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Original Research

Assessment of Melon (*Cucumis melo* L.) Cultivation and Its Economic Importance in Helmand Province, Afghanistan

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Abstract

Melon is one of the important agricultural crops in Afghanistan, particularly in Helmand Province, where it plays a significant role in farmers' income. However, its production is still largely based on traditional farming practices, and the limited use of modern agricultural technologies negatively affects both yield and quality. The objective of this study was to assess the current status of melon production in Helmand Province, evaluate the effect of seed type on yield, and identify the major constraints and challenges faced by farmers. This study was conducted between March 30, 2014 and July 6, 2015 in selected villages of Lashkar Gah, Garmser, and Nawah districts through face-to-face interviews with 37 farmers using a structured questionnaire consisting of 33 questions. The collected data were organized and analyzed using descriptive statistical methods, including averages, percentages, and comparative analysis. The results indicated that most farmers use local seeds, resulting in low yields (15–25 tons/ha), while farmers using improved seeds achieved higher yields (45–55 tons/ha). Statistical analysis indicated that seed type has a significant effect on crop yield. Furthermore, traditional irrigation practices, limited use of chemical fertilizers and pesticides, and marketing constraints negatively affect both production and income levels. In general, the study indicates that the use of improved seeds, enhancement of agricultural practices, efficient water management, and improved marketing facilities can significantly increase melon production and farmers' income.

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Statement of Sustainability: This study indicates that melon production in Helmand Province is largely based on traditional practices that limit productivity and resource efficiency. For sustainable development, there is a need to promote improved seed varieties, efficient water management, and modern agronomic practices. Strengthening extension services and market systems is also essential to ensure long-term economic and environmental sustainability of melon production in the region.

1. Introduction

Afghanistan has diverse climatic conditions, including arid, semi-arid, temperate, and sunny environments that are suitable for the cultivation of various fruits and vegetables (Zhang et al., **2016**). Vegetables are important sources of vitamins, minerals, and essential nutrients and also contribute significantly to the livelihoods and economic well-being of farming communities (Food and Agriculture Organization [FAO], 2011). Among vegetable crops, melon (*Cucumis melo* L.) is considered one of the important members of the Cucurbitaceae family. It is a warm-season annual crop propagated through seeds and cultivated under relatively fertile soil and favorable temperature conditions. Depending on variety and environmental conditions, melon requires approximately 90–120 days to complete its growth cycle (Lester, 2008; FAO, 2011). Melon production has considerable nutritional and economic importance in many arid and semi-arid regions. The crop is an important source of carbohydrates, vitamin C, and minerals and can provide substantial income for farmers within a relatively short production period (Lester, 2008; FAO, 2011). However, melon production in Afghanistan continues to face several challenges, including traditional farming practices, limited access to improved

seed varieties, inadequate irrigation systems, insufficient fertilizer use, pest and disease problems, weak market access, and limited technical knowledge among farmers (Botía et al., **2005)**. Previous studies have shown that irrigation management, soil fertility, improved seed varieties, and appropriate agronomic practices play an important role in improving melon productivity and fruit quality under semi-arid conditions (Fabeiro et al., 2002; Sensoy et al., 2007; Nerson, 2002). Efficient crop management and improved production inputs have also been reported as essential factors for increasing farmers' income and agricultural sustainability (FAO, 2011).

In Afghanistan, particularly in Helmand Province, melon cultivation is widely practiced using traditional production methods, while scientific information regarding production constraints and economic value remains limited. Problems such as limited agricultural extension services, lack of improved technologies, poor irrigation management, unstable market systems, inadequate storage facilities, and weak technical support continue to negatively affect productivity and farmers' income. Therefore, there is a need for a scientific assessment of melon cultivation practices, associated production constraints, and the economic importance of melon production in the province. This study was conducted during 2014–2015 in selected districts of Helmand Province, Afghanistan, to assess melon cultivation practices, identify the major production and marketing constraints faced by farmers, and evaluate the economic importance of melon production under local farming conditions. The findings of this study may provide useful baseline information for improving melon production practices, strengthening farmers' technical knowledge, enhancing agricultural planning, and supporting future rural development and food security programs in Afghanistan.

