International Scholars Journals

International Journal of Agricultural Sciences ISSN 2167-0447 Vol. 5 (7), pp. 864-873, September, 2015. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full length Research paper

Socioeconomic assessment of wheat varieties and the adoption of recommended technologies in North Jordan

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Accepted 22 July, 2015

This study explored socioeconomic conditions of wheat farmers to evaluate the impacts of the introduction of the full package (FP) which includes zero tillage practices, wheat improved varieties, fertilizer application, combine, and herbicides. A socio-economic questionnaire was designed, 100 farmers were personally interviewed from Irbid governorate. Garrett ranking was also applied to rank a set of factors in adopting the FP, it showed that new techniques have been adopted. Seeders are one of the main newly adopted techniques as mentioned by 96% of farmers, 92% of farmers adopted adding fertilizer, 98% of farmers adopted the use of herbicides. Regarding to seeding rate, 79% of farmers reduced the seeding rate, 98% of farmers adopted the use of fertilizer schedule, and 97% of farmers planted the improved variety. All farmers planted earlier because it increases the profit, and saves time and money. The net return for wheat enterprise was estimated at US$ 743 /ha. The recommended and promising technologies proved to be an appropriate and effective method that can be used in Jordan to increase both wheat yield and farmers income and therefore contribute to food security.

Key words: Garrett Ranking, SWOT analysis, wheat varieties, zero tillage.

INTRODUCTION

Jordan encourages wheat production through a price subsidy to producers. The amount of the subsidy is predefined each year prior to the cropping season. Nevertheless, farmers of rainfed are sequential decision-makers; they wait until they know the amount of rainfall between October 15th and the end of December to take a decision to plant wheat. Domestic wheat production has a very high degree of variability (Al-Karablieh *et al*., 2002). This instability of production makes it essential to introduce new technologies to enhance planting wheat.

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The Project “Enhancing Food Security in Arab Countries” comes to enhance food security and focuses primarily on improving wheat production and yield in wheat-based agricultural systems. It introduced full package which encompasses zero tillage, new improved varieties of, adding fertilizer, using the combine harvester, and herbicides.

A strand of literature, aimed primarily at agricultural technology policy, asks about particular technologies and why they are not being adopted in given locations. For example, from 1996-98, the International Center for Wheat and Maize Improvement (CIMMYT) collaborated with national research institutions in East Africa to conduct 22 micro-level studies of technology adoption in

Ethiopia, Kenya, Tanzania, and Uganda. These studies looked at the Leathers and Smale (1995) use a Baysian approach to examining the sequential decisions, adoption of improved varieties of wheat and maize, as well as adoption of chemical fertilizers. They provide useful descriptive information on who is using improved seed and fertilizer in some areas of East Africa. Many similar studies (e.g., Ransom, 2003; Hintze, 2003) showed that attention has shifted from the adoption of new crop varieties to the adoption of new management practices. Although some of these studies make methodological contributions, others contribute primarily by providing information on localized situations of interest to policy makers (Krishna, 2012).

Previous studies showed that yield increases (15–70%) have been achieved by resource poor farmers over the existing varieties through the adoption of new varieties and new resource conservation technologies (RCTs). The farmers have also made substantial cost savings and achieved higher yields through resource-conserving agronomic techniques such as zero till (Ferrara, 2007).

A previous research showed that the adoption of seed drill machine without adopting other components increases output by 5.7%, whereas the adoption of new varieties increases output by 3.2%. Adopting new varieties with machinery increases output by 7.9% (Al-Karablieh et al., 1996).

There are three reasons that farmers do not adopt improved technologies. The first is simply that they are not aware of them – or that they are not aware that the technologies would provide benefits for them. Farmers may also have misconceptions about the costs and benefits of the technologies.

The second reason is that the technologies are not available, or not available at the times that they would be needed.

The third reason is that the technologies are not profitable, given the complex sets of decisions that farmers are making about how to allocate their land and labor across agricultural and non-agricultural activities. Institutional factors, such as the policy environment, affect the availability of inputs and markets for credit and outputs and thus, the profitability of a technology.

