



Research Article

Current Status and Future Prospects of Organic Farming in Pakistan with Focus on Horticultural Crops

Muhammad Zamin^{1*}, Yousaf Jamal¹, Ibadullah Jan¹, Umer Rafique¹, Muhammad Amin¹, Haroon Ur Rashid³ and Shah Hassan⁴

¹Department of Agriculture, University of Swabi, Khyber Pakhtunkhwa, Pakistan; ²Shaheed Benazir Bhutto University, Sheringal, Khyber Pakhtunkhwa, Pakistan; ³Department of Agronomy, The University of Haripur, Khyber Pakhtunkhwa, Pakistan; ⁴Department of Agricultural Extension Education and Communication, The University of Agriculture, Peshawar, Khyber Pakhtunkhwa, Pakistan.

Abstract | Considering the importance of organic farming in human health, the current status and future prospects of organic vegetable and fruit production in Pakistan was investigated in the year 2021-22. The data analyzed was obtained from randomly selected 14 districts of Pakistan. The list of organic farms in Pakistan was collected from internet source and personal contacts, followed by data screening for authentication. Around 50% of farms were found suitable for interview, where probability of organic production was found. A structured questionnaire was used to collect primary data from the farmers. The analysis of data indicated that 50% of the organic farms were run by employees/farm supervisors and they all were graduated. This indicates that the investors have awareness and started their own organic farms to get better business opportunities. According to the data received from farmers, organic farming is a profitable business with an average cost benefit ratio of 1.5. A significant portion of farmers were using organic inputs such as 70% by taking organic pesticides and fertilizers. However, 20% were using their own seeds for propagation. By means of organic practices, the production at initial years is declining as 60% farmers claimed that organic crops production is 25% less than conventional crops, while 20% were in the opinion of 50% less than traditional farming. The decline in production was due to disease and pest's occurrence (60% farmers), while 20% farmers described that the non-availability of proper market for organic products is the main reason of its failure. The analysis of the farmers' perception indicated that 90% farmers perceived bright future of organic farming business in Pakistan. Besides, remaining farmers were hoping a proper market for organic products to make this profitable business. Mostly organic farms were operating in Khyber Pakhtunkhwa, Punjab and Islamabad territory. It was concluded that organic farming in Pakistan is not implemented in the true spirit in terms of fruits and vegetable production, so the government need to launch trainings and projects to promote organic farming.

Received | February 05, 2025; **Accepted** | March 24, 2025; **Published** | July 17, 2025

***Correspondence** | Muhammad Zamin, Department of Agriculture, University of Swabi, Khyber Pakhtunkhwa, Pakistan; **Email:** zaminhort@yahoo.com

Citation | Zamin, M., Y. Jamal, I. Jan, U. Rafique, M. Amin, H.U. Rashid and S. Hassan. 2025. Current status and future prospects of organic farming in Pakistan with focus on horticultural crops. *Sarhad Journal of Agriculture*, 41(3): 1023-1032.

DOI | <https://dx.doi.org/10.17582/journal.sja/2025/41.3.1023.1032>

Keywords | Organic, Agriculture, Fruits, Vegetables, Pesticide, Environment



Copyright: 2025 by the authors. Licensee ResearchersLinks Ltd, England, UK.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Introduction

Scientists are continuously working on how to increase yield to fulfil the food requirements of the growing population through different possible means, including fertilizers and pesticides (Anjum *et al.*, 2016). However, they did not consider the harmful effect of using pesticides and fertilizers which are the main carrier of toxic elements into the human body via food chain (Ahmad *et al.*, 2002). A lot of health issues are related to contaminated food. Due to the current awareness about the side effects of these pesticides, most people are health conscious, but they don't have any other option than using food items from local market which is highly contaminated. We should have a supply chain for the provision of organic products in the market. Although, all the advanced countries of the world have started to produce and promote organic food but, no one has taken serious and practical steps in this regard in Pakistan (Huq *et al.*, 2020).

