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Research paper

SWOT analysis to adopt technologies in pulses cultivation under climate change in Jordan's humid agriculture

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This paper examined the strengths, weaknesses, opportunities, and threats to new technologies adoption and application in representative sub-humid agricultural communities of Irbid, Madaba, and Karak of Jordan. This is predicated on the need for improved performance and reinvigoration of research tools for better policymaking. Some of the strengths are saving time, increase production, and profitability for new technologies. The study explored socio-economic conditions of pulses farmers to evaluate the impacts of the introduction of new technologies of seeder use, zero-tillage, new pulses varieties, adding fertilizers with scheduling, using herbicides, using recommended seeding rates, and recommended planting dates. On the other hand, opportunities that can be explored is expected increased incomes. No problems or threats expected to the adoption and application of new technologies. The paper recommends that research and policymakers should pay proper attention to the strengths, weaknesses, opportunities, and threats to adoption and application of new technologies with a view of making decisions truly more responsive to local concerns and policy.

Key words: adoption, pulses, SWOT, technologies, sub-humid

INTRODUCTION

Jordan is part of Mediterranean and Arid zone climate, Jordan has a hot, dry climate characterized by hot, dry summers and cool wet winters. The climate is influenced by Jordan's location between the subtropical aridity of the Arabian desert areas and the subtropical humidity of the eastern Mediterranean region. Daily temperatures can be very hot, especially in the summer; on some days it can be 40°C or more. About 70 percent of the average rainfall in the country falls between November and March. Rainfall varies from season to season and from year to year. Al-Karablieh and Salman (2016) reported three agro-climatic zones in Jordan: Jordan Valley, the highlands, and deserts. Most planted areas are located in the Jordan Valley and Highlands. The planted parts of the deserts are closed to the highlands. Al-Karablieh and Salman (2016) stated that the highlands and planted deserts are grouped into one category called 'Uplands'. On the other hand, Jordan's Ministry of Agriculture and the Middle East Regional Agricultural Program divided the agro-climatic zones of Jordan into five types Moustafa et al. (2007). Humid areas, which receive rain at an average of more than 500 mm per year, semi-arid areas with an average rainfall of (300 – 500) mm, rainfall rate in marginal areas (200-300), the average annual precipitation in the dry zone is between (100-200) mm, and the desert areas, which receive rain at an average of lower than 100 mm per year Moustafa et al. (2007). As a result, the sub-humid zone includes marginal and semi-arid areas, where most of the crops will be rain-fed and not irrigated. Jordan is part of Mediterranean and Arid zone climate. Mediterranean climate dominates in north and west regions, while arid climate dominates in the rest part of Jordan, three major sites of sub-humid climates in Jordan are Irbid (rainfall range 300-400 mm), Madaba (rainfall range 150-350 mm), and Karak (rainfall ranged between 200-350 mm). These areas are targeted at the status of agricultural communities and the extent to which new technologies in pulses cultivation can be introduced for adoption. Pulses are the edible seeds of various crops of the legume family. The sub-humid areas in this study are promising areas for the expansion of cultivation and production of this variety of crops.

Pulses (food) and forage legumes are essential crops in agricultural production and trade in Jordan. The major traditional food legumes are chickpea, faba-bean, peas, and lentil. It was estimated that the total planted area of chickpea in Jordan during 1997 was 1996.9 hectares, faba-bean area in 1997 was 754.03 hectares, the area of the pea in Jordan was 350.3 hectares in the same year, and lentil was 3081 hectares in 1997. The two species of vetch were planted in an area of 1667.69 hectares during 1997. Currently, due to the economic loss resulting from increasing labor costs, most of the local market of legume crops are imported from abroad. According to the statistics of the Department of Statistics (DOS) in 2017, the area of chickpeas planted in Jordan is about 463.5, faba-bean is 566.22 hectares, pea's area is 124.15 hectares, lentil area is about 123.7 hectares, and two vetch species-area recorded was 576.35 hectares. The importance of adopting modern agricultural technologies in the production of legumes is shown to enhance local production in line with the needs of local agricultural communities and the demand of Jordanian consumers.