Simply noting that a farmer has not adopted a “recommended” technology does not necessarily imply that the farmer would be better off if he did so. As researchers, we need to understand better the challenges that farmers are facing. We need to focus on the broader issue of how to increase agricultural production – realizing that new technologies may be a key component. Rather than simply asking whether farmers are using improved technologies, we need to be asking them about their levels of production and finding ways to increase it, through improved technologies, improved infrastructure and institutions, and improved policies.

Despite the economic potentials of the technology, two major factors were found limiting the wider dissemination of the ZT wheat in the study area (Krishna, 2012):

1. Limited availability of ZT seed drills: Only a small percentage of farmers, who are willing to adopt ZT (that constitutes about 90% of the survey respondents), have actually adopted the technology. Scarcity of seed drills is one of the major reasons behind non adoption and dis-adoption.
2. Lack of information on the working of no-till practice among farmers: About 29% of ZT drill adopters were using the drill as a mere wheat seeding equipment after ploughing the land. Such variant use or partial adoption of this “bundled technology” comes with a significant cost increase, given the high prevailing wage rate for human labor and custom hiring charges for land preparation.

Another study done by Tripathi, *et al*., 2013, about the Impact of Zero Tillage on Economics of Wheat Production in Haryana showed that the net income has been found higher in ZT method, mainly due to lower cost of production compared to that in conventional method but despite several economic and environmental advantages, adoption of ZT technology has been limited and one major constraint identified is the difficulty in accessing a zero-till seed drill machine during sowing period.

The study has suggested that ZT technology should be disseminated on a wider scale and availability of zero-till seed drill should be ensured at least through custom-hiring basis.

Derpsch, 2010 showed also that the spread of no-tillage systems on more than 110 million ha world-wide shows the great adaptability of the systems to all kinds of climates, soils and cropping conditions.

Global estimates of the extent of adoption of CA as a package are 124 million hectares (Friedrich et al., 2011), 87% of which is concentrated in five countries: the United States, Brazil, Argentina, Australia, and Canada (26.5, 25.5, 25.5, 17.0 and 13.5 million ha, respectively) (Brouder, 2014).

This study explored socio economic conditions of wheat farmers to evaluate the impacts of the introduction of the full package (FP) and aimed at characterizing the livelihood of communities in term of their assets and opportunities.

MATERIALS AND METHODS

A socio-economic questionnaire was designed to elicit basic numerical data on plant production, inputs and expenditures. The farmer was questioned on size and age of the family, size of the land holding, cropping system, sources of income, level of education, and agricultural practices. This study was done in Irbid governorate, namely in two districts, they are Bani kena-

nah, and Qasabet Irbid. From the selected sites, 100 farmers were personally interviewed.

Garrett ranking was also applied to rank a set of factors in adopting a particular technology as perceived by the sample respondents based on certain criteria. The order of the merit assigned by the respondents is converted into scores by using the formula given by Garrett and wood worth (1977) (Palanisami, 1999)

$$\text{Per cent position} = \frac{100\,(Rij - 0.5)}{Nj}$$

Where,

Rij = Rank given for i^{th} factor by j^{th} individual

Nj = Number of factors ranked by i^{th} individual

By referring the Garrett table the PP estimated was converted into scores. Then for each factor the scores of various respondents were added.

RESULTS AND DISCUSSION

Site Characterization

Climate

Jordan is part of Mediterranean and Arid zone climate. Mediterranean climate dominate in north and west regions, while arid climate dominate in the rest part of Jordan, whereas the semi humid climate is dominate in the communities' project areas and the rainfall ranged between 300-400 mm with an average of 355 mm.

Land Use and Ownership

Privately owned, rented, and partner, land tenure were found in the surveyed community. Results showed that 59% of the respondents own land, the owned area is between 0.1 ha and 15 ha, 67% of the respondents rent land, the rented area is between 0.4 ha and 20.0 ha, and 8% of the respondents share land, the shared area is between 1.3 ha and 7.0 ha with an average of 0.2 ha.