Under the current scenario, the demand for agricultural products will increase to 60% by 2030 (Nawaz *et al.*, 2025; Nosheen *et al.*, 2021). If we go back to history, the main reason behind Green Revolution was to meet the demands of agriculture goods adequately and to feed the increasing population at that time. Though, Green Revolution, allowed developing countries to overcome food shortage by using high-yielding varieties, modifying farm equipment, and substantially increasing use of chemical fertilizers (Margni *et al.*, 2002). Under this mission they promoted intensive agriculture whereby toxic organic and inorganic compounds were entering the environment on a large scale. Thus, the accumulation of pesticide residues in food products particularly fruit and vegetables and its use by human become a serious issue (Fenik, 2011; Shakur *et al.*, 2007). The use of pesticides and fertilizers promoted during the era between 1960s and 1990s which is maintained in the same pattern in many developing countries. As far as Pakistan is concerned, the growth rate of pesticide is 11% with an increasing tendency. According to an estimate the pesticide active ingredient use in 2012 was six billion pounds which is almost equal to one pound for each of the 6.6 billion people living on earth (Freeman, 2020; Lu, 2017). Pesticides affect health adversely in different means such as transfer to air, soil, ground and surface waters and food etc. However, the food intake is the major source. The food intake results

in the highest toxic exposure to human, about 103 to 105 times higher than that induced by drinking water or inhalation (Margni *et al.*, 2002). Apart from pesticides, we have another serious issue of heavy metal contamination in the environment. Taken up by plants, heavy metals may enter the food chain, and therefore, humans can also be exposed to them. Taking this food means we are taking poisonous chemicals on a daily basis. The accumulation of these carcinogenic chemicals is leading to serious human health problems which is reducing the efficiency of work performed by individuals. If we look into another aspect, our significant amount of financial budget is consumed on medicine and related health issues which also lead to an increase in the government budget for public hospitals (Grewal, 2017). Therefore, enhancing the production while keeping the environment safe is one of the major challenges in the 21st century. Currently, several countries are working to reduce the use of agrochemicals (Grewal, 2017; Durán-Lara, 2020). Many people are health conscious and are ready to pay any cost for buying the contamination free food, but they have no access to healthy/organic food.

Organic agriculture is now emerging as a sustainable alternative to traditional agriculture using environmentally friendly strategies such as the application of organic fertilizers and pesticides based on plant extracts and microbials (Durán-Lara, 2020). It comprises eco-friendly agricultural techniques leading towards the maximum production without using chemical inputs. This approach is gaining importance as it is leading to sustainable agriculture particularly under climate change scenario (Zamin *et al.*, 2025; Anjum *et al.*, 2016). The new sources of organic fertilizers such as Compost, Vermicompost, and Biochar can best replace synthetic fertilizers while keeping soil healthy. While biopesticides prepared from plants, extracts integrated with biological control techniques can control insects' damage to plants (Saleem *et al.*, 2024; Muhammad *et al.*, 2019)

Organic farming is the growing sector with potential of its high contribution to GDP. If proper planning and foresighted measures are timely taken, Pakistan has one of the greatest potentials among the developing countries to export organic food to international market (Husnain *et al.*, 2017). Due to the importance of organic farming, the area under organic cultivation in the world has increased from 30.47 million hectares in 2006 to 50.9 million

hectares in 2015. This indicates the growing demand for organic farming. There are different organizations recognized globally to evaluate and register an organic farm such as US Department of Agriculture (USDA), EU Organic, IFOAM Organic (International Federation of Organic Agriculture Movements) and Naturland Organic (a German-based organic farming association). These organizations allow a farm or processing facility to sell, label, and represent their products as organic (Greene, 2003). The organic brand provides consumers with more choices in the marketplace (Bruma *et al.*, 2023).

In Pakistan organic culture has not been taken seriously. Therefore, establishing a model organic farm in each province along with its market sponsored by the government to promote organic culture in the country will open a window for local trade, as well as provide opportunities in the international organic market. Therefore, the current study was launched to

explore current status of organic farming, to identify the hindrance in promoting organic farming and find out organic farmer's suggestions in promoting organic farming in Pakistan.

Materials and Methods

Study area

Almighty Allah has gifted us with many agricultural microclimates and four seasons of the year which can provide year-round supply of various crops in the country. Farmers were surveyed in various districts in each province of Pakistan in the year 2021/22. The major agricultural producing provinces of Pakistan i.e., Punjab, Khyber Pakhtunkhwa, Sindh, Baluchistan and Islamabad Capital territory were selected for the study. Initially data were collected from internet and personal contacts in various departments to prepare a list of organic farms in each province (Tables 1, 2, 3, 4 and 5).

