training needs assessment of olive farmers. In their study, it was reported that a major portion (51%) of the target population in training needs assessment of olive belonged to the mature age group. The dissemination of innovative technology through imparting training is utmost required to change their mind set (Cekada, 2010).

Our results illustrated that 32.3% of farmers had education up to intermediate and above classes. Educational attainments had a positive and significant relationship with training needs, it means, as the education level of the farmers increased, the training needs also increased (Paltasingh & Goyari, 2018). It is due to the fact that more educated farmers are aware of the importance of training, and they want to learn skills and practices involved in advanced olive cultivation. It was supported by the Raza et al. (2021) for training needs assessment of olive farmers in that 20% of the respondents had education up to graduation and above level and 10% of the respondents were educated at intermediate level. They also concluded that education is the process for bringing positive change in the behavior of an individual.

Our findings revealed that a majority (76.9%) of olive farmers were large land holders (more than 25 acres). The large land holding farmers took much interest in growing olive plants motivated by the Department of Agricultural Extension. This study was linked with the findings of Raza et al. (2021) who concluded that 56.5% of farmers who had 12 acres and above land under olive cultivation. They assessed similar needs of training for land holding size assumed as an important factor having impact on adoption of new technologies by the farmers. In the case of large land holdings, the adoption was maximum as the farmers with large land holdings were likely to be financially sound than the small farmers, so they took more interest in adoption of new practices. Our results showed that 67.7% of olive farmers said they desperately needed training for soil sample analysis. These results were correlated with Beigh et al. (2015) where 80% of the respondents reported the high need of training on soil sample analysis. The present results were comparable with Sanjeev and Singha (2010) who reported that 46% of the respondents agreed to take training on soil sample analysis for olive production in Manipur, India.

During our study a majority (59.2%) of olive farmers reported that they needed training on factors affecting water loss (soil type, soil moisture, plant type, climatic conditions) ranked 1st with mean value 2.30. Similarly, many olive farmers stated that they needed training for water sample testing which ranked 2nd with mean value

2.27. Similar results were reported by Beigh et al. (2015) who conducted a research study on training needs assessment of olive farmers in Uri block J&K. They reported that taking water samples for testing got highest rank with a mean score of 2.37 and high extent of training need. Time of irrigation and method of irrigation, water requirement of olive crop, and factors influencing water requirement (soil type, soil moisture, plant type, climatic conditions, etc.) also required training with mean scores of 2.16, 2.00 and 1.80. Gu et al. (2020) reported that adequate amount of knowledge concerning irrigation application is essential for farmers since water shortage and nitrogen scarcity decrease photosynthesis. Four irrigations are required to keep away from stress on crown root starting, tiller completion, booting phase and milking step. The main thing on seed vigor is water stress during seed formation which as a result small and wrinkled seed (Abdoli & Saeidi, 2012). Water scarcity in critical periods demolishes the physiological, enzymatic, and chemical tasks contained by the crop which cannot be overcome later. In addition, water stress after flowering decreases spike and end grain yield (Yang et al., 2003).

During the present study, the majority of respondents reported that are in dire need of training (35.4%) on selection of best varieties. Similar results were gained by Beigh et al. (2015) for training needs assessment of olive farmers in Uri block J&K where awareness regarding diseases, pests and resistant varieties (a mean score of 2.70) got first rank for high training need. The least ranked sub-area was information regarding improved varieties with a mean score of 2.06 where there was a medium extent of training need. Findings of our study declared that majority of the respondents (56.2%) reported that they were in highly need of training on selection of fertilizer for olive production. Similar findings were reported by Pan and Zhang (2018) who reported that sufficient knowledge about application of fertilizer is essential for farmers to produce quality seed because fertilizer is a main input for healthier production of crops. The well-timed and balanced use of fertilizer raises the yield. Fertilizer application and management is of key value in irrigated production systems since yield potential is high, leading to an extensive removal of essential nutrients. Beigh et al. (2015) also reported method of fertilizer application got highest rank with mean score of 2.52 and high extent of training need, while the lowest rank was found in sub-area as choice of fertilizer with mean score of 2.01.