The adoption of agricultural technologies of importance is consistent with agricultural development goals. The use of automatic seeders, the use of conservation agriculture (zero-tillage) and the cultivation of improved varieties are all modern agricultural inputs (technologies) and play a pivotal role in enhancing productivity and quality and raising the economic return of farms. Al Hiary (2014) explored and reported socio-economic conditions of Irbid wheat farmers in Jordan to evaluate the impacts of the introduction of the full package of technologies which contains zero tillage, new varieties of wheat seed, adding fertilizer, using the combine, and using herbicides. Strengths, weaknesses, opportunities, and threats (SWOT) analysis was used to provide a framework for potential solutions (opportunities) and threats. The study showed that the newly adopted technologies saved time as mentioned by all farmers, 92% of farmers pointed out that the new technologies allowed for planting earlier, 80% of farmers mentioned that the new technologies reduced the labor cost. 49% of farmers mentioned that these technologies increased production as well as the profit. However, about 68% of farmers mentioned that they are reluctant to apply the new technologies and methods because of the high cost, and about 60% of farmers mentioned that machines couldn't be available on time, and 66% said that there is difficulty in using these machines in sloppy areas. Only 20% of farmers complained that they don't have the improved variety. About 23% of farmers mentioned that they would like to apply the new technologies and methods to increase the quantity and quality of production, and about 16% of farmers mentioned that there is an opportunity to increase the planted area, and 9% said that using these machines will save time and effort. About 43% of farmers mentioned that there is no problem in applying the new technologies and methods, but 22% said that they are reluctant to apply the new technologies and methods because machines couldn't be available on time and 9% said that there is difficulty in applying the new technologies and methods because of the raising in input prices. It is clear from the above findings the importance of using a (SWOT) analysis to strengthen agricultural development systems and adapt them to the concerns and conditions of local communities.

Tripathi et al. (2013) conducted a research to compare the economics of wheat production with zero-tillage and with traditional methods, and to evaluate the contribution of technologies to increase productivity due to zero-tillage. The results showed that net income was higher in zero-tillage technology, mainly due to the lower cost of production compared to the conventional method. The study noted that this technology has the potential to provide additional income for farmers and help preserve scarce resources. It can be concluded that technologies that save time and money and increase productivity and income are technologies that have strengths and increased opportunities for adoption. This coincides with the conclusion that strengths that increase the likelihood of adoption implicitly reflect the absence of weaknesses, risks, and threats.

Al Hiary (2014) stated that three reasons why farmers do not adopt improved technologies. The first is simply that they are not aware of them, or they do not realize that the technology will provide them with benefits; farmers may also have misconceptions about the costs and benefits of technologies. The second reason is that technologies are unavailable at times that are needed. The third reason is that technologies are not profitable, based on the complex sets of decisions farmers make about how to allocate their land and work through agricultural and non-agricultural activities. The second and third reasons can be seen through the infrastructure factors, such as the policy environment, that affects the availability of inputs and markets for credit and products, and therefore on the profitability of technology. Simply stating that the farmer did not adopt a "recommended" technology does not necessarily mean that the farmer would be better off doing so. As researchers, we need a better understanding of the challenges farmers face. We need to focus on the broader issue of how to increase agricultural production, recognizing that new technologies may be a key component. Rather than simply asking whether farmers are using improved technologies, we need to ask them about their production levels and find ways to increase them, through improved technologies, improved infrastructure, institutions, and improved policies Al Hiary et al. (2015). Strengths, weaknesses, opportunities, and threats (SWOT) analysis helps to understand the implicit structure of new technologies and the extent to which agricultural communities are able to integrate them into indigenous agricultural activities. This analysis provides a professional tool for researchers and farmers to make important policy decisions in the formulation of adoption decisions. Al-Hiary (2014) concluded that strengths, weaknesses, opportunities, and threats (SWOT) analysis was used to provide a framework for potential solutions (opportunities) and threats and analysis of the full package introduction for wheat farmers in Jordan. The study explored socio-economic conditions of wheat farmers to evaluate the impacts of the introduction of the full package (FP) which contains zero tillage, new varieties of wheat seed, adding fertilizers, using the combine, and using herbicides.

