

Assessing the role of agriculture in enhancing livelihoods in rural Tehsil Lawa, District Chakwal, Pakistan

Saif Ullah^{1*} and Muhammad Imran²

¹Ministry of Local Government & Rural Development, Islamabad, Pakistan

²ActionAid, Pakistan

*Corresponding author's email: saifallah01@hotmail.com

Abstract

This study examined the role of agricultural farming in the livelihood of rural communities in Tehsil Lawa, District Chakwal. It focused on the impact of high input costs (seeds, pesticides, fertilizers), small landholdings, limited innovation adoption, lack of guidance, illiteracy, and market insecurity on farmers' socio-economic conditions. The research also aimed to identify best practices for improving rural livelihoods through better agricultural production. Data was collected from 144 progressive farmers using a structured questionnaire. Results showed that 80% of farmers were poorly educated, while 20% were illiterate. Due to this, 60% were unaware of modern farming techniques, and many found such technologies too costly to adopt. About 80% lacked sufficient financial resources, and 74% reported inadequate access to microcredit facilities. The findings revealed that improved

agricultural practices significantly enhanced crop yields and farmers' socio-economic status. Most farmers stated that higher crop production increased their family income. Among them, 90% used this income for house construction and family marriages, while others spent it on better health and education for their families. The study concluded that enhanced agricultural productivity leads to better livelihoods in rural communities. It is recommended that both government and non-government organizations support farmers through education, financial assistance, subsidized fertilizers, timely input delivery, and access to modern technologies. Additionally, improved trade policies should be introduced to ensure direct benefits for rural communities. © 2025 The Author(s)

Keywords: Agriculture and livelihood, Agricultural productivity, Rural development, Smallholder farmers, Socioeconomic status, Tehsil Lawa

Citation: Ullah, S., & Imran, M. (2025). Assessing the role of agriculture in enhancing livelihoods in rural Tehsil Lawa, District Chakwal, Pakistan. *Journal of Plant Production and Sustainability*, 1(2), 50–62. <https://doi.org/10.63072/jpps.25011>

Introduction

The growth of agriculture sector is important for rural development and sustainability of food security. It plays a key role in providing employment, engaging approximately 37.4% of the labor force, and serves as a significant source of foreign exchange through exportable surpluses (Nadeem, 2025). Additionally, agriculture supplies essential raw materials to various industries (Voronin et al., 2022). Growth in agriculture has a direct and widespread impact on the overall economy (Iqbal et al., 2018; Abbas & Shafique, 2019; Mehmood et al., 2020). The agriculture sector serves as a steward of the rural landscape and acts as an environmental safeguard by promoting climate-resilient production and preserving ecosystems (Noroz et al., 2021). Recognizing its critical role, the government has adopted new development policies aimed at boosting productivity and increasing exports (Zaman et al., 2021; Abbas et al., 2024). These initiatives are expected to have a positive impact on the development of rural communities (Nadeem et al., 2022). The Pakistan Economic Survey 2023–24 reports that agriculture's growth in FY 2023–24 was 6.25% (Government of Pakistan, 2024). In contrast, in FY 2024–25, the agriculture sector's growth dramatically declined to

0.56%, missing its target of 2%. The poor performance in FY 2024–25 was largely because of steep declines in output of major crops (wheat, cotton, sugarcane, maize) (Government of Pakistan, 2025). During FY 2024–25, Pakistan's agriculture sector recorded a modest growth of 0.56%, reflecting both resilience and underlying challenges. This limited growth was primarily driven by a 4.72% increase in the livestock sector, which remained the most stable contributor to agricultural output. In contrast, the crop sub-sector contracted by 6.82%, largely due to a significant 13.49% decline in important crops, attributed to reduced cultivation areas and adverse weather conditions. Specific declines were observed in cotton (30.7%), wheat (8.9%), sugarcane (3.9%), maize (15.4%), and rice (1.4%), despite some increases in cultivated areas for sugarcane and rice. Cotton ginning declined by 19%, further impacting the crop sub-sector. Other crops demonstrated some resilience, growing by 4.78%, and contributing 13.88% to agricultural value addition and 3.27% to GDP. Important crops, however, contributed 17.82% to agriculture's value added and 4.19% to national GDP (Kiani, 2025).

In Pakistan, agriculture is primarily practiced through traditional, small-scale, and low-technology farming methods (Mumtaz, 2020). It serves as a vital means for rural communities to absorb shocks from disasters and

address economic disparities (Brüntrup & Heidhues, 2002). Components of agriculture such as home gardens, domestic livestock, and poultry can play a significant role in reducing food insecurity and rural food scarcity (Iqbal, 2018). Increased agricultural yields can improve livelihoods and help lower high food prices. To increase and stabilize their incomes, rural inhabitants are actively exploring diverse livelihood opportunities (Singh et al., 2024). Despite this diversification, farming remains a crucial part of rural household economies (Nepali et al., 2024). Consequently, the livelihoods of rural communities depend not only on agriculture but also on related enterprises and allied activities (Tripp, 2004). Rural livelihoods linked to the agriculture sector are not static; rather, they have evolved over time through farmers' adaptability and their ability to respond to changing rural and economic conditions (Kumar & Nair, 2004).

Pakistan has a population of 256.24 million, with approximately 88.15 million people living in urban areas and 168.09 million residing in rural regions in the year 2025 (Worldometer, 2025). The national population density stands at 331 people per square kilometer (Worldometer, 2025). According to the 2023 Census, Chakwal District has a total population of 1,734,854, comprising 1,300,049 people living in rural areas and 434,805 in urban areas (Pak Information, 2024). Tehsil Lawa, a sub-region of Chakwal, covers an area of 910 km² and has population in 2023 is of 144,611 (Pakistan Bureau of Statistics, 2023). In Lawa, 37.4% of the population is employed in the agriculture sector. The area comprises 6 Union Councils and 18 villages. The main crops grown include wheat, groundnuts, grams, pulses, barley, and mustard (Latif et al., 2025). Rapid increase in population has a visible impact on reduction in agriculture land for farming. It is a reality that as family sizes grows the amount of farmland available per person decreases. As a result, farmers are increasingly turning to more complex and intensive farming practices to boost agricultural output, diversify income sources, and ensure agricultural sustainability (Abebe, 2005). The agricultural sector in rural villages is considered the backbone of Pakistan's economy. Its performance is directly linked to the wellbeing of the rural population. Livelihood strategies in these areas largely depend on sustainable agricultural practices (Azam & Shafique, 2017). In contrast, in urban areas, agriculture serves as a source of livelihood only partially or temporarily (Ahmad et al., 2023).