Table 1: Organic farms of KPK.

S. No	Name of organic farms	Contact No	District	Product	Remarks
1	Fresh organic farming movement Pakistan	03149019406	Swabi	Vegetable	Interview
2	Dilazak-farm	03449932915	Haripur	Vegetable	Phone call
3	Amir Khan farm	03349113599	Mardan	Vegetable	Phone call
4	Mishal organic farming private limited	03462223338	Karak	Vegetable	Phone call
5	Shahzad farm organic food (organic shop)	03331979906	Hayatabad Peshawar	Vegetable	Phone call
6	Farm fresh mushrooms	03355107118	Haripur	Mushrooms	Phone call
7	Taimur fruit and vegetable farms	03360000563	Haripur	Fruit and Vegetable	Phone call
8	Ghazi organic farm	03348866600	Buner	Fruits	Phone call
9	Rasheed organic farm	03149858324	Swabi	Vegetable	Interview
10	Anees Khan organic farm	03169171495	Abbottabad	Oils	Phone call

Table 2: Organic farms of Islamabad.

S. No	Name of organic farms	Contact No	District	Product	Remarks
1	Hashirs organic	033351411118	Banigala	Vegetables	Interview
2	Aman vegetable farm	03335755176	Rawalpindi	Vegetable	Phone call
3	Garden market organic farm	03441583433	Islamabad	Vegetable and fruits	Interview
4	Organic Reri farm Isloo farm	035227578	Islamabad	Vegetable and fruits	Phone call
5	Strawberry garden	03075154453	Islamabad	Vegetable and fruits	Phone call

Table 3: Organic farms of Sindh.

S. No	Name of organic farms	Contact No	District	Product	Remarks
1	Orion organic farm	03353704236	Karachi	Vegetable	Phone call
2	Sughra farm	03341895694	Sindh	Vegetable	Interview
3	Karachi farms	02137299045	Karachi	Vegetable and fruits	Phone call
4	Pasha farms	03142099955	Karachi	Vegetable	Interview
5	O organic farm	03111223265	Karachi	Vegetable and meet	Phone call
6	Hara organic farm	03452377398	Karachi	Vegetable	Interview
7	Mehran agriculture farm	0345 0531111	Sindh (Thatta)	Vegetable	Phone call

Table 4: *Organic farms of Punjab.*

S. No	Name of organic farms	Contact No	District	Product	Remarks
1	Asad Farooq farm	03000501749	Attack	Vegetables	Interview
2	Awan organic farm	03338596669	Rawalpindi	Vegetable	Phone call
3	Khan organic farm	03458222642	Chakwal	Vegetable and oil	Interview
4	Zeez garden	03454539222	Lahore	Vegetable	
5	Back to nature	03037467454	Bahawalpur	Vegetable	Interview
6	Ahmad organic farm	03335714142	Bahadar Abad	Vegetable	Interview
7	Javed Akhtar	3025640030	Rawalpindi	Fruits and vegetables	Interview
8	Shah organic farm	03059704747	Attock Punjab	Meat	Phone call
9	Signature organic farm	03344542424	Chakwal	Vegetables	Phone call
10	Royal organic farm	03313820501	Mangwal	Vegetables	Phone call

Table 5: *Organic farms of Balochistan.*

S. No	Name of organic farms	Contact No	District	Product	Remarks
1	Bin Akram farms and traders	03368313136	Mastung	Vegetable	Interview
2	Kolchi group of companies	03108103776	Baluchistan	Vegetable	Phone call
3	Barkhan organic cotton	03337086431	Baluchistan	Cotton	Interview
4	Dagarzai fruit farm	0325479442	Winder, Balochistan	Fruit	Phone call

Table 6: *Farmer's education level, ownership status, farm characteristics, cost benefit ratio of organic farm.*

Variable	Description	Mean (percentage)
Farmer education	Years of school attended	14
Farmer type	Farmer ownership	50%
Organic farm age	Years of farming experience	7
Farm size	Size of farmers farm in kanals	30
Cost benefit ratio	Annual operational cost on organic farms production per farm (labors/machinery/water), inputs (fertilizers, pesticides, seeds, rent) in rupees (Lac)- Annual net income from farm products in rupees (lac)	1.5
Farm certification	Registration with International Certification organization for standards	0