All previous research conducted by Al Hiary (2014) and Al Hiary et al. (2015) on the SWOT analysis of wheat growing in the Irbid region has helped guide research into food legumes (pulses) and forage legumes crops in several sub-humid regions of Jordan. There is an urgent need for studies that include the adoption of new technologies such as herbicides, pesticides, soil health and fertility, and optimum planting dates. Few previous studies have shown the importance of using herbicides and pesticides, especially with regard to the extent to which rural communities respond and adopt new technologies. Massimi (2017) reported how climate change may influence the survival and distribution of alfalfa weeds. It was concluded that growers training will equip farmers with necessary competencies to become pioneers of knowledge about weed ecology, and growing habits to choose the most appropriate chemical management strategy with lower costs and time-saving. Improve soil health and increase yield are other reasons that have led to the use of biopesticides in food legumes production (green beans and green cowpeas) Massimi et al. (2019). The latter research concluded the importance of promoting legumes adoption improved varieties of green beans and green cowpeas in the context of national food security through extension and rural women societies and by using biological safe pesticides. Other studies revealed the importance to determine the optimal planting dates for all types of horticultural crops in Jordan

(include food legumes) for many reasons from the principle of management of inputs and the costs of agricultural inputs, especially with regard to irrigation costs, water costs, and fertilizers costs Massimi et al. (2018). SWOT analysis is required in the target rural communities to determine the appropriateness and viability of rural communities to adopt new technologies such as herbicides, pesticides, soil fertility, improved varieties, and optimum planting dates. This research paper aims to assess the (SWOT) analysis of selected sub-humid regional communities of Jordan as a research tool to provide a framework for potential solutions and risks, as well as to provide an analysis of new technologies introduction for pulses farmers in Jordan.

MATERIALS AND METHODS

Jordan is part of Mediterranean and Arid zone climate. Mediterranean climate dominates in north and west regions, while arid climate dominates in the rest part of Jordan, whereas the sub-humid climate is dominant in the communities project areas. Three sites were chosen in the Kingdom to conduct the questionnaire: Irbid (rainfall range 300-400 mm with an average of 371 mm), Madaba (rainfall range 150-350 mm with an average of 304 mm), and Karak (rainfall ranged between 200-350 mm with an average of 285 mm). Of the sites selected in the study, 25 farmers from Irbid, 50 from Madaba, and 51 from Karak were interviewed. The study was done in Irbid governorate, namely, in two districts, they are Qasabat Irbid and Bani kananah. The interviewed farmers were belonging to 14 villages. In Madaba governorate, the study was done in five districts, they are Madaba, Granada, Naor, Mamounia, and Maen. The interviewed farmers were belonging to 15 villages. Finally, Karak governorate study targeted four districts, they are Qasabat Karak, Al-Qaser, Fagou' and Almazaer. The interviewed farmers were belonging to 20 villages. All farmers from all the villages surveyed were representative of the various districts in the three governorates. A socio-economic questionnaire was designed to elicit basic numerical data on plant production, inputs, and expenditures. The farmer was questioned on the size and age of the family, size of the landholding, cropping system, sources of income, level of education, and agricultural practices. The study explored socio-economic conditions of pulses farmers to evaluate the impacts of the introduction of new technologies of seeder use, zero-tillage, new pulses varieties, adding fertilizers with scheduling, using herbicides, using recommended seeding rates, and recommended planting dates. A SWOT analysis was conducted to demonstrate the negatives and advantages of adopting new technologies in terms of time-saving, increased production and cost reduction. While addressing the opportunities to adopt modern technologies and obstacles.