The rural areas of Punjab face persistent poverty, with communities having limited access to basic necessities such as adequate shelter, clothing, healthcare, education, sanitation, sewerage systems, and fundamental human rights (Government of the Punjab, 2006). These communities largely depend on agriculture for their livelihoods. They rely on a combination of natural, physical, human, social, and financial assets to sustain themselves (Singh et al., 2024a). Crop production, livestock, and forests serve as key sources of income, particularly for landless individuals and small-scale landowners who are highly dependent on these resources (Datta et al., 2024). The development and effective management of these assets have both direct and indirect impacts on the livelihoods of the rural population (Datta et al., 2024). To the best of our knowledge, no comprehensive research study has been conducted in this

area to date. Therefore, this study represents a unique and valuable contribution to the existing body of literature, aiming to address emerging questions related to rural agricultural practices. Agricultural activities encompass both farming and non-farming livelihoods, playing a critical role in the socio-economic development of rural areas. Farm operations, market transactions, and agro-based industrial activities are integral components of the rural economy that contribute to poverty alleviation (Singh et al., 2024b). As a result, the purchasing power of rural populations improves, enabling better access to essential services and amenities such as food, cooking oil, housing, sanitation, safe drinking water, clean air, healthcare, education, and electricity (Pawlak & Kołodziejczak, 2020). In this context, the present study was conducted in Tehsil Lawa of District Chakwal to analyze land use patterns, cost structures, and input utilization in wheat and groundnut cultivation. The study also includes a comparative assessment of production costs and fertilizer types used across major Rabi crops. It also aimed to evaluate the socioeconomic profile of rural farming households and the contribution of various farming activities such as subsistence farming, livestock rearing, and kitchen gardening to their livelihood and food security. Furthermore, the study examined the relationship between agricultural development and key development models (Frontier, Conservation, and High Pay-off Input Models), while assessing the moderating effect of agricultural challenges on these relationships through correlation, regression, and moderation analysis.

Materials and Methods

Study area and sampling technique

This research was conducted during the Rabi seasons of 2018–2019 and 2019–2020 in district Chakwal, Punjab, Pakistan. A multi-stage sampling technique was employed for data collection. District Chakwal comprises five tehsils: Chakwal, Talagang, Kallar Kahar, Choa Saidan Shah, and Lawa. Among these, Tehsil Lawa was selected purposively based on its strong agricultural base and the predominance of wheat and groundnut cultivation. The selection was guided by the objective of the study, which aimed to assess the role of agriculture in enhancing rural livelihoods. Tehsil Lawa comprises 18 villages, and a sample of 144 progressive farmers from these villages was selected using a stratified random sampling technique. Initially, the villages were considered as strata to ensure geographical representation across the tehsil. Within each village, farmers engaged in wheat and groundnut cultivation were identified, and progressive farmers (defined as those primarily dependent on agriculture, using modern techniques and inputs to improve productivity and income) were randomly selected. This approach ensured both randomness and relevance to the study objectives. A well-structured and pre-tested questionnaire was developed for primary data collection. The questionnaire was designed to gather information related to land utilization, input costs, and crop yields for wheat and groundnut. Data

was collected through face-to-face interviews with the selected farmers.

Data analysis

Data analysis was conducted using Statistical Package for Social Sciences (SPSS). To estimate the profitability of wheat and groundnut farming, the farm budgeting technique was employed. This method allowed for the calculation of costs, revenues, and net returns associated with the selected crops. The approach follows methodologies used in previous studies (Samiullah et al., 2014; Afridi et al., 2021).

Procedure used for cost estimation

The procedure for cost estimation was based on the methodology adopted by Chaudhry et al. (1992). The cost incurred per acre was calculated by identifying and summing the expenses associated with each input used in crop production. These included the cost of land preparation, seed, drilling/sowing, irrigation, harvesting, pesticides and plant protection, and Farmyard Manure (FYM). Additional costs such as threshing, hired labor, and administrative or management expenses were also included. The opportunity cost of family labor and a bank markup of 9.5% on investment for a six-month period were included to reflect the actual cost of capital. Furthermore, land-related expenses, including land tax and either actual land rent or the opportunity cost of owned land, were incorporated. Finally, total variable and fixed costs were aggregated to estimate the overall cost of production per acre.

Procedure for calculating gross income or gross value product (GVP)

The method used for calculating the Gross Value Product (GVP) or Gross Income (GI) per acre followed the approach outlined by Chaudhry et al. (1992). GVP per acre was estimated by multiplying the total crop production by its respective unit price. The total income from each crop was then calculated on a per-acre basis. For wheat, gross income was derived by adding the income from wheat grain and the value of wheat straw. For groundnut, gross income included the combined value of groundnut grain and groundnut fodder.

Procedure for estimation of gross margin and net return

In this study, the Gross Margin per acre was calculated by subtracting the variable costs incurred by farmers from the Gross Income (GI) obtained through the sale of wheat and groundnut crops. The variable costs included all cash expenses related to land preparation, seed, fertilizers, pesticides, irrigation, harvesting, and other operational activities. The gross income was determined based on the market value of both the grain and by-products (wheat straw and groundnut fodder).

Gross margin = Gross income – Variable costs

To calculate the Net Return per acre, both variable costs and fixed costs (such as opportunity cost of family labor,

land rent or its opportunity cost, and interest on capital) were deducted from the gross income. This reflects the actual profitability of crop production for the selected farmers.

Net return = Gross income – (Variable costs + Fixed costs)

These calculations were based on data collected directly from farmers through structured interviews, focusing on input use, costs, crop yields, and market prices.

Techniques for data analysis

Data was collected using a structured questionnaire, which was administered through face-to-face interviews with selected farmers. The questions were designed in simplified language to ensure clarity and ease of response. Farmer responses were recorded, compiled, and analyzed, with majority opinions used where applicable. For data analysis, both descriptive statistics and regression analysis were employed. The Ordinary Least Squares (OLS) method was used to examine the relationships between selected independent variables such as the Gini coefficient of operational land holdings, percentage of land ownership titles, land use intensity, and the number of fragmented farms per cultivated area and dependent variables including the percentage of food-insecure population, food availability, and food access. Due to high multicollinearity, the Gini coefficient of land ownership holdings was excluded from the regression model. All statistical analyses were performed using SPSS version 20.

Results

Cultivated land

Table 1 presents the distribution of cultivated land among the sampled farmers based on their responses during the survey. On average, each farmer cultivated a total of 10.3 acres of land during the Rabi season. Of this, 4.8 acres (46.6%) were allocated to wheat, 2.0 acres (19.4%) to groundnut, and 3.5 acres (34%) to other Rabi crops or left fallow in preparation for Kharif crops. The data show that farmers allocated approximately 2.4 times more land to wheat than to groundnut, indicating the importance of wheat as a staple food crop and as a source of wheat straw used for animal feed.