About 57% of the respondents cultivate the owned land with wheat; the owned area is between 0.1 ha and 1.2 ha with an average of 1.3 ha, 57% of the respondents cultivate the rented land; the rented area is between 0.2 ha and 2 ha with an average of 1.8 ha, 7% of the respondents cultivate the shared land; the shared area is between 0.2 ha and 4 ha with an average of 0.1 ha.

Socio-economic Characteristics

Gender and Age

The average number of family was 6 members which indicated that the number of families decreased this year comparing with the previous years due to the iterance of young farmers in the project. The awareness of the benefits of adopting the full package is increasing rapidly within the targeted communities.

The number of males was between 1-10 males, with an average of 3 members. The number of females in the family was also between 1-10 females, with an average of 3 members.

Farmer's age ranged from 19 years to 80 years with an average of 51 years old, if we compare this to the last season, it appeared that the youngest farmer age was 30 but this season there is a young farmer who is 19 years old. Results show that about 76% of farmers were less than 60 years old, and 24% was from 61 years to 80 years old.

Marital Status

About 94% of the interviewed farmers were men; this implies that men in this community are leading this kind of agriculture, but there was 6% of farmers were women which indicated that women are now aware of the importance of agriculture as a source of living. Regarding to the marital status of farmers, about 90% of them is married (85% of men and 5% of women), and about 7% of them is single.

Educational Level

Regarding to farmer's educational level, results showed that 45% of farmers finished high school, and 32% have higher education. Regarding to male's educational level, results showed that 32% of them finished higher education (diploma, BsC, High education), and regarding to female educational level about 33% have higher education.

Family Labor and Participation in Agriculture

Regarding to the farm activities, it was done mainly by men, there is about 38% of farmers mentioned that there is at least one male of the family members is working in the farm. About 17% of farmers mentioned that there is at least one female of the family members is working in the farm. But the rest are not working in agriculture because they are educated and they are not willing to work in agricultural activities.

About 46% of family members don't help their fathers in plant production because they are working in other jobs outside agricultural activities.

Labor

About 61% of farmers mentioned that they hired labor, but 39% mentioned that they don't because there is at least one of the family members is working in the farm.

Farmer's Income Sources

Source of income is used as a good indicator for community welfare. The survey examined 'farm income'. The percentage of farmers who are depending on plant production source between (1-25 %) was 47% while about 83% of farmers mentioned that they are not depending on the animal production sources on their living, and 40% are depending mainly on the off-farm income.

Credit

Results showed that there are only 8 farmers (8%) took loan from different sources. The amount of credit varies between 2113-9859 JD. The average amount of the loan was 5825 JD. The purpose of taking the loan was for the animal production and bee keeping.

Farmers' Practices

Kind of Participation in the Project

Results showed that there is an increase in the percentage of adopters to the full package (FP) comparing with the last season due to the effort which was done by the team of the project to disseminate the benefits of the FP. About 48% of farmers adapted the FP comparing to 32% in the last season. Only 4% of farmers were adopting zero tillage (ZT) last season but this percentage increased to 10% which indicated that farmers are now aware to the benefits which gained from ZT. About 9% were adopting the new verities, the rest are not participating in the project.

Wheat Varieties

Farmers mentioned that they were not aware about the new improved wheat varieties before the project launching; they used to plant Hourani variety of wheat from early ago until nowadays because it is tolerant to drought and because it gives high production of seed and hay as 50% of farmers mentioned. About 4% of farmers plant Cham1 variety because it gives high production of seed and hay and it is tolerant to drought. Farmers mentioned that the most suitable varieties of wheat are Hourani and ACSAD 65 as mentioned by 50% and 32% respectively. Results showed that promising ACSAD varieties gives the highest productivity of seed, and Hourani variety gives the highest productivity of hay.

Wheat breeders and extension agents of NCARE encourage farmers with improved varieties such as ACSAD, Dir-Alla6, and they started to plant these varieties and they are now aware that these varieties give high productivity of seed and hay. About 74% plant ACSAD because it gives high production of seed and hay. About 49% of farmers plant Hourani because it gives high production of seed and hay. About 23% of farmers plant Deir Alla because it gives high production.