RESULTS AND DISCUSSION

The number of Irbid farmers interviewed were 25 farmers and crops are legumes of lentils, faba-beans, vetches, and chickpeas. Madaba farmers surveyed is 50 and their crops are legumes such as lentils, faba-beans, peas, and vetches. While the number of farmers of Karak was 51 and their crops were represented in legumes of lentils, vetches, and chickpeas. **Table** (1) shows that the most important features (strengths and pros) of the technologies adopted in Irbid, Madaba, and Karak were saving time in percentages (100, 84, and 100) respectively. The addition of fertilizers according to soil analysis was supported by 95.5% of Irbid farmers, 88% of Irbid farmers and 94% of Karak farmers surveyed. In addition, the optimum (suitable) time for planting was evident by 87.5 % in the Irbid farmers questionnaire. But was equal (90%) for the farmers of Madaba and Karak. The increase in production and the improvement in the profit of agricultural products as a result of the adoption of modern technologies was 87.5% in the responses of the survey of Irbid farmers, 76% for Madaba farmers and 90% for the farmers of Karak. Similar findings were recorded and reported by Al Hiary (2014). The responses of wheat farmers in Irbid regarding the advantages of adopting new technologies are as follows: new full package technologies saved time as mentioned by all farmers (100%), 92% of farmers pointed out that the new technologies allowed for planting earlier, 49% of farmers mentioned that these technologies increased the production as well as the profit. It seems clear that the results of the current and old study (Al Hiary 2014) clearly show that the farmers of Irbid, Madaba, and Karak regard new technology as an innovation that has the main advantages of saving time, increasing production, profitability and adjusting crop planting dates. The advantages mentioned above have received the highest priority among the farmers of the three cities and their agricultural districts (Irbid, Madaba, and Karak). The survey included farmers' reactions to other positives such as reduce seed rates, reduce weeds, labor costs reduction and increased cultivated and planted areas.

In contrast, with respect to farmers' answers to the negatives (disadvantages) of modern technologies, the responses were very uneven and did not adopt any uniform trend in the three regions (Irbid, Madaba, and Karak). The disadvantages were considered among four criteria: the lack of timely machines and the difficulty of using them (when

Table 1. Strengths (Advantages) of the New Technologies Percentages

Governate	Irbid			Madaba			Karak		
Advantage	Yes	No	Neutral	Yes	No	Neutral	Yes	No	Neutral
Save time	100	-	-	84	2	14	100	-	-
Increase in production and profit	87.5	12.5	-	76	10	14	90	8	2
Reduce the seeding rate	7`0.8	25	4.2	70	16	14	78	18	4
Reduce Weed	87.5	12.5	-	70	10	18	86	6	6
Reduce Labor Cost	70.8	16.7	12.5	52	16	32	76	14	10
Increase Planting Area	62.5	16.7	20.8	46	30	24	57	31	12
Add Fertilizer	95.8	-	4.2	88	4	8	94	2	4
Planting Date	87.5	12.5	-	90	4	6	90	6	4

Table 2. Weaknesses (Disadvantages) of the New Technologies Percentages

Governorate	Irbid			Madaba			Karak		
Disadvantage	Yes	No	Neutral	Yes	No	Neutral	Yes	No	Neutral
Machines [1]	34.8	65.2	-	30	68	2	25	75	-
Improved variety [2]	43.5	56.5	-	20	74	6	18	80	2
Difficulty in Sloppiest [3]	36.4	63.6	-	20	78	2	20	78	2
High prices [4]	31.8	59.1	9.1	6	90	4	6	92	2

available) in the sloppy lands, the absence of improved varieties and the high prices. Table (2) shows that the negatives of modern technologies were not important. Given farmers' response that there were no negatives, 59.1% of respondents from Irbid farmers, 90% of Madaba farmers and 92% of the farmers of Karak. It can be concluded that modern technologies have boosted the strengths and positives more than weaknesses and negatives for legumes farmers in sub-humid agricultural areas of Jordan.