Average cost of production of wheat & groundnut in Tehsil Lawa

The average cost per acre of producing wheat and groundnut in tehsil Lawa is presented in Table 2. The results show that the average cost of producing wheat was Rs. 28,599 per acre, while for groundnut, it was Rs. 24,574 per acre. This indicates that wheat production is approximately 1.3 times more expensive than groundnut production. In Tehsil Lawa, the average variable cost per acre was Rs. 23,150 for wheat and Rs. 19,125 for groundnut. The average fixed cost, including the opportunity cost of land (land rent) and land tax, was Rs. 5,449 for both crops. The major cost components included land rent, which accounted for approximately 17% of the

total cost for wheat and 22% for groundnut. Land preparation made up 17.8% of wheat costs and 18.2% of groundnut costs. Fertilizer costs accounted for 14.4% in wheat and 11.1% in groundnut.

Table 1 Average cultivated land allocation per farmer by crop type in the selected study area

| Selected sample | Average acres | % of cultivated area |
|------------------|---------------|----------------------|
| Wheat area | 4.8 | 46.6 |
| Groundnut area | 2.0 | 19.42 |
| Other crops area | 3.5 | 33.98 |

Table 2 Average cost of production of wheat & groundnuts in tehsil Lawa

| S. No. | Activity/ Item cost | Wheat (PKR) | % of total land | Groundnut (PKR) | % of total land |
|--------|---|----------------|--------------------|--------------------|--------------------|
| 1 | Land preparation | 5079 | 17.8 | 4476 | 18.2 |
| 2 | Seed cost/ acre | 5000/40 kg | 7.6 | 12000/40 kg | 1.5 |
| 3 | Drill/sowing cost | 720 | 2.5 | 718 | 2.9 |
| 4 | Irrigation cost | 144 | 0.5 | 106 | 0.4 |
| 5 | Pesticide cost | 723 | 2.5 | 0 | 0.0 |
| 6 | Fertilizer cost | 4120 | 14.4 | 2733 | 11.1 |
| 7 | FYM cost | 2017 | 7.1 | 2181 | 8.9 |
| 8 | Total hired labor cost for above practices(Sr. No 1 to 7) | 867 | 3.0 | 1621 | 6.6 |
| 9 | Cost of harvesting through machinery | 1314 | 4.6 | 2032 | 8.3 |
| 10 | Threshing cost | 1843 | 6.4 | 1144 | 4.7 |
| 11 | Total hired labor cost for harvesting & threshing | 3157 | 11.0 | 3176 | 12.9 |
| 12 | Management cost/ Opportunity cost of family labor | 2632 | 9.2 | 2579 | 10.5 |
| 13 | Markup on bank loan @ 9.5% for 6 months on Sr. No. 1 to 8 | 1506 | 5.3 | 1160 | 4.7 |
| 14 | Total variable cost (Sum of Sr. No. 1 to 10, 12 & 13) | 23150 | 80.9 | 19125 | 77.8 |
| 15 | Opportunity cost of land or land rent | 5414 | 18.9 | 5414 | 22.0 |
| 16 | Land tax | 35 | 0.1 | 35 | 0.1 |
| 17 | Total fixed cost (Sum of Sr. No. 15 to 16) | 5449 | 19.1 | 5449 | 22.2 |
| 18 | Total cost (Sum of Sr. No. 14 & 17) | 28599 | 100.0 | 24574 | 100.0 |

Education status and household size

Table 3 presents the distribution of education levels among rural respondents in the sampled areas of Tehsil Lawa. The data indicates that 35.42% of respondents had no formal education. About 24.31% had received basic schooling, while 20.83% had completed high school education. Additionally, 19.44% of the respondents acquired technical or religious (Madrasah) education. These figures reflect the overall literacy and educational profile of the rural

population in the study area. The distribution of household sizes based on the number of adult members (aged over 18) is presented in Table 4. The results indicate that 10.42% of households had fewer than four members, while 15.28% had exactly four members. Households with five and six members accounted for 12.50% and 11.11%, respectively. Additionally, 21.53% of households had seven members, and the largest group (29.17%) comprised households with more than seven members.

Table 3 Distribution of respondents by education level in Tehsil Lawa

| Category | Frequency (f) | Percentage (%) |
|--------------------------------|---------------|----------------|
| Non-formal | 51 | 35.42 |
| Basic school | 35 | 24.31 |
| High school | 30 | 20.83 |
| Technical and Mudras education | 28 | 19.44 |

Table 4 Household size distribution of respondent according to their age

| Family size | Frequency (f) | Percentage (%) |
|-------------|---------------|----------------|
| Less than 4 | 15 | 10.42 |
| 4 Members | 22 | 15.28 |
| 5 Members | 18 | 12.50 |
| 6 Members | 16 | 11.11 |
| 7 Members | 31 | 21.53 |
| More than 7 | 42 | 29.17 |

Farming as a major source of livelihood

The data in Table 5 clearly indicate that subsistence farming serves as a primary source of livelihood for the majority of rural households. Among the respondents,

17.36% had been engaged in farming for less than five years, 22.22% for 6 to 8 years, and 12.50% for 9 to 12 years. A significant portion (27.08%) had between 13 to 15 years of experience, while 20.83% had been practicing subsistence farming for more than 15 years. These findings

suggest that many rural households have a long-term dependence on farming as their main means of livelihood.

Table 5 Distribution of households by years of experience in subsistence farming

| Category | Frequency (f) | Percentage (%) |
|-------------------|---------------|----------------|
| Less than 5 years | 25 | 17.36 |
| 6-8 Years | 32 | 22.22 |
| 9-12 Years | 18 | 12.50 |
| 13-15 Years | 39 | 27.08 |
| Above 15 years | 30 | 20.83 |

Importance of home gardens in household livelihoods

Table 6 presents respondents’ perceptions of the importance of home (kitchen) gardens to their household livelihoods. A significant portion of respondents (29.86%) considered home gardening to be extremely important for

meeting their livelihood needs. Additionally, 24.31% viewed it as important, while 18.75% felt it was somewhat important. Meanwhile, 13.19% of respondents stated that home gardening was not so important. Interestingly, 13.89% reported that they practiced home gardening primarily for recreation, rather than for subsistence or income purposes.

Table 6 Perceived importance of home gardens to household wellbeing

| Level of importance | Frequency (f) | Percentage (%) |
|--------------------------|---------------|----------------|
| Extremely important | 43 | 29.86 |
| Important | 35 | 24.31 |
| Somewhat important | 27 | 18.75 |
| Not so important | 19 | 13.19 |
| Primarily for recreation | 20 | 13.89 |

Monthly household expenses

Table 7 presents the distribution of respondents based on their family’s monthly household expenses. The data reveals that a significant proportion of respondents (39.58%) reported monthly expenses of less than Rs. 8,000, indicating a predominance of low-income households in the study area. About 32.64% of the families

spend between Rs. 9,000 and Rs. 16,000 per month, while 20.14% have monthly expenditures ranging from Rs. 17,000 to 24,000. A smaller segment, comprising only 7.64% of respondents, reported spending Rs. 25,000 or more per month. These figures highlight the overall modest expenditure levels among rural families, suggesting limited disposable income and possibly constrained access to higher living standards.