Source: *Field survey, 2021/22.*

Sampling and data

The list of organic farms in various districts of four provinces and ICT was prepared based on the information available on the internet and coordination with various authorities in agriculture departments including but not limited to agriculture extension, research, universities and NARC. Though, Directorate of Organic Farming, Islamabad was established in 2008 to help the small farmers to go for organic farming but unfortunately it is not operational, and government has no projects pertaining to organic farming. We used simple random samplings to select farmers in each province. 40 to 50% of the farms from the list were taken and a total of 14 farmers were interviewed belonging to different districts of Pakistan.

While searching for and selecting organic farms, the specific focus was given on fruits and vegetables. A well-designed questionnaire (Provided in appendices) was developed to solicit information on various aspects of organic farming as given below:

Type of respondent/organic farmer

1. When did organic farm start (how many years ago)
2. Who inspired you to start organic farming (How did you started organic farming)?
3. Education level of farmer/respondent (years)
4. Location/district and province in which organic farm exists
5. Is the farm certified?
6. Farm area (kanal)

7. Crops grown
8. Protection measures
9. Fertilizers used
10. Seeds used
11. Annual operational cost on organic farms production per farm (labors/ machinery/ water), inputs (fertilizers, pesticides, seeds, rent) in rupees (Lac)
12. Annual net income from farm products in rupees (lac)
13. Yield of organic crops as compared to traditional/ inorganic crops production
14. Problems in organic production
15. Prospect of organic farming (future) in Pakistan
16. Suggestion to promote organic Farming in Pakistan

The data collection tool was pre-tested to remove any ambiguity and irrelevancy of the questions. Information was solicited on the information/ perceptions of the farmers about the parameters mentioned above.

Data was analyzed using SPSS and means table were provided as shown in the next chapter results and discussion.

Results and Discussion

Farmer's education level, ownership status, farm characteristics, cost benefit ratio of organic farm

The important variables related to famers educational level, farm characteristics and income details are presented in Table 6. The mean educational level of farmers was 14 years which shows that most farmers were graduated, and they are health conscience. They are well aware of organic farming and its benefits as

compared to conventional farming where heavy use of pesticides is observed. 50% farmers were owners and had not to pay rent. Thus, they had no issue with loss during initial years of farm establishment. On average the farms were established 7 years ago. However, there were some farms which were established more than 10 years ago when government of Pakistan initiated a campaign for organic farming and for this purpose, they established directorate of organic farming in collaboration with foreign funding agencies. As far as the farm size is concerned the average size was 30 kanal, while some farms were located on several acres (Husnain and Khan, 2015).

Cost benefit ratio of organic farming

Cost benefit ratio is the main factor determining the success or failure of a farm, therefore, questions were posed to the farmers to know their perceptions about the annual operational cost on organic farms production per farm (labours/machinery/water), inputs (fertilizers, pesticides, seeds, rent) in rupees (Lac). The discussion with the local farmers indicated that though, the net profit from organic farming was found less than conventional farming. The average cost benefit ratio was 1.5, indicating a 50% net profit from the produce of organic farming which is not satisfactory. However, it can sustain the farmers if they are getting health benefits and practicing organic farming in the public interest. Some of the farmers explained that the initial 2 to 3 years are more important where the farm operational cost is higher or very close to the profit from produce. During this period pest management and soil health improvement is costing higher while the subsequent years are followed by very minimum infestation and fertile soil (Anjum *et al.*, 2016).

Table 7: *Farmers perceptions who inspired and crops grown in the field.*

Question description	Options	Percent response
Who inspired you to start organic farming (How did you started organic farming)	watching/listening mass media/social media for importance of organic farming	10
	Foreign funded project campaign	5
	Govt project or training	5
	From friends and relatives residing abroad	30
	Brought vision by staying abroad	10
	Self-initiative	30
	All of above	10
Crops grown	Fruits	20
	Vegetables	30
	Others	50
	All	100

Source: Field survey, 2021/22.

Is the organic farm certified?