2. Materials and Methods

2.1. Agronomic and Environmental Conditions

The study areas in Helmand Province are characterized by arid and semi-arid climatic conditions with warm temperatures and low annual rainfall, which are generally suitable for melon cultivation. Melon production in the selected districts was commonly practiced under traditional farming systems. The soils in most cultivation areas were mainly sandy loam, silt loam, and clay loam, which are considered suitable for melon growth due to their relatively good drainage and aeration properties. Farmers reported that soils containing sufficient organic matter produced comparatively better crop performance.

2.2. Irrigation System

Traditional surface irrigation methods were commonly used by farmers, depending mainly on canal and river water sources. Irrigation frequency varied according to local climatic conditions, soil moisture, and water availability. In most cases, farmers applied irrigation at regular intervals during the vegetative and fruit development stages.

2.3. Planting Density

Planting density also varied among farmers depending on field size, seed availability, and local cultivation practices. In general, farmers maintained moderate spacing between plants and rows to facilitate plant growth and field management.

2.4. Fertilizer Uses

Both organic manure and chemical fertilizers were used by some farmers; however, fertilizer application rates were not standardized and depended largely on farmers' economic conditions, local experience, and input availability. Limited access to agricultural extension services and modern production technologies influenced the overall management practices in the study areas.

Since this study was primarily based on field surveys and farmer interviews, detailed quantitative measurements of soil properties, irrigation volumes, fertilizer rates, and planting density were not systematically recorded. Therefore, yield differences observed in the study may also have been influenced by other agronomic and environmental factors in addition to seed type.

2.5. Study Period

This study was conducted from March 30, 2014, to July 6, 2015. During this period, all stages of agricultural activities from land preparation to harvesting, transportation, and marketing were systematically observed and analyzed.

2.6. Study Area and Design

The study was conducted in selected villages of Lashkar Gah City and the Garmser and Nawah districts of Helmand Province. A survey and face-to-face interview method were used to collect data from farmers. The study was descriptive and analytical in nature, covering major stages of melon production from land preparation to harvesting and market delivery. The questionnaire included 33 questions related to seed type, irrigation practices, fertilizer application, pest and disease management, marketing constraints, production challenges, and farmers' management practices. The collected information was primarily analyzed using descriptive and comparative methods to assess the major factors affecting melon production and its economic value under local farming conditions.

2.7. Sampling

A total of 37 farmers were interviewed for this study, including 25 farmers from villages of Lashkar Gah and 12 farmers from selected villages of Garmser and Nawah districts. In villages with higher population and household density, multiple farmers were interviewed to ensure data completeness and reliability.

2.8. Data Collection Instrument

A structured questionnaire containing 33 technical questions was developed for this study. The questionnaire covered all aspects of melon production, from cultivation practices to marketing, in order to obtain accurate and scientific information from farmers' experiences.

2.9. Data Collection Procedure

Data were collected through field visits using private transportation to each selected village. Melon production fields were physically observed, and face-to-face interviews were conducted using the questionnaire. All stages of production, from land preparation to harvesting, transportation, and marketing, were practically examined.

2.10. Key Observations of the Study

During the survey, it was observed that irrigation was mainly carried out through canals and traditional water channels. Farmers selected their fields in advance, and most of them practiced crop rotation. Cultivation was carried out in furrow and row patterns, and the cultivated area per farmer was approximately 0.5–1 ha. In most areas, improved seeds, chemical fertilizers, and pesticides were either limited or unavailable. The soil type was mostly sandy, and the average yield was recorded at about 17.5–20 tons/ha. Harvesting was done manually and usually at a single time, and market prices were relatively low. Storage and marketing constraints were also common

2.11. Findings from Garmser and Nawah Districts

Interviews with farmers in Garmser and Nawah districts revealed that most farmers used local seed varieties, organic fertilizer use was limited, and crop rotation practices were poorly adopted. Irrigation was carried out through canals and traditional channels. The soil was sandy, and the average yield ranged from 15 to 17.5 tons/ha. Awareness regarding improved seeds, chemical fertilizers, and pesticides was low. Poor road conditions, lack of markets, and insufficient storage facilities were also identified as major constraints.