During our study, we found that the majority of the olive farmers needed training on reasons for prevalence of insect-pests and spread of diseases. Similarly, most olive farmers stated that they needed training for time-and method of controlling insect/pests and diseases. Most of the respondents said that olive farming was new for them, therefore, they did not identify the insects, pests, and diseases. They needed regular training to identify the above problems, which may be helpful to increase the production of olive fruit. Similar results were reported by Raza et al. (2021) for training needs assessment of olive farmers in knowing the causes of insect pests and diseases of olive with a mean value 2.48. In their study, about 63.2% of olive farmers said that they needed training on identification and controlling of insect pest and diseases with total mean value 2.34. Our study revealed that half of

olive farmers interacted with the Director of Agriculture (DOA) both by face and name. While the majority of olive farmers interacted with Deputy Director of Agriculture (DDA) both by face and name. A large proportion (88.5%) of olive farmers interacted with AD both by face and name. All the population in the study interacted with the field assistant (FA) by face and name. Our findings are in line with Hassan (2017) who also reported similar results that mostly farmers were familiar with assistant director (AD) and field assistants (FA) working in their areas both by face and by name. A majority (82.7%) of the respondents were also having acquaintance with Deputy Director of Agriculture (DDA) both by face and by name. Director of Agriculture (DOA) was known to 28.8% of the respondents. Slightly more than half (54.3%) of the respondents just knew the name of DOA followed by 16.8% of the respondents who knew him by face only.

During the current study, a majority of the respondents indicated that both the Director of Agriculture (DOA) and Deputy Director of Agriculture (DDA) rarely visited, with 96.2% and 91.5%, respectively, stating that they never or seldom visited. In contrast, 69.2% of the respondents reported that the Assistant Director (AD) visited on a monthly basis. Additionally, the majority of the study population, comprising 54.6%, perceived that Field Assistants made monthly visits. Similar to our findings, Mengal et al. (2012) reported that 24.17% of the farmers were never visited by Extension Field Specialists (EFS), while about 1/5th of the farmers accounted for their visits once or twice in a year. Nearly 10% of the farmers exposed EFS fortnightly visits. Our findings are contradictory with those of Abbas et al. (2003) who reported 1.25/month visits paid by Extension Field Specialists (EFS). Several factors could contribute to the contradictory results observed in the current study compared to the findings reported by Abbas et al. (2003). These may be due to differences in geographical regions, different times, changes in policies, leadership, or resource allocation that could impact the frequency of visits by agricultural authorities and extension specialists.

From our findings it was cleared that the training facilities provided by the Extension Department were appropriate place for farmers in conducting trainings with mean values 3.85, and adequate seating arrangement for the farmers with mean values 3.73. This study was linked with Hassan (2017) for training needs assessment of vegetable farmers in Faisalabad in which the same results were reported for an appropriate place for conducting trainings with mean value 4.52. Availability of audio-visual aids, availability of reference material and adequate seating arrangement during training were the aspects which were ranked between high and very high categories. During our study, the majority of the olive farmers had a lack of technical knowledge (86.2%) and non-cooperation behavior with extension field staff (64.5%) were the major constraints responsible for low olive production. Our findings are in agreement with a previous research study conducted by Azbar et al. (2004) who studied similar kind of parameters and reported that lack of technical knowledge, non-availability of inputs, lack of involvement, lack of irrigated water, adulteration of pesticides and fertilizers, lack of labor and lack of interest were the main problems for low olive production.