The certification and registration of farms play key role in the sustainability of farms and to ensure the farmers are producing what is required by the customer and to protect the customer right as well. In this regard, questions were asked from farmers to know the current status of organic farms on ground and to identify which farms are organic in real sense. As per the local farmers, we found poor results pertaining to the registration with international certification organizations for standards. This might be due to the fact that it was not economical for farmers to follow organic farming standards while keeping profit margin. So, we could not introduce their products in the international market, thus they remained limited to their local market only.

Crops grown

The type of crop grown has significant effect on the success or failure of the farm as each crop has its own market value. Farmers were asked about the crops grown on their farm and as per their feedback 50% organic farms were covered with non-horticultural crops while 30% area was planted by vegetables followed by orchards (Table 7). These findings indicate that there is clear variability in the crops grown depending upon the farmer easy of operational works and market value of crop. These findings support the findings of Anjum *et al.* (2016).

How the farmer was inspired

The farmers were asked using structured questionnaire regarding their interest in organic farming. 40% farmers claimed that they have brought the concept from advanced countries either by staying there or having relatives residing in these countries. 30% farmers were initiative which indicates that our farmers are also aware of the organic farming particularly the educated farmers.

Protection measures for disease and pest management

The farmers were asked using structured questionnaire regarding the use of pesticides and how to control pests in organic farming. 70% farmers were using biopesticides to control the pests and diseases, while 30% farmers were preparing their remedy for pest management.

Type of seeds used

The type of seeds used has significant effect on the success or failure of the farm as each seed has its own

success percentage. Farmers were asked about the type of seeds used on their farm and as per their feedback 60% organic farmers were using their own seeds while 30% were taking from local market. However, some (10%) also claimed that they are using hybrid seeds which indicates that they have no idea about organic farming rather they are following their own standards (Table 8).

Table 8: Protection measures, farm inputs and yields.

Question de- scription	Options	Percent response
Protection meas- ures	organic pesticides	70
	synthetic pesticides	10
	both organic and synthetic pesticides	10
	homemade organic pesticides	10
Fertilizers used	compost/manure (organic)	70
	synthetic fertilizers	10
	Both	20
Seeds used	own seeds	20
	hybrid seeds	10
	locally purchased seeds	30
	All	40
Yield of organic crops as com- pared to tradi- tional/inorganic crops production	Same	5
	25% less	60
	50% less	20
	75% less	4
	100% less	4
	25% more	2
	50% more	2
	75% more	2
	100% more	1

Source: Field survey, 2021/22.

Fertilizer used

The type of fertilizers used has significant effect on the success or failure of the farm as each fertilizer has its own nutrient status which led to either success or failure of crop. Farmers were asked about the type of fertilizers used on their farm and as per their feedback 70% organic farmers were using their own organic fertilizers (Farmyard manure) while 20% were using both type of organic and synthetic fertilizers (Adnan *et al.*, 2020).

Yield of crops in organic farms as compared to traditional crops

According to farmer's perception and experience, 60% farmers stated that the organic farming production

is 25% less than conventional farming while 20% perceived that production of organic and inorganic is less than 50%. Some of the farmers explained that the initial 2 to 3 years are more important where the farm operational cost is higher or very close to the profit from produce. During this period pest management and soil health improvement is costing higher while the subsequent years are followed by very minimum infestation and fertile soil (Anjum *et al.*, 2016).

Problems in organic production

Farmers were asked about the problems faced by them during organic farming. As per their feedback, 60% problems perceived from diseases and pests while 20% farmers claimed that the main reason in failure of organic farming is the non-availability of proper market for organic products. 10% were attributed to high cost of labours on organic farming (Table 9).

Table 9: Farmers' perceptions of problems in organic production, prospects of organic farming (future) in Pakistan and suggestion to promote organic farming in Pakistan.

Question description	Options	Percent response
Problems in organic production	Disease and insects' control	60
	high labor requirements	10
	Seeds, biofertilizers and bio pesticides availability	5
	Market not available/no customer	20
	No awareness	5
	Low quality of product	0
Prospect of organic farming (future) in Pakistan	High	90
	Low	10
	Don't know	0
Suggestion to promote organic Farming in Pakistan	Govt to create awareness on media	40
	Govt to restrict pesticides and synthetic fertilizers use	10
	Subsidy on organic farming	10
	Special loan for starting organic farming business	20
	Promote organic pesticides and organic fertilizers	10
	All of above	20

Source: Field survey, 2021/22.