Table 7 Distribution of respondents according to their family’s monthly expenses

| Category | Frequency (f) | Percentage (%) |
|---------------------|---------------|----------------|
| Less than Rs. 8000 | 57 | 39.58 |
| Rs. 9000-16000 | 47 | 32.64 |
| Rs. 17000-24000 | 29 | 20.14 |
| Rs. 25000 and above | 11 | 7.64 |

Fruits and vegetables as major sources of livelihood

The present study explores the key sources of livelihood in Tehsil Lawa, with a particular focus on fruit and vegetable cultivation. As shown in Table 8, a portion of the rural respondents reported having fruit gardens within their premises. However, only 34.72% of respondents were engaged in fruit cultivation as a livelihood source, while the remaining 65.28% were not. In contrast, the cultivation of vegetables, particularly seasonal crops, was found to be a more prominent livelihood activity. A significant 77.78%

of respondents reported involvement in summer vegetable cultivation, indicating its major contribution to household income. Similarly, 68.75% of respondents were engaged in winter vegetable cultivation, further emphasizing the importance of vegetable farming in sustaining rural livelihoods. The remaining 22.22% and 31.25%, respectively, were not involved in these seasonal agricultural practices. These findings suggest that while fruit cultivation is practiced by a minority, seasonal vegetable cultivation plays a crucial role in supporting the economic well-being of rural households in the study area.

Table 8 Distribution of respondents based on their engagement in fruit and vegetable cultivation as a major source of livelihood

| Category | Frequency (f) | Percentage (%) |
|--|---------------|----------------|
| Fruits as a source of livelihood | | |
| Engaged in fruit cultivation | 50 | 34.72 |
| Not Engaged in fruit cultivation | 94 | 65.28 |
| Summer vegetables as a source of livelihood | | |
| Engaged in summer vegetable cultivation | 112 | 77.78 |
| Not engaged in summer vegetable cultivation | 32 | 22.22 |

Winter vegetables as a source of livelihood

| | | |
|---|----|-------|
| Engaged in winter vegetable cultivation | 99 | 68.75 |
| Not engaged in winter vegetable cultivation | 45 | 31.25 |

Livestock rearing as a source of livelihood

A significant portion of the rural population relies on various forms of livestock to sustain their income and food needs (Table 9). The findings show that 84.03% of respondents rear cows for livelihood, while 15.97% do not. Similarly, buffaloes are reared by 93.75% of the respondents, with only 6.25% not involved in buffalo rearing. Regarding bulls, 86.81% of respondents are

engaged in their rearing, while 13.19% are not. A higher percentage (96.53%) rear goat, making it one of the most common livestock choices, with only 3.47% not involved. Donkey rearing is also a source of livelihood for 77.78% of respondents, though 22.22% reported not engaging in it. Finally, poultry farming, particularly the rearing of hens, is practiced by 86.81% of respondents, indicating its importance for both food and income generation.

Table 9 Distribution of respondents based on their engagement in livestock rearing as a major source of livelihood

| Category | Frequency (f) | Percentage (%) |
|-------------------------------------|---------------|----------------|
| Cows as a source of livelihood | | |
| Yes | 121 | 84.03 |
| No | 23 | 15.97 |
| Buffaloes as a source of livelihood | | |
| Yes | 135 | 93.75 |
| No | 9 | 6.25 |
| Bulls as a source of livelihood | | |
| Yes | 125 | 86.81 |
| No | 19 | 13.19 |
| Goats as a source of livelihood | | |
| Yes | 139 | 96.53 |
| No | 5 | 3.47 |
| Donkeys as a source of livelihood | | |
| Yes | 112 | 77.78 |
| No | 32 | 22.22 |
| Hens as a source of food and income | | |
| Yes | 125 | 86.81 |
| No | 19 | 13.19 |

Utilization of labor during cultivation

During the cultivation period in Tehsil Lawa, farmers employed hired labor on a daily wage basis to support their agricultural activities. The distribution of labor usage among respondents showed that 11.81% hired labor for less than 7 days, 17.36% for 7 to 15 days, 24.31% for 16 to

22 days, and 46.53% for 23 to 30/31 days (Table 10). This indicates that nearly half of the respondents relied heavily on hired labor throughout the cultivation season. Additionally, all farm owners were personally involved in various labor activities on their farms, which positively influenced crop production and overall farm productivity.

Table 10 Distribution of respondents according to number of hired labor days during cultivation

| Working days | Frequency (f) | Percentage (%) |
|------------------|---------------|----------------|
| Less than 7 days | 17 | 11.81 |
| 7-15 days | 25 | 17.36 |
| 16-22 days | 35 | 24.31 |
| 23- 30/31 days | 67 | 46.53 |

Use of fertilizers and support services required by farmers

Table 11 presents the distribution of respondents based on the type of fertilizer used and the support services needed in Tehsil Lawa. The data shows that a majority of farmers (50.69%) relied primarily on chemical fertilizers, while 18.75% used natural or organic fertilizers. Additionally, 30.56% of respondents reported using a combination of both organic and inorganic fertilizers, indicating an effort

to balance crop yield with soil health and sustainability. In terms of support services, a significant portion of farmers expressed a need for various forms of assistance to improve agricultural productivity. Specifically, 15.97% of respondents required subsidies, 20.14% needed extension services, 17.36% requested improved seed varieties, 18.75% sought better access to pesticides, another 17.36% needed fertilizer support, and 10.42% indicated a need for artificial insemination services to support their agri-business activities.

Table 11 Distribution of respondents by type of fertilizer used and support services needed

| Category | Particular | Frequency (f) | Percentage (%) |
|-------------------------------|-------------------------|---------------|----------------|
| Fertilizer type used | Natural/organic | 27 | 18.75 |
| | Chemical | 73 | 50.69 |
| | Both | 44 | 30.56 |
| Support needed by respondents | Subsidies | 23 | 15.97 |
| | Extension service | 29 | 20.14 |
| | Seed | 25 | 17.36 |
| | Pesticides | 27 | 18.75 |
| | Fertilizer | 25 | 17.36 |
| | Artificial insemination | 15 | 10.42 |

Cultivation practices and market dependency

The present study assessed the cultivation patterns and market dependency of rural respondents in Tehsil Lawa, District Chakwal (Table 12). Out of the total sample (N = 144), a significant majority of the respondents (93.75%) reported cultivating Bajra during the summer season, while only 6.25% cultivated pulses. Similarly, during the winter season, wheat was identified as the primary crop by 93.75% of the respondents, whereas only 6.25% cultivated rice. With regard to condiment and fruit cultivation, 74.31% of respondents indicated that they cultivate condiments on their land, while 25.69% did not. Additionally, 70.14% of respondents reported the cultivation of fruits, and 29.86% did not engage in fruit production. The findings further revealed that only 31.25% of the respondents believed their farming activities sufficiently met the annual household needs, while the remaining 68.75% relied on other income sources such as salaried jobs, small businesses, or livestock. In terms of market dependency, 77.78% of the rural households reported purchasing essential commodities such as flour, sugar, and cooking oil from the market. Only 22.22% were self-sufficient in this regard. Furthermore, 70.14% stated that they also purchase alternative items such as maize and jaggery, indicating a considerable level of market reliance. Regarding land ownership and farm satisfaction, 52.08% of the farmers expressed satisfaction with their current farm size, while 47.92% were not satisfied. A notable