Conclusion and recommendations

Training played a vital role in disseminating latest information and knowledge among olive farmers. In Pothwar region, the climatic condition and environment is very suitable for olive cultivation. It was concluded near about half of respondents were old aged (above 50 years). It was observed that majority of farmers had education up to intermediate and above classes. The results showed that most olive growers owned more than 12 acres of land. Farmers expressed a strong need for training in key aspects of olive production, including the selection of improved cultivars, soil testing, and the appropriate use of fertilizers and organic amendments. They also required guidance on water quality assessment and efficient irrigation practices. In addition, respondents indicated a need for training in the identification and management of insect pests and diseases. For harvesting and post-harvest management, farmers sought information on the appropriate harvesting time, fruit picking techniques, and marketing opportunities at both domestic and international levels. A majority of farmers had no idea regarding market preferences and price. It was concluded that all farmers were well-known with the EFS working in their area both by face and name. It was concluded land preparation, appropriate place for conducting training's, training staff is cooperative, trainings are not conducted regularly. It was concluded that the lack of technical knowledge was main factor that hindered the olive production. It is recommended that public and private sector organizations consider establishing or strengthening product buy-back arrangements to reduce marketing uncertainty and provide greater market security to olive farmers. Training programs for olive growers could place greater emphasis on priority areas, including integrated pest management, soil fertility management, and efficient water-use practices, based on farmers' identified training needs. Public and private sector organizations may consider conducting regular training programs and field demonstrations to strengthen farmers' knowledge and facilitate the adoption of improved and modern olive production technologies.

Declarations

i. Ethics approval and consent to participate

This study did not require formal ethical approval from an institutional review board, as per the policies of the researchers' affiliated institutions. However, all ethical considerations for social research involving human participants were carefully followed. Informed consent was obtained from all participating farmers prior to data collection. Participation was entirely voluntary, and confidentiality and anonymity of responses were ensured.

ii. Consent for publication

Consent for publication is not applicable because the study does not include any identifying information or personal data of individual participants.

iii. Data availability

All data generated or analyzed during this study are included in this article.

iv. Competing interests

Authors have declared that no competing interests exist.

v. Authors' contributions

Z.A. designed the study and conducted the experiments. G.R. performed the statistical analysis and contributed to the interpretation of the results. Z.A. prepared the first draft of the manuscript. Both authors critically revised the manuscript for important intellectual content and read and approved the final version of the manuscript.

vi. Funding

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vii. Acknowledgement

Not applicable.

viii. SDGs addressed

Zero Hunger (SDG 2), Quality Education (SDG 4), Decent Work and Economic Growth (SDG 8), Responsible Consumption and Production (SDG 12), Climate Action (SDG 13)

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References

- Abbas, M., Mohammad, S., Nabi, I., & Sheikh, A. D. (2003). Farmer-extension interaction and the dissemination of recommended sugarcane production technologies in the central Punjab (Pakistan). *International Journal of Agriculture & Biology*, 5(2), 134–137.
- Abdoli, M., & Saeidi, M. (2012). Effects of water deficiency stress during seed growth on yield and its components, germination and seedling growth parameters of some wheat cultivars. *International Journal of Agriculture and Crop Sciences*, 4(15), 1110–1118.
- Ali, S., N.U.R. Khatak, S.E. Saqib and S.U. Rehman. 2022. Impact of tenancy status on wheat productivity in Central Khyber Pakhtunkhwa, Pakistan. *Sarhad Journal of Agriculture*, 38(2), 693–700.
- Allahyari, M. S., Damalas, C. A., & Ebadattalab, M. (2017). Farmers' technical knowledge about integrated pest management (IPM) in olive production. *Agriculture*, 7(12), 101.
- Al-Shadiadeh, A. N. H. (2007). Descriptive study of the training needs for men and women farmers in semi-