2.12. Data Analysis

The collected data were analyzed using descriptive methods. Scientific conclusions were drawn based on farmers' experiences, field observations, and questionnaire responses and were systematically evaluated.

3. Results and Discussion

A survey regarding melon cultivation was conducted in selected villages of Lashkar Gah City and the Garmser and Nawah districts of Helmand Province. In this study, face-to-face interviews were conducted with 37 farmers using a structured questionnaire consisting of 33 questions. The collected information showed that melon cultivation in the study areas is largely based on traditional farming practices and relatively homogeneous production systems. According to farmers' responses, soil conditions and general agronomic practices were similar across the study areas. Melon cultivation was mainly carried out using furrow irrigation systems, while seed treatment practices were rarely applied. The spacing between furrows was approximately 3–4 meters, whereas the spacing between plants ranged from 60–70 cm. Irrigation was mainly practiced through canals and traditional water channels. Farmers generally irrigated their fields about seven times during cooler seasons and approximately ten times during warmer periods, depending on climatic conditions and water availability (Kirnak et al., **2005**). Similar irrigation and production practices under semi-arid conditions have also been reported in previous studies (Fabeiro et al., 2002)..

3.1. Melon Production Status in Lashkar Gah and Surrounding Areas

The results presented in Table 1 indicate that the majority of farmers relied on local seed varieties, while only a limited number of farmers had access to improved seeds. Farmers using local seeds generally obtained lower yields ranging from 15–25 tons/ha, whereas farmers using improved seeds achieved comparatively higher yields ranging from 45–55 tons/ha. Similar findings have been reported in previous studies, which demonstrated that improved seed varieties and better agronomic practices can significantly enhance vegetable productivity under semi-arid conditions (Evenson & Gollin, 2003; Cabello et al., 2009).

Table 1. Melon production status in selected villages of Lashkar Gah and surrounding areas, Helmand province.

Seed Type	Number of Farmers	Average Yield (tons/ha^{-1})	Major Constraints
Local seeds	20 farmers	15–25 tons	Lack of improved seeds, absence of chemical fertilizers and pesticides, marketing problems, limited storage facilities
Improved seeds	5 farmers	45–55 tons	Limited availability, but relatively higher yield

The findings further indicate that several production and marketing constraints negatively affected melon productivity and farmers' income in the study areas. Major challenges included limited access to improved seeds, inadequate use of fertilizers and pesticides, insufficient technical knowledge, weak market systems, and lack of storage facilities (Kerje & Grum, 2000). Similar marketing and production-related constraints have also been identified in many developing agricultural systems where limited infrastructure reduces farmers' economic returns (Barrett, 2008). Overall, the results suggest that the adoption of improved seed varieties, better agronomic practices, and improved marketing systems may substantially enhance melon productivity and farmers' livelihoods in Helmand Province.

3.2. Agricultural Status of Melon Farmers in Garmser District

The findings from Garmser District indicate that most farmers used local seed varieties, resulting in relatively lower yields ranging from 15–25 tons/ha (Table 2). In contrast, the farmer who cultivated improved seeds achieved a comparatively higher yield of 40–45 tons/ha despite experiencing technical limitations. These findings suggest that improved seed varieties may contribute positively to yield performance; however, seed quality alone may not be sufficient to ensure maximum productivity. Other agronomic and environmental factors such as irrigation management, fertilizer application, soil conditions, crop management practices, and farmers' technical knowledge may also strongly influence production levels. Previous studies have similarly reported that the effectiveness of improved agricultural technologies depends largely on the availability of complementary production inputs and proper farm management practices (World Bank, 2007). Therefore, the findings indicate that improved seeds should be accompanied by appropriate agronomic management practices in order to achieve sustainable productivity improvements.

Table 2. Agricultural status of melon farmers in selected villages of Garmser district.