Seeds Sources and Seed Rate

Most farmers used to buy wheat seeds from Jordanian Cooperative Corporation, the price is 470 JD/ton. The seed rate is different between farmers; some farmers add 120-140 kg/ha of seeds as recommended by researchers and extension agents of NCARE, but the majority prefer to add 150-200 kg/ha as their grandfather did. This year (2014) the drought season obligated farmers to reduce the seed rate. The range was between 80-200 kg/ha, the average quantity of seeds was 148 kg/ha. Previous research showed that using 125kg/ha of seeds will give a high yield reaches to 5574 kg/ha (Gastel et al., 1998).

Regarding to seed source, this season2013-2014 about 69% of farmers depend on Maru Agricultural Research Station/NCARE to get seed because it provides farmers with high seed quality and guaranteed seeds as mentioned by 43% of farmers, and they purchased some local seed varieties from the other farmers as mentioned by 10% of farmers. About 26% of farmers leave part of their production for seed purposes after succession in one season, and they also store a little amount of wheat production for food purposes. About 37% of farmers depend on the Jordanian Cooperative Corporation (JCC) because it provides farmers with improved quality and guaranteed seeds as mentioned by 28% of farmers.

Farming Systems

About 91% of farmers mentioned that they use seed driller for planting wheat, but 9% of farmers are still broadcasting their land by hand because the land is not suitable for machinery and the area is small for using machinery.

About 75% of farmers mentioned that they plow their fields before planting wheat, but 25% of farmers mentioned that they use zero-till system. As it is clear the awareness for the zero-till system is increasing rapidly during the project period.

Sowing Date

Farmers mentioned that they plant wheat during November and December each year after the first rainfall until the end of January from the next year.

Crop Rotation

About 91% of respondents mentioned that they follow a crop rotation; the types of crop rotation are double (59%) and triple (32%). Results showed that there is an increase in the percentage of adopters to the crop rota-

tion due to the awareness of the benefits of it especially in the drought seasons.

The Previous Crop before Wheat

About 29% of farmers leave their lands without planting for one year before planting wheat, and 29% mentioned that they plant summer crops before planting wheat. Others plant onion and legumes before planting wheat in order to increase the wheat productivity.

Fertilizers

Farmers don't do soil analysis before adding fertilizers, but they have previous experience about the soil type and the needed quantity of fertilizer, 90% of farmers add fertilizers, and they used to add manure and chemical fertilizers.

One farmer added only manure and 80% of farmers added chemical fertilizers before agriculture as complex fertilizer in different ranges. This season the quantity of fertilizer which was added is decreased due to the decrease in the rainfall.

About 9% of farmers added urea, and 5% of farmers added DAB, but the majority added DAB with sowing and then they added urea after the first rain to increase vegetation growth and tillering.

Weed Control

The application of herbicides was done by 84 farmers out of 100 (84%), and 16 farmers mentioned that they don't apply herbicides (16%) because of the high cost of herbicides or because there are no weeds in their fields. The used type of herbicides was Ester 2-4D for the broad leaves because it is efficient, cheaper than other herbicides and well known for farmers.

Marketing

An important issue about marketing options, farmers answered that they have three options; authorized marketing centers, intermediaries for sale, and personal marketing. And the answers related to different reasons, about 45% of farmers take the role of marketing their production by themselves, because they can get direct financial benefits, easier for sale, and the farmer can control the price and save the good quality for the next season. But 5% of farmers depend on Intermediaries for marketing their production because they can get direct financial benefits and easier for sale from their point of view.

About 56% of farmers depend on authorized marketing centers (Ministry of Trade and Industry, Jordanian Cooperative Corporation) for these reasons: easier for sale, get direct financial benefits, and reduces the time and labor. But there are some problems face these farmers: seed examination, and late payment for grains.