- desert areas: A case study of South Jordan. *World Applied Sciences Journal*, 2(1), 12–21.
- Azam, A., & Shafique, M. (2017). Agriculture in Pakistan and its impact on economy—A review. *International Journal of Advanced Science and Technology*, 103, 47-60. <http://dx.doi.org/10.14257/ijast.2017.103.05>
- Azbar, N., Bayram, A., Filibeli, A., Muezzinoglu, A., Sengul, F., & Ozer, A. (2004). A review of waste management options in olive oil production. *Critical Reviews in Environmental Science and Technology*, 34(3), 209-247.
- Beigh, M. A., Peer, Q. J. A., Mehraj, S., & Sibat, F. (2015). Analytical study of training needs of olive growers in various subject matter areas of olive cultivation in Uri Block of district Baramulla, J&K, India. *Journal of Applied and Natural Science*, 7(1), 466–470.
- Cekada, T. L. (2010) Training needs assessment. *Professional Safety*, 55, 28-33.
- Cultivation Ag. (2026, July 2). *Pakistan now imports 90% of its edible oil requirements*. Retrieved from <https://ukragroconsult.com/en/news/pakistan-now-imports-90-of-its-edible-oil-requirements/>
- Eades, J. (2014). 3 ways organizations can improve the way they measure training effectiveness. Retrieved from <https://elearningindustry.com/3-ways-measure-training-effectiveness>
- Fadare, O. A., Akerele, D., & Toritseju, B. (2014). Factors influencing adoption decisions of maize farmers in Nigeria. *International Journal of Food and Agricultural Economics*, 2, 45-54.
- Ghanbari, R., Anwar, F., Alkharfy, K. M., Gilani, A. H., & Saari, N. (2012). Valuable nutrients and functional bioactives in different parts of olive (*Olea europaea* L.) - a review. *International Journal of Molecular Sciences*, 13(3), 3291-3340.
- GoP. (2019). Economic survey of Pakistan 2018-2019. Economic Advisor's Wing, Finance Division, Islamabad, Pakistan.
- Gu, Z., Qi, Z., Burghate, R., Yuan, S., Jiao, X., & Xu, J. (2020). Irrigation scheduling approaches and applications: A review. *Journal of Irrigation and Drainage Engineering*, 146(6), 04020007.
- Hassan, G. (2017). *Training needs assessment of vegetable growers in peri-urban areas of Faisalabad* (Doctoral dissertation). Institute of Agricultural Extension & Rural Development, University of Agriculture, Faisalabad, Pakistan.
- Hübel, Ş.-R., Stan, M.- I., & Taseşte, T. (2023). How respondents' age influences perceptions of socio-economic issues in the context of sustainable local development. *Eximia Journal*, 11, 41-56.
- Iqbal, M. A., Hafiz, I. A., Abbasi, N. A., & Shah, M. K. N. (2019). Adaptability, agronomic and yield performance of exotic olive (*Olea europaea*) cultivars in Pothwar region of Pakistan. *Pakistan Journal of Botany*, 51(5), 1745-1751.
- Jahangir's World Times. (2020, November 9). Olive cultivation in Pakistan: How to exploit our potential. Retrieved from <https://www.jworldtimes.com/old-site/others/olive-cultivation-in-pakistan-how-to-exploit-our-potential/>
- Jones, R. (2023, November 29). Reasons to do a training needs assessment. Retrieved from <https://www.trainingfolks.com/blog/reasons-to-do-a-training-needs-assessment#:~:text=A%20training%20needs%20assessment%20is,training%20program%20needs%20to%20address>
- Juned, S. (2017, July 22). How to start olive farming (fruit cultivation) in Pakistan. Retrieved from <https://dikhawa.pk/blogs/content/how-to-start-olive-farming-fruit-cultivation-in-pakistan>
- Khalique, A., Ali Shah, S. M., Akram, M., Munir, N., Daniyal, M., Irshad, M., & Ahmad, S. (2020). Determination of oil contents from eight varieties of *Olea europaea* (Olive) grown in Pakistan. *Natural Product Research*, 34(13), 1951-1955.
- Khan, N., Ray, R. L., Zhang, S., Osabuohien, E., & Ihtisham, M. (2022). Influence of mobile phone and internet technology on income of rural farmers: Evidence from Khyber Pakhtunkhwa Province, Pakistan. *Technology in Society*, 68, 101866.
- Marbun, T. O., Antarani, P., & Putri, M. A. (2023). Effective communication results in effective leadership. *Daengku Journal of Humanities and Social Sciences Innovation*, 3(4), 571–578. doi:10.35877/454RI.daengku1760
- Mengal, A. A., Mallah, M. U., Mirani, Z. A., & Siddiqui, B. N. (2012). An analysis of public and private agricultural extension services in Balochistan, Pakistan. *Pakistan Journal of Agricultural Research*, 25(4), 307-317.
- Mujtaba Phambra, A., Tahir, S., & Imran, M. (2020). Small farms and the current structure of farmland holdings in Pakistan. *Pakistan Journal of Economic Studies*, 3(1), 47-64.
- Munawar, S. T., & Khalid, M. U. (2025). Integrating indigenous agricultural knowledge with modern practices for sustainable farming and food security. *Journal of Agriculture and Biology*, 3(1), 196–208. doi:10.55627/agribiol.003.01.1173
- Munir, B. L. (2009). *Various propagation approaches in olive* (B.Sc. (Hons.) internship report, Khyber Pakhtunkhwa Agricultural University, Peshawar, Pakistan, pp. 22–23).
- Mwangi, M., & Kariuki, S. (2015). Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of Economics and Sustainable Development*, 6(5), 208-216.
- Olive Oil Times. (2020, July 30). How many olive varieties are there and which are the most popular? Retrieved from <https://www.oliveoiltimes.com/basics/how-many-olive-varieties-are-there/84373>
- Pakistan Agricultural Research Council (PARC). (2018). *Olive achievements*. Retrieved from <http://parc.gov.pk/index.php/en/oliveachievements>
- Paltasingh, K. R., & Goyari, P. (2018). Impact of farmer education on farm productivity under varying technologies: Case of paddy growers in India. *Agricultural and Food Economics*, 6(1), 1–19.
- Pan, D., & Zhang, N. (2018). The role of agricultural training on fertilizer use knowledge: A randomized