70.14% expressed a desire to increase their farm size to improve agricultural productivity and income, while 29.86% were content with their current holdings. In terms of the profitability of subsistence farming, 68.75% of respondents perceived it as profitable, while 31.25% did not share this view. When asked about the use of paid labor for agricultural work, 52.08% reported hiring laborers during peak seasons, whereas 47.902% did not employ additional help. A substantial 79.86% of respondents reported cultivating traditional crops, following the farming methods of previous generations. Conversely, 20.14% adopted more modern practices. Furthermore, 52.08% of farmers showed a willingness to change their crop patterns for better yields and income diversification, while the rest preferred to continue with current cropping systems. On the topic of livestock, only 31.25% of respondents considered making changes to their livestock rearing practices, while 68.75% were not considering any alterations. The majority (93.75%) acknowledged facing pest and disease issues in their crops, indicating a widespread challenge across the area. Regarding the adoption of farm management techniques, 68.75% of farmers were open to adopting new methods to improve productivity, while 31.25% were not. However, access to financial support remains a critical issue, as only 9.72% of respondents reported receiving any form of government assistance, whereas a large majority (90.28%) stated they received no support.

Table 12 Distribution of respondents according to their cultivation practices and market dependency (N = 144)

| Particulars | Frequency (f) | Percentage (%) |
|---|---------------|----------------|
| Cultivation of bajra and pulses | | |
| Bajra | 135 | 93.75 |
| Pulses | 9 | 6.25 |
| Cultivation of wheat and rice in winter | | |
| Wheat | 135 | 93.75 |
| Rice | 9 | 6.25 |
| Cultivation of condiments and fruits | | |
| Condiments - Yes | 107 | 74.31 |
| Condiments - No | 37 | 25.69 |
| Fruits - Yes | 101 | 70.14 |
| Fruits - No | 43 | 29.86 |
| Farming caters to annual needs of household | | |
| Yes | 45 | 31.25 |
| No | 99 | 68.75 |
| Purchase of commodities (flour, sugar, oils, etc.) from market | | |
| Yes | 112 | 77.78 |
| No | 32 | 22.22 |

| | | |
|---|-----|-------|
| Purchase of alternate items (e.g., maize, jaggery, etc.) | | |
| Yes | 101 | 70.14 |
| No | 43 | 29.86 |
| Satisfaction regarding farm size | | |
| Yes | 75 | 52.08 |
| No | 69 | 47.92 |
| Desire to increase farm size | | |
| Yes | 101 | 70.14 |
| No | 43 | 29.86 |
| Perceived profitability of subsistence farming | | |
| Yes | 99 | 68.75 |
| No | 45 | 31.25 |
| Engagement of paid labor for field work | | |
| Yes | 75 | 52.08 |
| No | 69 | 47.92 |
| Cultivation of traditional crops | | |
| Yes | 115 | 79.86 |
| No | 29 | 20.14 |
| Changing crop patterns | | |
| Yes | 75 | 52.08 |
| No | 69 | 47.92 |
| Considering change in livestock rearing | | |
| Yes | 45 | 31.25 |
| No | 99 | 68.75 |
| Pest and disease problems | | |
| Yes | 135 | 93.75 |
| No | 9 | 6.25 |
| Adoption of farm management techniques | | |
| Yes | 99 | 68.75 |
| No | 45 | 31.25 |
| Need for financial support from government | | |
| Yes | 14 | 9.72 |
| No | 130 | 90.28 |

Reliability analysis of scales

Reliability analysis was conducted to examine the internal consistency of the measurement scales used in this study. Cronbach’s alpha was applied to determine whether the items under each construct were consistent and measured the same underlying concept. According to Sekaran and Bougie (2013), a Cronbach’s alpha value above 0.6 is considered acceptable, while values above 0.8 indicate excellent reliability. The results of the reliability analysis are presented in Table 13. The Cronbach’s alpha values for all constructs ranged from 0.77 to 0.89, demonstrating strong internal consistency across the scales. Specifically, Agriculture development recorded the highest alpha value (0.89), indicating excellent reliability. The constructs of Frontier model (0.78), Conservation model (0.77), and High pay-off input model (0.78) also showed satisfactory reliability. Similarly, the construct of Challenges in agriculture sector achieved an alpha value of 0.88, signifying high reliability. These results confirm that all scales used in the study were reliable and suitable for further statistical analysis.

Table 13 Scale reliability analysis

| Constructs | Cronbach’s Alpha |
|----------------------------------|------------------|
| Agriculture development | 0.89 |
| Frontier model | 0.78 |
| Conservation model | 0.77 |
| High pay off input model | 0.78 |
| Challenges in agriculture sector | 0.88 |

Correlation analysis

The correlation analysis was conducted to examine the association among the key variables of the study including Agriculture development, Frontier model, Conservation model, High pay-off input model, and Challenges in the agriculture sector. The results presented in Table 14 provide practical evidence of the relationships between these constructs. As shown in Table 14, Agriculture development is positively and significantly correlated with the Frontier model ($r = 0.297, p < 0.01$), Conservation model ($r = 0.146, p < 0.05$), High pay-off input model ($r = 0.240, p < 0.01$), and Challenges in the agriculture sector ($r = 0.378, p < 0.01$). These results suggest that improvements in Agriculture development are practically linked with advancements in all three models and are influenced by challenges in the sector. Furthermore, the moderator variable (Challenges in the agriculture sector) shows significant positive correlations with the Frontier model ($r = 0.338, p < 0.01$), Conservation model ($r = 0.435, p < 0.01$), and High pay-off input model ($r = 0.313, p < 0.01$). This implies that the challenges faced in agriculture not only affect overall development but also play a substantial role in moderating the relationship between agricultural models and outcomes. Practically, these correlations indicate that coordinated efforts to enhance frontier and conservation practices, alongside addressing sectoral challenges, can significantly strengthen agricultural development.