Garrett Ranking

Garrett ranking showed that new techniques have been adopted by the farmers through the full package. Seeders is one of the main newly adopted techniques as mentioned by 96% of farmers for these reasons: good distribution of seed, profit increase with the increase in production, reduced seed rate, and saving in time and money (less number of workers) but 2% mentioned that they don't use it because it is not available.

Zero tillage is also one of the main newly adopted techniques as mentioned by 23% of farmers for these reasons: good distribution of seed, profit increase, and saving time and money (less number of workers).

A research done by IFPRI in 2009 about the case of zero-tillage technology in Argentina showed that the adoption of zero tillage improved soil fertility by reversing decades of soil degradation, created an estimated 200,000 new farm jobs, and shocked the agricultural commodity markets with additional supplies that helped keep global food prices from escalating.

Erenstein, et al, 2007, showed that the combination of a significant "yield effect" and "cost-saving effect" makes adoption worthwhile and is the main driver behind the rapid spread and widespread acceptance of ZT in Haryana, India. In Punjab, Pakistan, adoption is driven by the significant ZT-induced cost savings for wheat cultivation. Thus, the prime driver for ZT adoption is not water savings or natural resource conservation but monetary gain in both sites. Both the Haryana, India and Punjab, Pakistan studies confirmed significant ZT-induced resource-saving effects in farmers' fields in terms of diesel and tractor time for wheat cultivation. Water savings are, however, less pronounced than expected from on-farm trial data.

The benefits of Conservation Agriculture (CA) include: higher productivity and income (Kassam, 2012). Another research on the CA adoption among small holder farmers in southern Africa showed that the diverging definitions of what constitutes and is promoted as CA complicate the assessment of adoption across the region. Nevertheless, a recurrent set of farm-level constraints and prerequisite (contextual) conditions for smallholder CA adoption has been identified in scientific articles and project documents. These barriers are generally regarded as the cause of limited CA adoption among smallholder farmers in Africa. Yet, the identified adoption barriers are usually related to specific CA practices or the agro-ecological circumstances in which they need to be applied, while their adoptability by different types of farmers and in different socio-economic circumstances tends to be understudied (Andersson,2014).

Friedrich et al., 2012 showed that the main reasons for

Table 1. Order of Priority for Technologies.

Technologies	Rank	PP	S
Seeder Use	V	56.25	47
The use of no-till seeder	VIII	93.75	20
Add fertilizer	VI	68.75	40
The use of herbicides	II	18.75	67
Seed rate	VII	81.25	32
Fertilizer schedule	III	31.25	60
The use of improved variety	IV	43.75	53
Planting date	I	6.25	80

Source: Research Sample

Table 2. Percentage of farmers who adopted the Technology %.

Technologies	Percentage of farmers who adopted the Technology %
Seeder Use	54.24
The use of no-till seeder	26.00
Add fertilizer	50.73
The use of herbicides	56.23
Seed rate	48.59
Fertilizer schedule	54.12
The use of improved variety	53.12
Combine	54.81

Source: Research Sample

adoption of CA can be summarized as follows: (1) better farm economy (reduction of costs in machinery and fuel and time-saving in the operations that permit the development of other agricultural and nonagricultural complementary activities); (2) flexible technical possibilities for sowing, fertilizer application and weed control (allows for more timely operations); (3) yield increases and greater yield stability (as long term effect); (4) soil protection against water and wind erosion; (5) greater nutrient efficiency; and (6) better water economy in dryland areas.

Editorial, 2014 reported that some of the CA management packages resulted in significant benefits in terms of yield, water saving, and profit although the magnitude of benefits depended on the cropping system and component crops.

92% of farmers mentioned that they adopted adding fertilizer for these reasons: profit increase, and it enhances the growth of the plant and 98% of farmers mentioned that they adopted the use of herbicides for these reasons: profit increase, weed reduction and increase the productivity.

Regarding to seeding rate, there are about 79% of farmers mentioned that they have reduced the seeding rate for these reasons: reduction in the rate of seed, profit increase, and increase in the productivity.