Seed Type	Number of Farmers	Average Yield (tons/ha^{-1})	Major Problems
Local seeds	6	15-25	Low awareness, market problems
Improved seeds	1	40-45	Technical limitations

3.3. Agricultural Status of Melon Farmers in Nawah District

The analysis of Table 3 indicates that the majority of farmers in Nawah District also relied on local seed varieties, resulting in comparatively lower yields ranging from 15–20 tons/ha. In comparison, the farmer using improved seeds obtained a yield of approximately 45 tons/ha. These findings further support the observation that improved seed varieties may enhance melon productivity under local farming conditions. However, the results also indicate that limited access to improved agricultural inputs, technical services, and market opportunities continues to constrain overall production performance in the district. Similar observations have been reported in previous agricultural studies conducted under arid and semi-arid conditions, where access to improved technologies and farm management practices significantly influenced crop productivity (Sensoy et al., 2007).

Table 3. Melon farmers' agricultural status in selected villages of Nawah district, Helmand.

Seed Type	Number of Farmers	Average Yield (tons/ha^{-1})	Major Problems
Local seeds	4	15-20	Low awareness, market issues
Improved seeds	1	45	Limited access

3.4. Economic Value of Melon Production

Melon production plays an important role in improving farmers' livelihoods in Helmand Province. Based on average market prices and yield performance, the economic value of melon cultivation varied considerably according to seed type and production practices.

The economic analysis presented in Table 4 showed that farmers using local seed varieties achieved an average yield of approximately 20 tons/ha, resulting in an estimated average income of 355,560 AFN per hectare. In contrast, farmers using improved seed varieties achieved a higher average yield of 47.5 tons/ha with an estimated average income of 844,455 AFN per hectare. These

findings indicate that improved seed varieties and better production practices may substantially increase both melon productivity and farmers' economic returns. Previous studies have also reported that improved agricultural practices, better-quality seeds, and efficient farm management systems can significantly increase crop profitability and enhance rural livelihoods under semi-arid farming conditions (Rouphael et al., 2008). Nevertheless, the findings of this study should be interpreted carefully because the study was based primarily on farmer survey responses and descriptive field observations. Detailed quantitative measurements of soil properties, irrigation volumes, fertilizer application rates, and other agronomic variables were not systematically recorded. Therefore, differences in yield performance may also have been influenced by environmental and management-related factors beyond seed type alone (Yilmaz et al., 2011). Overall, the findings of this study are generally consistent with previous international research and suggest that the adoption of improved seed varieties, efficient irrigation management, appropriate agronomic practices, and improved market systems may contribute significantly to enhancing melon production and farmers' income in Helmand Province.

Table 4. Estimated economic analysis of melon production.

Seed Type	Average Yield (tons/ha)	Estimated Average Income (AFN/ha)
Local seeds	20	355,560
Improved seeds	47.5	844,455

3.5. Study Limitation

Since the study was based on farmer survey data collected under different field conditions, the observed yield differences cannot be attributed solely to seed type. Other factors such as soil quality, irrigation access, farm management practices, and farmers' technical experience may also have influenced productivity levels.

4. Conclusion

The findings of this study indicate that melon cultivation in Helmand Province is still largely dependent on traditional farming practices, while limited access to modern agricultural technologies, improved seed varieties, and technical support services continues to constrain productivity and economic performance. Farmers using improved seed varieties generally achieved better yield performance and higher estimated income compared to those relying on local seed varieties. However, the study also suggests that improved seeds alone are not sufficient to ensure optimal production. Other important factors such as irrigation management, fertilizer application, crop protection practices, and farmers' technical knowledge also play a critical role in improving productivity. In addition, marketing-related constraints including weak market access, the presence of intermediaries, inadequate storage facilities, and unstable market prices were identified as major challenges affecting farmers' economic returns. Overall, the study suggests that improving agricultural extension services, promoting modern agronomic practices, strengthening irrigation and input management, and enhancing market systems may substantially improve melon production and farmers' livelihoods in Helmand Province. Although the study was limited to selected districts and based primarily on survey data collected from farmers, the findings provide useful baseline information for future agricultural research and rural development programs in Afghanistan.

Author Contributions

Shamsuldin Wafa oversaw the research process, helped with paper review, and conceived and designed the study. Mohammad Din Khadim carried out the fieldwork, gathered and examined the data, and wrote the first draft of the manuscript. Niamatullah Danish edited and reviewed the text in addition to helping with data collection and interpretation. The final draft of the work was reviewed and approved by all authors.

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Declarations

Conflicts of Interest: The authors declare that there are no conflicts of interest regarding the publication of this paper.