Table 14 Pearson correlation matrix among agriculture development, agricultural models, and sectoral challenges

| Variables | 01 | 02 | 03 | 04 | 05 |
|----------------------------------|--------|--------|--------|--------|----|
| Agriculture development | 1 | | | | |
| Frontier model | .297** | 1 | | | |
| Conservation model | .146* | .157* | 1 | | |
| High pay off input model | .240** | .239** | .143* | 1 | |
| Challenges in agriculture sector | .378** | .338** | .435** | .313** | 1 |

N = 144; *Correlation is significant at the .05 level; ** Correlation is significant at the 0.01 level, *** Correlation is significant at the 0.001 level (1-tailed)

Regression analysis

Regression analysis was conducted to determine the practical influence of Agriculture development on different agricultural models, as presented in Table 15. This analysis helps identify how changes in Agriculture development contribute to variations in the Frontier model, Conservation model, and High pay-off input model. The results in Table 15 indicate that Agriculture development explains a 50% change in the Frontier model (B = 0.500, p < 0.001), an 18.4% change in the Conservation model (B = 0.184, p < 0.01), and a 69.2% change in the High pay-off input model

(B = 0.692, p < 0.001). These findings show that as agricultural development improves, it significantly enhances the effectiveness and adoption of these agricultural models. When compared with the correlations presented in Table 14, the regression outcomes further confirm that Agriculture development has a strong and positive practical effect on advancing agricultural practices. This suggests that focused development initiatives can substantially strengthen agricultural performance through improved resource utilization, innovation, and productivity.

Table 15 Regression analysis showing the effect of Agriculture development on Agricultural models

| Variables | B | SE | T | p |
|---|---------|------|--------|-------|
| Agriculture development -> frontier model | .500*** | .189 | 4.215 | .0000 |
| Agriculture development -> conservation model | .184** | .231 | 3.651 | .0023 |
| Agriculture development ->high pay off input model | .692*** | .157 | 4.3974 | .0000 |

*p < .05; **p < .01; ***p < .001; B = Regression coefficients; SE = Standard error; T = t-values; p = Significance levels

Discussion

Our study revealed that the majority of farmers cultivated summer and winter vegetables, condiments, and fruits. These products were both consumed by the farmers themselves and sold in local markets. These findings align with the results of Altman et al. (2009), who argued that household food production is influenced by the size of the family and the corresponding need for food. Larger households tend to engage in subsistence production as a strategy to meet their food requirements. However, the capacity of a household to produce food often depends on the presence of able-bodied members who can actively participate in farming activities. Small-scale agricultural production therefore serves as a vital contributor to household food security. Nevertheless, in semi-industrialized economies such as Pakistan, small-scale farming can face challenges that may hinder its effectiveness in meeting basic food needs or sustaining agricultural productivity.

The findings of the study revealed that 68.75% of farmers reported that the monetary value of all their subsistence farm products was profitable, indicating that they derived tangible benefits from subsistence farming. These results are consistent with the findings of Tocco et al. (2012), who reported that subsistence farming makes a significant contribution to household incomes. In their study, the valuation of subsistence production lifted 8% of households above the poverty line, with the effect being most pronounced among the poorest households. Similarly, Mathijs and Noev (2002) argued that subsistence farming

serves as a survival strategy for poor communities living under difficult and risky conditions, helping them to cope with high transaction costs in economically fragile environments. In the present study, the majority of farmers were actively engaged in subsistence farming, with nearly 50% having more than 13 years of experience. This highlights both the importance of subsistence farming and the farmers' dependence on it to meet their livelihood needs. These findings align with the analysis of Tocco et al. (2012), which emphasized that subsistence farming is of critical importance for poor rural communities, particularly in countries such as Bulgaria and Romania. It can be viewed as a vital survival strategy not only for low-income groups but also in middle-income countries, especially during periods of economic reform or recession. Under such conditions, subsistence farming becomes a necessity rather than a choice, as rural households are often compelled to rely on it due to imperfect markets and exposure to economic shocks.

The study found that 93.75% of farmers in the research sample identified wheat as their main source of food consumed in daily life. This finding aligns with the results of Searchinger et al. (2008), who reported that wheat is the most important staple crop grown in temperate regions, with particularly high demand in industrialized and urbanized countries. Wheat serves as a major source of essential nutrients, providing energy and starch, as well as valuable components such as protein, vitamins particularly B vitamins, phytochemicals, and dietary fiber that are beneficial to human health. The results also indicated that 93.75% of farmers experienced problems related to pests

and diseases, which significantly reduced the production of various crops. This observation corresponds with the findings of Lucas (2011), who stated that pests and diseases adversely affect crop yield and quality, while also decreasing resource-use efficiency. Lucas (2011) further emphasized that the assessment of post-harvest losses is vital for conserving valuable agricultural produce, improving the livelihoods of farming families, and enhancing global food security. However, he noted that accurately assessing yield losses and their causes remains a major challenge, particularly for perennial crops. Additionally, the findings revealed that the majority of respondents perceived a lack of government support. Nearly 90.28% of farmers reported that they received no assistance in the form of subsidies. This result is consistent with Edeogbon (2008), who identified the lack of government support, insufficient funds, and the high cost of sustainable agricultural practices as major barriers to the adoption of sustainable farming methods.

The results showed that 89.58% of farmers had insufficient land for cultivation, indicating very small landholdings. This aligns with the findings of Saqib et al. (2018), who reported that farmers with smaller land sizes often have limited access to credit compared to those with larger holdings. Additionally, 68.75% of farmers were unable to sustain their households throughout the year solely from subsistence farming, suggesting that the income generated was inadequate. These findings correlate with Aliber and Hart (2009), who emphasized that while subsistence farming contributes to household food security, South Africa's black farming communities face significant challenges, including low input use and poor yields. They argued that over four million subsistence farmers in South Africa require financial support tailored to local contexts. The study also found that 70.14% of farmers purchased feed and fodder for their livestock, highlighting challenges in meeting animal feed requirements. This is consistent with Walsh et al. (2009), who noted that dairy farmers often face constraints such as low milk yields from indigenous breeds, fodder shortages, limited water availability, and inadequate preservation technology. Furthermore, 80.5% of respondents stated that subsistence farming is vital for their households, as it provides essential products for domestic use. This finding supports Baiphethi and Jacobs (2009), who concluded that poor households rely mainly on three food sources: markets, their own subsistence production, and public or community-based food programs. Although subsistence farming plays a critical role in household food security, its production remains insufficient to meet overall needs.

The study found that 88.2% of farmers faced challenges such as the absence of proper markets for selling their produce and high input costs, which contributed to a gradual shift away from subsistence farming. These findings are consistent with Bengana et al. (2013), who reported that high food prices, limited irrigation water, restricted market access, and costly fertilizers were major production constraints, prompting farmers to adopt more cash-oriented cropping patterns. Furthermore, 76.39% of farmers relied on the market to obtain inputs such as seeds and fertilizers, which constrained their production capacity. Similar research has shown that limited education, high transportation costs, long farm-to-market distances, and lack of market

information significantly affect small farmers' access to output markets and overall income. This study highlights that agricultural practices play a crucial role in poverty alleviation, employment generation, economic activity, and trade. The findings emphasize the need for improved market access, affordable inputs, and supportive policies to strengthen rural livelihoods and sustain agricultural productivity.