And 98% of farmers mentioned that they adopted the use of fertilizer schedule for these reasons: increase the growth of the plant, profit increase, save time and money (less number of workers).

Regarding to the use of improved variety, there are about 97% of farmers mentioned that they have planted the improved variety for these reasons: profit increase, increase the productivity, and tolerant to water stress.

All farmers planted earlier according to the project team recommendations because it increases the profit, and saves time and money.

Results showed that the most important reason for not adopting the technology was socio-economic issue because of the non-availability of the technology, but it wasn't due to an error in the technology itself.

Garrett Ranking was applied also to rank the technologies according to its importance.

Accordingly, the top priority was given for planting date by the respondents, followed by others which are: using of herbicides, fertilizer schedule, the use of improved varieties, seeder use, adding fertilizer, seed rate, and the use of no-till seeder (Table 1).

Results showed that the use of the different techniques is easy and available according to farmers, but Ministry of Agriculture (MoA) and The National center for Agricultural Research and Extension (NCARE) should enhance their role regarding to the awareness of farmers regarding this full package and its benefit.

Results showed that almost half of farmers adopted the new technologies in the selected sites, except the use of

Table 3. Advantages of the New Techniques.

Advantage	Yes		No		No Difference	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Save time	97	97	1	1	2	2
Increased in production	87	87	9	9	4	4
Reduce seed rate	76	76	17	17	7	7
Reduce the cost	77	77	14	14	9	9
Reduce weed	79	79	15	15	6	6
Reduce the labor cost	71	71	16	16	13	13
Increase planting area	59	59	26	26	15	15
Add fertilizer according to soil analysis	92	92	3	3	5	5
Planting in suitable time	87	87	7	7	6	6
Increased Profit per unit of area	60	60	33	33	7	7

Source: Research Sample

Table 4. Disadvantages of the New Techniques.

Disadvantage	Yes		No		No Difference	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Don't found machines at requested time	32	32	63	63	5	5
Don't have the improved variety	35	35	59	59	6	6
Difficulty use in sloppy areas	34	34	61	61	5	5
High prices	20	20	62	62	18	18

Source: Research Sample

no-till seeder, due the non availability of the seeder (Table 2).

SWOT Analysis

Farmers mentioned that they adopted the new techniques because they save time, 97% of farmers pointed out that the new techniques allowed for planting earlier, about 92% mentioned that they add fertilizer according to the soil analysis. About 87% of farmers mentioned that these techniques increased the production as well as the profit, and 79% of farmers mentioned that it reduced weed in their farms and 77% of farmers mentioned that it reduced cost (Table 3).

About 20% of farmers mentioned that they are reluctant to apply the new technologies and methods because of the high prices, and about 32% of farmers mentioned that machine isn't available on time, but 34% said that there is difficulty in using these machines in sloppy areas. About 35% of farmers complained that they don't have the improved variety (table 4).

About 21% of farmers mentioned that they would like to apply the new technologies and methods to increase the quantity and quality of production, 18% said that using these technologies will save time and effort, 16% of farmers mentioned that these technologies will reduce the needed labors, and about 14% of farmers mentioned that there is opportunity to increase the planted area (table 5).

About 36% of farmers mentioned that there is no problem in applying the new technologies and methods and 17% mentioned that there is no comments, but 19% said that they are reluctant to apply the new technologies and methods because machines isn't available on time, and 10% said that there is difficulty in applying the new technologies and methods because of the raising input prices (pesticides, fertilizers, seed) (table 6).

Wheat Costs and Returns

The objective of this section is to estimate the costs and returns of wheat production. Data used for the analysis were collected through a well-structured questionnaire and personal interview on the plant units, costs and revenue items in the farm.

The net return for wheat enterprise is estimated at US$ 743 /ha, the variable costs are estimated at US$ 774.5 / ha with fixed costs at US$ 862.6 / ha. The total cost of wheat is estimated at US$ 1637 / ha and the total return is estimated at 2380 JD/ ha.

As shown from table 7 below, it is clear that the highest variable cost was the cost of labor and the cost of harvesting by combine. Regarding to the fixed cost, the cost of land rent was the highest followed by the cost of seed.