Farmers perception about prospects of organic farming in Pakistan

Farmers adjust their farming practices in response

to external stimuli and market. 90% farmers were in the opinion that organic farming has bright future. However, the government support is required. A few (10%) farmers stated that organic farming future is dark and they were disappointed. This might be due to their personal weakness or lack of training.

Farmers suggestion to promote organic farming in Pakistan

According to farmer's perception and experience, 40% farmers stated that government should support the organic farming while 10% perceived that production of organic farming can be promoted by providing subsidy by the government. Similarly, 10% farmers said that organic farming can be improved by creating awareness on media, Govt to restrict pesticides and synthetic fertilizers use (Hayat *et al.*, 2013), providing subsidy on organic farming, special loan for starting organic farming business etc. Similar findings were recorded by Anjum *et al.* (2016).

Conclusions and Recommendations

The current study concluded that all the farms under study were not registered and they are not following specific standards designed for organic farming in Pakistan. The main reason for constraints in organic farming is the lack of interest from the government side and non-availability of organic market in the country. However, the farmers are enthusiastic for the organic production.

Therefore, it is recommended that the government should launch special projects for training and awareness pertaining to organic farming. It can be promoted by giving special incentives and credit to farmers who are involved in organic farming in addition to establishing and supervising organic markets in the country

Acknowledgements

We are grateful to Department of Agriculture Extension for their support in finding organic farms.

Novelty Statement

Owing to the excessive use of pesticides and synthetic fertilizers, it was imperative to evaluate the current status of organic farming in Pakistan and highlight the matter to policy makers in the best interest of the

nation.

Author's Contribution

Muhammad Zamin: Conceptualization, supervision, investigation and manuscript drafting.

Yousaf Jamal: Helped data collection and processing.

Ibadullah Jan: Contributed in analysis and discussion of results.

Umer Rafique and Muhammad Amin: Helped in interpretation of results:

Haroon Ur Rashid and Shah Hassan: Assisted data collection and arranged interviews.

Conflict of interest

The authors have declared no conflict of interest.

References

- Adnan, M., S. Fahad, M. Zamin, S. Shah, I.A. Mian, S. Danish and R. Datta. 2020. Coupling phosphate-solubilizing bacteria with phosphorus supplements improve maize phosphorus acquisition and growth under lime induced salinity stress. *Plants*, 9(7): 900. <https://doi.org/10.3390/plants9070900>
- Ahmed, I., M.A. Khan, M.H. Soomro and H. Waibel. 2002. Pesticides hazards for health and environment. *Farm. Outl.*, pp. 14-16.
- Ali, B., M. Zamin and M. Rahman. 2003. Assessing the role of project for horticultural promotions (PHP) extension and training materials in the solution of horticultural problems in the target area (A case study of Malakand Division). *Asian J. Plant Sci.*, 2(7): 578-581. <https://doi.org/10.3923/ajps.2003.578.581>
- Anjum, A.S., S. Muhammad and M.Y. Mirza. 2011. Organic sunflower production in rainfed area of Pakistan. In: Annual report oilseed crops 2009-10. pp. 74-78.
- Anjum, A.S., R. Zada and W.H. Tareen. 2016. Organic farming: Hope for the sustainable livelihoods of future generations in Pakistan. *J. Pure Appl. Agric.*, 1(1): 20-29.
- Aungudornpukdee, P., 2019. Pesticide use and environmental contamination a study in Khao Koh District, Phetchabun Province, Thailand. *J. Hlth. Res.*, 33(2): 173-182. <https://doi.org/10.1108/JHR-12-2018-0174>
- Baig, M.B., S.A. Shahid and G.S. Straquadine. 2013. Making rainfed agriculture sustainable through environmental friendly technologies in Pakistan: A review. *Int. Soil Water Conserv. Res.*, 1(2): 36-52. [https://doi.org/10.1016/S2095-6339\(15\)30038-1](https://doi.org/10.1016/S2095-6339(15)30038-1)
- Baldwin, K.R., 2006. Crop rotations on organic farms. North Carolina Cooperative Extension Service. Retrieved from www.oacc.info/Docs/Cefs/Crop_Rotations.pdf
- Banaras, M., S. Muhammad, K. Farooq and M.M. Mahmood. 2011. Effect of different levels of organic fertilizers on potato production. (Abstract). In: International science conference "Prospects and Challenges to Sustainable Agriculture" Program, Rawalakot, AJK.
- Brumă, I.S., A.R. Jelea, S. Rodino, P.E. Berteau, A. Butu and M.A. Chițea. 2023. A bibliometric analysis of organic farming and voluntary certifications. *Agriculture*, 13(11): 2107. <https://doi.org/10.3390/agriculture13112107>
- Durán-Lara, E.F., A. Valderrama and A. Marican. 2020. Natural organic compounds for application in organic farming. *Agriculture*, 10(2): 41. <https://doi.org/10.3390/agriculture10020041>
- FAO, 2011. The role of women in agriculture. (ESA Working Paper No. 11-02). Retrieved from www.fao.org/docrep/013/am307e/am307e00.pdf
- FAO, 2014. Building a common vision for sustainable food and agriculture. Retrieved from www.fao.org/3/ai3940e.pdf
- FAO, 2016. Rural households and sustainability: Integrating environment and gender. Retrieved from <http://www.fao.org/docrep/V5406e/V5406e00.htm>
- Fenik, J., M. Tankiewicz and M. Biziuk. 2011. Properties and determination of pesticides in fruits and vegetables. *TrAC Trends Anal. Chem.*, 30(6): 814-826. <https://doi.org/10.1016/j.trac.2011.02.008>
- Freeman, L.E.B., 2020. Challenges of pesticide exposure assessment in occupational studies of chronic diseases. *Occup. Environ. Med.*, 77(6): 355-356. <https://doi.org/10.1136/oemed-2019-106348>
- Greene, C., 2003. US Organic farming in 2000-2001: Adoption of certified systems. (No. 780). US Department of Agriculture, Economic Research Service.
- Grewal, A.S., 2017. Pesticide residues in food grains, vegetables and fruits: A hazard to human health. *J. Med. Chem. Toxicol.*, 2(1): 1-7. <https://doi.org/10.1016/j.jmct.2017.01.001>