An examination of the socioeconomic background of the study area reveals that the local population relies heavily on agriculture and livestock, supported mainly by rainfall and constrained water resources. Major crops cultivated in the region include wheat, barley, pulses, maize, and groundnuts. Among these, wheat is more profitable than groundnuts, although its production cost per acre is higher. Land preparation accounts for a major portion of the total cost 17% of land rent for wheat and 20% for groundnut, 16% for land preparation in wheat and 17% for groundnuts, while fertilizer use represents 13% for wheat and about 10% for groundnut. Groundnut generates an average gross income of Rs. 120,000 per acre, which is nearly half that of wheat (Rs. 45,000 per acre). The study observed that most farmers do not apply fertilizers in the recommended quantities due to their low purchasing power and high market prices. Many farmers also reported the sale of counterfeit seeds and fertilizers, which negatively affects crop yields and contributes to rural poverty. This issue calls for strict market regulation to stabilize fertilizer prices and control the circulation of fake agricultural inputs such as seeds, pesticides, and herbicides. Ensuring the timely availability of quality agricultural input is crucial for maintaining productivity. Groundnut yields, averaging only 10 maunds (400 kg) per acre, remain far below their potential. The survey further revealed that most farmers were unaware of proper groundnut thinning practices. Therefore, agricultural extension and research systems should focus on raising farmer awareness and improving access to modern production technologies to enhance groundnut productivity.

Conclusion and Recommendations

This study revealed that agriculture remains the primary source of income and food security, despite limited resources, small landholdings, and low access to modern technologies for rural communities in Tehsil Lawa, District Chakwal. Most farmers cultivate wheat and groundnut, which together occupy more than 65% of the cultivated area. Livestock rearing and vegetable cultivation further supplement household income and nutrition. The research highlighted that low literacy rates, limited financial support, and inadequate infrastructure constrain productivity. About 90% of farmers reported not receiving any government assistance, and only a minority adopts modern farm management or conservation practices. Regression and correlation analyses confirmed that agricultural development strongly and positively influences the adoption of frontier, conservation, and high pay-off input models, indicating that investment in agricultural capacity directly enhances productivity and livelihoods. Conclusively, agriculture plays a decisive role in rural livelihood improvement in Tehsil Lawa.

However, realizing its full potential requires targeted interventions in technology adoption, education, and institutional support to ensure sustainable income generation and poverty reduction. Agricultural extension programs should be expanded to focus on modern cultivation techniques, pest control, and soil conservation, while farmer field schools and peer-learning groups should be promoted to enhance the adoption of innovative practices. Access to finance and agricultural inputs should be facilitated by simplifying credit procedures and ensuring the provision of subsidized fertilizers, certified seeds, and modern equipment. Local microcredit facilities should be established to support smallholders during input-intensive seasons. Furthermore, farmers should be provided with training in improved livestock breeding, feed management, and disease control. Coordination among government departments, NGOs, and local institutions should be strengthened to ensure effective implementation of agricultural development initiatives and maximize their impact on rural livelihoods.

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.

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

S.U. conceived and designed the study, developed the research instruments, conducted field data collection, performed data analysis, and prepared the initial manuscript draft; M.I. contributed to refining the research design, assisted in data interpretation, provided critical revisions to the manuscript, and supported the finalization of the article.

vi. Funding

No funding was received for the design, data collection, analysis, interpretation, or writing of this research manuscript.

vii. Acknowledgement

Not applicable.

viii. SDGs addressed

No Poverty (SDG 1); Zero Hunger (SDG 2); Decent Work and Economic Growth (SDG 8)

Publisher's note: All claims shared in this article are entirely those of the authors and do not reflect the positions of their affiliated institutions, AgriBio e-Spectrum (the publisher), editors, or reviewers. Any mention or assessment of a product, as well as any claims made by its manufacturer, are not endorsed or guaranteed by the publisher.

References

- Abbas, A., Lu, F., Yaseen, M., & Ameen, M. (2024). Exploring the impact of foreign aid, agricultural production, and corporate social responsibility on poverty reduction in Pakistan. *World*, 5(3), 570–587. <https://doi.org/10.3390/world5030029>
- Abbas, Q., & Shafique, A. (2019). Integrated use of organic and inorganic fertilizers improves soil health, growth and yield of wheat (*Triticum aestivum* L.). *Advances in Agriculture and Biology*, 2(1), 48-54. <https://doi.org/10.63072/aab.19007>
- Abebe, T. (2005). *Diversity in homegarden agroforestry systems of Southern Ethiopia* (Doctoral dissertation, Wageningen University, The Netherlands). ISBN 90-8504-163-5.
- Afridi, F., Mahajan, K., & Sangwan, N. (2021, July). The gendered effects of climate change: Production shocks and labor response in agriculture (IZA Discussion Paper No. 14568). IZA – Institute of Labor Economics. <https://ftp.iza.org/dp14568.pdf>
- Ahmad, M. I., Oxley, L., Ma, H., & Liu, R. (2023). Does rural livelihood change? Household capital, climate shocks and farm entry-exit decisions in rural Pakistan. *Frontiers in Environmental Science*, 10, 857082. <https://doi.org/10.3389/fenvs.2022.857082>
- Aliber, M., & Hart, T. G. B. (2009). Should subsistence agriculture be supported as a strategy to address rural food insecurity? *Agrekon*, 48(4), 434–458.
- 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. <https://doi.org/10.14257/ijast.2017.103.05>
- Baiphethi, M. N., & Jacobs, P. T. (2009). The contribution of subsistence farming to food security in South Africa. *Agrekon*, 48(4), 459–482.
- Bengana, M., Bakhouch, A., Lozano-Sánchez, J., Amir, Y., Youyou, A., Segura-Carretero, A., & Fernández-Gutiérrez, A. (2013). Influence of olive ripeness on chemical properties and phenolic composition of Chemlal extra-virgin olive oil. *Food Research International*, 54(2), 1868–1875. <https://doi.org/10.1016/j.foodres.2013.08.037>
- Brüntrup, M., & Heidhues, F. (2002). *Subsistence agriculture in development: Its role in processes of structural change* (Discussion Paper No. 1/2002). Institute of Agricultural Economics and Social Sciences in the Tropics and Subtropics.
- Datta, P., Behera, B., & Rahut, D. B. (2024). Assessing the role of agriculture–forestry–livestock nexus in improving farmers' food security in South Asia: A