The farmers of the three regions agree that the opportunities inspired by the application and adoption of new technologies are bound to increase income (Table 3). 24 % of Irbid farmers, 14 % of Madaba farmers and 34.5 % of Karak farmers confirm the viability of new technologies and their role in improving and raising incomes as a major opportunity. This reinforces the rise in the strength percentages of productivity, quality, and profitability in Table 1.

Table 3. Opportunities for New Technologies Percentages

Governorate	Irbid	Madaba	Karak
Opportunities	Responses by (Yes)		
Cost Reduction	-	14	27.3
Increase Income	24	14	34.5
No Comment	4	78.4	38.2

The farmers of the three regions agree that the obstacles (threats) resulting from the application and adoption of new technologies are absent and negligible. This is clearly shown in the answer that there are no problems in Table 4, which confirms the previous interpretation of Table (2). The highest percentages of farmers' responses were in the absence of risks and threats and there were no problems with 40% among Irbid farmers, 66% among Madaba farmers and 45.1% among Karak farmers.

Table 4. Threats (Constraints) of New Technologies Percentages

Governorate	Irbid	Madaba	Karak
Threats	Responses by (Yes)		
Lack of Mechanisms in Appropriate Time	28	16	17.6
The High Cost of Manpower	4	18	31.4
No Problems	40	66	45.1
No Comments	24	-	5.9

CONCLUSION

The paper study the adoption and application in some sub-humid agricultural communities in Jordan and also strengths, weaknesses, opportunities, and threats are examined with a view of suggesting how to reinvigorate the research tools to provide a framework for potential solutions and risks, as well as to provide an analysis of the new technologies introduced for pulses farmers in Jordan for effective and efficient response to client needs. The (SWOT) features highlighted major items of save time, increase production, and profitability is to be noted for policy considerations so that research plans and policy-making outputs will be more truly responsive to local conditions and concerns.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

ETHICS APPROVAL

Not applicable.

REFERENCES

Al Hiary, M. (2014). Characterization of the Socioeconomic Conditions, Full Package, and Adoption of New Technologies of Wheat Crop at Irbid Governorate, Jordan. *Asian Journal of Agricultural Extension, Economics & Sociology*, 605-618.

Al Hiary, M., Shakhatreh, Y., Khalaf, E. Y. B., & Maysoon, E. (2015). Socioeconomic assessment of wheat varieties and the adoption of recommended technologies in North Jordan. *International Journal of Agricultural Sciences*, *5*(7), 864-873.

Al-Karablieh, E., & Salman, A. (2016). Water resources, use and management in Jordan. A focus on groundwater. *IWMI Project Report: Groundwater governance in the Arab world*. No.11, 41-42

Department of Statistics, 2017. Survey. Agriculture. DOS website, Government of Jordan.

Massimi, M. (2017). Importance of field extension training for farmers of alfalfa (Medicago sativa L.) to adopt weed control techniques. *Asian Journal of Agricultural Extension, Economics & Sociology*, 1-7.

Massimi, M. A., & Al-Bdour, A. I. (2018). A Short Scientific Note on the Horticultural Crops Optimum Planting Dates in Jordan. *Egyptian Journal of Horticulture*, *45*(2), 337-340.

Massimi, M., Haseeb, M., & Rahma, N. A. (2019). Why Using Organic Fertilizers and Biopesticides is Important for Food Legumes Production in Jordan. *Advances in Environmental Biology*, *13*(1), 38-41.

Moustafa, A. T., Jabarin, A., Jarrar, A., Jayyousi, A., Aycicegi, A. L., Yolles, D., ... & Kühn, M. (2007). Salinity management in dry regions: Fundamentals and experiences from Egypt, Israel, Jordan and the Palestinian Authority. *Ramallah: Middle East Regional Agricultural Programme*.

Tripathi, R. S., Raju, R., & Thimmappa, K. (2013). Impact of zero tillage on economics of wheat production in Haryana. *Agricultural Economics Research Review*, *26*(347-2016-17080), 101-108.