- controlled experiment. *Ecological Economics*, 148, 77-91.
- Rapoport, H. F. (2014). The reproductive biology of the olive tree and its relationship to extreme environmental conditions. *Acta Horticulturae*, 1057, 41–50. doi:10.17660/ActaHortic.2014.1057.2
- Raza, H., Luqman, M., Yaseen, M., & Shahbaz, B. (2021). An assessment of training needs of olive growers in Pothwar region of Punjab, Pakistan. *Journal of Agricultural Research*, 59(3), 313–319.
- Rose, M. (2009). Is cultural competency the panacea for the deficit syndrome? 5th National Indigenous Education Conference, Hobart, TAS.
- Sanjeev, M. V., & Singha, A. K. (2010). Training needs of farmers and rural youth: An analysis of Manipur State, India. *Journal of Agricultural Science*, 3, 103–112.
- Sumrah, M. A., Jan, M., Mahfooz, S. H., Akhtar, J., Pasha, M. F. K., & Anser, M. R. (2022). Economical olive cultivation by selection of suitable variety in Pothwar region of Pakistan. *Journal of Economic Impact*, 4(3), 213-217.
- Torres, M., Pierantozzi, P., Searles, P., Rousseaux, M. C., García-Inza, G., Miserere, A., Bodoira, R., Contreras, C., & Maestri, D. (2017). Olive cultivation in the southern hemisphere: Flowering, water requirements and oil quality responses to new crop environments. *Frontiers in Plant Science*, 8, 1830. <https://doi.org/10.3389/fpls.2017.01830>
- Yang, J. C., Zhang, J. H., Wang, Z. Q., Zhu, Q. S., & Liu, L. J. (2003). Activities of enzymes involved in sucrose-to-starch metabolism in rice grains subjected to water stress during filling. *Field Crops Research*, 81, 69–81. doi:10.1016/S0378-4290(02)00214-9



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