- systematic literature review. *Agricultural Systems*, 213, 103807; <https://doi.org/10.1016/j.agry.2023.103807>
- Government of Pakistan. (2024). *Pakistan economic survey 2023–24*. Economic Adviser's Wing, Finance Division.
- Government of Pakistan. (2025). *Pakistan economic survey 2024–25*. Economic Adviser's Wing, Finance Division.
- Government of the Punjab. (2006). *Poverty focused investment strategy for Punjab*. Planning & Development Department. Punjab Resource Management Program. https://prmp.punjab.gov.pk/system/files/PFIS_MAIN_STRATEGY.pdf
- Iqbal, J., Shah, S. F. H., & Ahmad, I. (2018). Effect of sowing time, advanced genotype, and potassium application on seed cotton yield in relay cropping with wheat. *Advances in Agriculture and Biology*, 1(1), 15-22. <https://doi.org/10.63072/aab.18003>
- Iqbal, M. T. (2018). Subsistence farming and rural food security: A review. *Advances in Agriculture and Biology*, 2(1), 1-5. <https://doi.org/10.63072/aab.18001>
- Kiani, K. (2025, June 4). 'Flawed' govt policies cause sharp contraction in major crops. *Dawn*. Retrieved from <https://www.dawn.com/news/1915349>
- Kumar, B., & Nair, P. (2004). The enigma of tropical homegardens. *Agroforestry Systems*, 61–62, 135–152. <https://doi.org/10.1023/B:AGFO.0000028995.13227.ca>
- Latif, R., Latif, A., Arsalan, M., Khan, M., Ullah, R., Bilal, M., Aulakh, A. M., Shah, S. H., & Abdullah, M. (2025). Characterization and distribution of rainfed soils of District Chakwal for sustainable agricultural production. *Pure and Applied Biology*, 14(2), 607–615. <https://doi.org/10.19045/bspab.2025.140058>
- Mathijs, E., & Noev, N. (2002, August 28–31). Commercialization and subsistence in transition agriculture: Empirical evidence from Albania, Bulgaria, Hungary and Romania. Paper presented at the 10th EAAE Congress, *Exploring diversity in the European agri-food system*, Zaragoza, Spain.
- Mehmood, K., Arshad, M., Ali, G. M., Razzaq, A., & Qureshi, R. (2020). Optimization of factors affecting callus-based gene transformation by *Agrobacterium tumefaciens* in wheat (*Triticum aestivum* L.). *Advances in Agriculture and Biology*, 3(1), 23-31. <https://doi.org/10.63072/aab.20004>
- Mumtaz, I. A. (2020). Potential and constraints of growing sunflower crop in Pakistan: An updated review. *Advances in Agriculture and Biology*, 3(1), 38-44. <https://doi.org/10.63072/aab.20006>
- Nadeem, M. (2025, August 28). *Agriculture's role in Pakistan's economy and food security*. The Agricultural Economist. Retrieved from <https://www.agriconomist.com/agricultures-role-in-pakistan-economy-and-food-security>
- Nadeem, M. A., Surlenty, L., & Haque, M. M. (2022). Impact of organization decision making styles and safety accountability on occupational health and safety implementation: The moderating role of mimetic motives. *Frontiers in Public Health*, 10, 1004767; <https://doi.org/10.3389/fpubh.2022.1004767>
- Nepali, B., Jackson, T., & Johns, C. (2024). Exploring the potential of agriculture diversification as a pathway to an improved smallholder livelihood dietary system in Nepal. *Sustainability*, 16(21), 9384. <https://doi.org/10.3390/su16219384>
- Noroz, M. M., Shah, A. N., & Latif, A. (2021). Role of adaptation strategies for climate change and nutrients management tools in Gilgit Baltistan's agriculture. *Advances in Agriculture and Biology*, 4(1), 14-21. <https://doi.org/10.63072/aab.21003>
- Pak Information. (2024). Population of Chakwal Census 2023. Retrieved October 9, 2025, from <https://pakinformation.com/population/chakwal.html>
- Pakistan Bureau of Statistics. (2023). Population and area statistics of Tehsil Lawa, District Chakwal (Census 2023). Retrieved October 9, 2025, from <https://www.pbs.gov.pk/>
- Pawlak, K., & Kołodziejczak, M. (2020). The role of agriculture in ensuring food security in developing countries: Considerations in the context of the problem of sustainable food production. *Sustainability*, 12(13), 5488. <https://doi.org/10.3390/su12135488>
- Samiullah et al. (2014). Climate change and agricultural system: potential impacts and soil management strategies. https://www.researchgate.net/profile/Umar-Nawaz-3/publication/309397467_Indus_Basin_Irrigation_System_and_Climatic_Trends_Regarding_Glacial_Regimes_and_Water_Runoff/links/5ce42afc92851c4eabb4d8b9/Indus-Basin-Irrigation-System-and-Climatic-Trends-Regarding
- Searchinger, T., Heimlich, R., Houghton, R. A., Dong, F., Elobeid, A., Fabiosa, J., Tokgoz, S., Hayes, D., & Yu, T.-H. (2008). Use of U.S. croplands for biofuels increases greenhouse gases through emissions from land-use change. *Science*, 319(5867), 1238–1240. <https://doi.org/10.1126/science.1151861>
- Sekaran, U., & Bougie, R. (2013). *Research methods for business: A skill-building approach* (6th ed.). John Wiley & Sons: New York.
- Singh, A. K., Pathak, M., Joshi, M. D., Kumar, S., Kashyap, S., & Hasan, W. (2024b). The role of agriculture in poverty alleviation and rural development. *Journal of Scientific Research and Reports*, 30(8), 529–549. <https://doi.org/10.9734/jsrr/2024/v30i82276>
- Singh, R., Dell'Angelo, J., Oguge, N., & Odote, C. (2024a). The role of livelihoods in agrifood sustainability transitions. *Environmental Innovation and Societal Transitions*, 50, 100799. <https://doi.org/10.1016/j.eist.2023.100799>
- Tocco, B., Davidova, S., & Bailey, A. (2012, February). *Key issues in agricultural labour markets: A review of major studies and project reports on agriculture and rural labour markets* (Factor Markets Working Paper No. 20). Centre for European Policy Studies (CEPS).
- Voronin, B. A., Chupina, I. P., Voronina, Y. V., Kukhar, V. S., & Simachkova, N. N. (2022). About agricultural products, raw materials and food with improved characteristics (scientific commentary on

- the Federal Law). *IOP Conference Series: Earth and Environmental Science*, 949(1), 012025. <https://doi.org/10.1088/1755-1315/949/1/012025>
- Walsh, M. R., Hancock, S. H., Wilson, S. J., Patil, S. L., Moridis, G. J., Boswell, R., Collett, T. S., Koh, C. A., & Sloan, E. D. (2009). Preliminary report on the commercial viability of gas production from natural gas hydrates. *Energy Economics*, 31(5), 815–823. <https://doi.org/10.1016/j.eneco.2009.03.006>
- Worldometer. (2025). Pakistan population (LIVE). Retrieved October 9, 2025, from <https://srv1.worldometers.info/world-population/pakistan-population/>
- Zaman, S. B., Ishaq, M., & Niazi, M. A. (2021). Contribution of agriculture sector in economic growth of Pakistan: An empirical analysis. *Journal of Applied Economics and Business Studies*, 5(2), 103–120. <https://doi.org/10.34260/jaeb.527>



Copyright: © 2025 by the author(s). This open access article is distributed under a Creative Commons Attribution License (CC BY 4.0), <https://creativecommons.org/licenses/by/4.0/>