- org/10.15436/2575-808X.17.1355
- Hayat, Z., B. Ahmad, H. Badshah, A. Saljoqi, M. Naeem, S. Anwar and M. Zamin. 2013. Study of comparison of field effectiveness of coccinillid predators and chemical insecticides in the management of sugarcane black bug *Cavelarius excavatus* (Dist.) (Lygaedae: Hemiptera) in Shahpur Sargodha, Pakistan. Sarhad J. Agric., 29(2): 213-217.
- Huq, M.E., S. Fahad, Z. Shao, M.S. Sarven, I.A. Khan, M. Alam, M. Saeed, H. Ullah, M. Adnan, S. Saud and Q. Cheng. 2020. Arsenic in a groundwater environment in Bangladesh: Occurrence and mobilization. J. Environ. Manage., 262: 110318. <https://doi.org/10.1016/j.jenvman.2020.110318>
- Husnain, M.I. and M. Khan. 2015. The public and private benefits from organic farming in Pakistan. (Working Paper No. 99-15). Kathmandu, Nepal: South Asian Network for Development and Environmental Economics (SANDEE). Hunza apricots: Reaching great heights. www.unep.org/pdf/SmallholderReport_WEB.pdf
- Husnain, M.I.U., M. Khan and H.Z. Mahmood. 2017. An assessment of public and private benefits of organic farming in Pakistan. J. Anim. Plant Sci., 27(3): 996-1004.
- Iqbal, M. and M. Ahmed. 2005. Science and technology based agriculture vision of Pakistan and prospects of growth. Proceedings of the 20th Annual General Meeting Pakistan Society of Development Economics, Islamabad. Pakistan Institute of Development Economic (PIDE), Islamabad, Pakistan.
- Kesavan, P.C. and M.S. Swaminathan. 2008. Strategies and models for agricultural sustainability in developing Asian countries. Philos. Trans. R. Soc. Lon. Ser. B, Biol. Sci., 363(1492): 877-891. <https://doi.org/10.1098/rstb.2007.2189>
- Khan, A.T., 2012. Untapped fruit export potential. Dawn, Retrieved from <http://www.dawn.com/news/690148>
- Lu, J.L., 2017. Assessment of pesticide-related pollution and occupational health of vegetable farmers in Benguet Province, Philippines. J. Health Pollut., 7(16): 49-57. <https://doi.org/10.5696/2156-9614-7.16.49>
- Margni, M., D. Rossier, P. Crettaz and O. Jolliet. 2002. Life cycle impact assessment of pesticides on human health and ecosystems. Agric. Ecosyst. Environ., 93(1-3): 379-392. [https://doi.org/10.1016/S0167-8809\(01\)00336-X](https://doi.org/10.1016/S0167-8809(01)00336-X)
- Muhammad, B., M. Adnan, F. Munsif, S. Fahad, M. Saeed, F. Wahid, M. Arif, J. Amanullah, D. Wang, S. Saud and M. Noor. 2019. Substituting urea by organic wastes for improving maize yield in alkaline soil. J. Plant Nutr., 42(19): 2423-2434. <https://doi.org/10.1080/01904167.2019.1659344>