Institutional/Ethical Approval: Standard research ethics were followed in the conduct of this investigation. Farmers were not required to participate, and all respondents gave their full consent before any data was collected. Sensitive or private information was not revealed. Since this study used non-invasive survey-based data collecting, formal institutional ethical approval was not necessary.

Data Availability/Sharing: The datasets used and analysed during the current study will be made available from the corresponding author upon a reasonable request.

Supplementary Information Availability: Not applicable.

References

Barrett, C. B. (2008). Smallholder market participation: Concepts and evidence from eastern and southern Africa. *Food Policy*, 33(4), 299–317. https://doi.org/10.1016/j.foodpol.2007.10.005

Botía, P., Navarro, J. M., Cerdá, A., & Martínez, V. (2005). Yield and fruit quality of two melon cultivars irrigated with saline water at different stages of development. *European Journal of Agronomy*, *23*(3), 243–253. https://doi.org/10.1016/j.eja.2004.11.003

Cabello, M. J., Castellanos, M. T., Romojaro, F., Martínez-Madrid, C., & Ribas, F. (2009). Yield and quality of melon grown under different irrigation and nitrogen rates. Agricultural Water Management, 96(5), 866–874. https://doi.org/10.1016/j.agwat.2008.11.006

Evenson, R. E., & Gollin, D. (2003). Assessing the impact of the Green Revolution, 1960 to 2000. *Science*, 300(5620), 758–762. https://doi.org/10.1126/science.1078710

Fabeiro, C., Martín de Santa OlallaF., & de Juan, J. A. (2002). Production of muskmelon (*Cucumis melo* L.) under controlled deficit irrigation in a semi-arid climate. *Agricultural Water Management*, *54*(2), 93–105. https://doi.org/10.1016/s0378-3774 (01)00151-2

FAO. (2011). The State of the World's Land and Water Resources for Food and Agriculture (SOLAW): Managing Systems at Risk. Rome: Food and Agriculture Organization of the United Nations. https://www.fao.org/3/i1688e/i1688e.pdf

Kerje, T., & Grum, M. (2000). The origin of melon, Cucumis melo: A review of the literature. *Acta Horticulturae*, 37-44. https://doi.org/10.17660/actahortic.2000.510.5.

Kirnak, H., Higgs, D., Kaya, C., & Tas, I. (2005). Effects of Irrigation and Nitrogen Rates on Growth, Yield, and Quality of Muskmelon in Semiarid Regions. *Journal of Plant Nutrition*, *28*(4), 621–638. https://doi.org/10.1081/pln-200052635

Nerson, H. (2002). Relationship between Plant Density and Fruit and Seed Production in Muskmelon. *Journal of the American Society for Horticultural Science*, *127*(5), 855–859. https://doi.org/10.21273/jashs.127.5.855

Rouphael, Y., Cardarelli, M., Colla, G., & Rea, E. (2008). Yield, Mineral Composition, Water Relations, and Water Use Efficiency of Grafted Mini-watermelon Plants under Deficit Irrigation. *HortScience*, *43*(3), 730–736. https://doi.org/10.21273/hortsci.43.3.730

Sensoy, S., Ertek, A., Gedik, I., & Kucukyumuk, C. (2007). Irrigation frequency and amount affect yield and quality of field-grown melon (Cucumis melo L.). *Agricultural Water Management*, *88*(1-3), 269–274. https://doi.org/10.1016/j.agwat.2006.10.015

World Bank. (2007). *World development report 2008: Agriculture for development*. World Bank. https://openknowledge.worldbank.org/entities/publication/ba969388-b5eb-5155-b8f2-6d323a6e5a52

Yilmaz, H., Demircan, V., & Kurtluk, S. (2011). An economic analysis of open-field melon (Cucumis melo L.) production in Cankiri province of Turkey. *Bulgarian Journal of Agricultural Science*, *17*(4), 484-490. https://www.agrojournal.org/17/04-11-11.pdf

Zhang, H., Wang, H., Yi, H., Zhai, W., Wang, G., & Fu, Q. (2016). Transcriptome profiling of Cucumis melo fruit development and ripening. *Horticulture Research*, *3*(1). https://doi.org/10.1038/hortres.2016.14