- Muhammad, S. and M. Banaras. 2010. Biofertilizer preparation and application in organic crop production. Tech. Bull. (Language English and Urdu). NIOA, NARC, PARC, Islamabad.
- Musa, M., S.M. Bokhtiar and T.R. Gurung. 2015. Status and future prospect of organic agriculture for safe food security in SAARC countries. Dhaka, Bangladesh: SAARC Agriculture Centre. Retrieved from www.sac.org.bd/archives/publications/Organic%20Agriculture.pdf Naeem
- Nawaz, T., D. Nelson, S. Fahad, S. Saud, M. Aaqil, M. Adnan and M.J. Raihan. 2025. Impact of elevated CO₂ and temperature on overall agricultural productivity. In challenges and solutions of climate impact on agriculture. Academic Press. pp. 163-202. <https://doi.org/10.1016/B978-0-443-23707-2.00007-6>
- Nosheen, S., I. Ajmal and Y. Song. 2021. Microbes as biofertilizers, a potential approach for sustainable crop production. Sustainability, 13(4): 1868. <https://doi.org/10.3390/su13041868>
- PARC, Islamabad, 2010. Support activities for flood affectees of KPK, Sindh and Punjab. NARC, PARC, Islamabad. Report. pp. 46.
- Rasul, G. and A. Hussain. 2015. Sustainable food security in the mountains of Pakistan: Towards a policy framework. Ecol. Food Nutr., 54: 625-643. <https://doi.org/10.1080/03670244.2015.1052426>
- Saleem, A., S. Anwar, T. Nawaz, S. Fahad, S. Saud, T. Ur Rahman and T. Nawaz. 2024. Securing a sustainable future: The climate change threat to agriculture, food security, and sustainable development goals. J. Umm Al-Qura Univ. Appl. Sci., pp. 1-17. <https://doi.org/10.1007/s43994-024-00177-3>
- Serageldin, I. and D. Steeds. 1997. Rural well-being: From vision to action. Proceedings of the fourth annual world bank conference on environmentally sustainable development. ESD Proceedings Series 15. Washington, D.C:

- World Bank. <https://doi.org/10.1596/0-8213-3987-7>
- Shakur, M., F. Ullah, M. Naem, M. Amin, A.U.R. Saljoqi and M. Zamin. 2007. Effect of various insecticides for the control of potato cutworm (*Agrotis ipsilon* huf, Noctuidae: Lepidoptera) at Kalam Swat. *Sarhad J. Agric.*, 23(2): 423.
- Ullah, F., M. Shakur, H. Badshah, S. Ahmad, M. Amin and M. Zamin. 2012. Efficacy of *Trichogramma Chilonis Ishii* in comparison with two commonly used insecticides against sugarcane stem borer *Chilo Infuscatellus Snellen* (Lepidoptera: Pyralidae). *J. Anim. Plant Sci.*, 22(2): 463-466.
- Zamin, M., F. Rabbi, H. Khan, M. Zahid, R. Saqib, S. Ullah and M. Shakur. 2025. The future of horticultural crops: Navigating climate uncertainty in the context of farmers perception and metrological data. *Sarhad J. Agric.*, 41(1): 263-274. <https://doi.org/10.17582/journal.sja/2025/41.1.263.274>