Table 5. Opportunities of the New Techniques.

Opportunity	Yes		Percent of Cases
	Frequency	Percent	
Increasing in quantity and quality of production	31	21.1%	32.3%
Agricultural Loan	2	1.4%	2.1%
The provision of manpower	24	16.3%	25.0%
Save time and effort	26	17.7%	27.1%
Increase the area planted	20	13.6%	20.8%
Agricultural techniques and the mechanics and keep up with technology	8	5.4%	8.3%
Cost Reduction	5	5.7%	10.0%
Increased income	15	10.2%	15.6%
The development of production inputs and improved varieties and pesticides	5	5.7%	10.0%
Reduce the rate of seed	6	4.1%	6.3%
No Comment	9	6.1%	9.4%
Total	147	100.0%	153.1%

Source: Research Sample

Table 6. Constraints of the New Techniques.

Constraints	Responses		
	Frequency	Percent	Percent of Cases
Lack of mechanisms in appropriate time	21	18.9%	21.0%
Raising input prices (pesticides, fertilizers, seed)	11	9.9%	11.0%
The high cost of manpower	2	1.8%	2.0%
Lack of access to modern technologies	1	0.9%	1.0%
Lack of improved seeds	9	8.1%	9.0%
Higher prices to rent farmland	3	2.7%	3.0%
lack of rain	2	1.8%	2.0%
Rugged land	3	2.7%	3.0%
There are no problems	40	36.0%	40.0%
No Comment	19	17.1%	19.0%
Total	111	100.0%	111.0%

Source: Research Sample

Role of Women in agriculture

Regarding to women participation, results showed that about 28% of women participated in plant activities, and 6% of them participated in milking and dairy processing activities. There is five women farmers who manage the farm by themselves, and there are about seven farmers plant summer crops. There is 17% of women plant the home garden.

There is only six women participate in the livestock production such as milking and milk processing, in addition to feeding the herd. Results showed that the age of wives are young, and the new generation is not working in livestock activities.

Problems faced by farmers in the wheat based farming system

A question about what are the obstacles and difficulties in wheat cultivation, the answers were varied: limited access to machinery, erratic of rainfall, rising costs of production inputs, and high labor wages (Table 8).
Farmers suggested some ideas to solve these problems such as: providing agriculture machines and inputs at encouraging prices, governmental incentives and support for farmers, and activation of agricultural extension (Table 9).

Evaluation of the project: Enhancing Food Security in Arab Countries

It is important to evaluate the project from the point of view of farmers, the good thing that about 46% of farmers mentioned that this project is very important, and 33% of farmers see that it is useful, but 14% think that the project is normal (table 10).

About 14% of farmers mentioned that more than 80% of farmers in the selected areas benefited from the projects in terms of full package, or improved varieties seeds, or seed driller. About 33% of farmers mentioned

Table 7. Average Net Return and Cost of Production of Wheat for One Hectare.

Activity	Unit	Quantity	Price US $	Total
Wheat grains		2500	0.56	1400
Straw	Kg	3500	0.28	980
Total Return	US $			2380
Variable Cost				774.5
Mechanical plowing	US $/ ha			84.5
Weeding	US $			14
Herbicides	US $			24.7
Pesticides	US $			14
Spraying Machine	US $			20
Fertilizer	Kg	70	0.98	68.6
Spreading	US $			11.8
Harvesting (by combine)	US $			140.8
Urea	US $			73.8
Bags	no.	120	0.14	16.8
Transportation	US $			84.5
Labor	US $			140.8
Interest on operational cost				80.4
Fixed Cost	US $/ ha			862.6
Seeds	kg	169	0.56	94.6
Depreciation	US $			42
Land Rent	US $/ ha			634
Interest on capital cost	US $			92
Total Cost	US $			1637
Net return	US $			743

Source: Calculated by the researcher from the data of research sample

Table 8. Constraints Related to Planting Wheat.

Constraints	Frequency	Percent (%)
Mechanisms are not available at the appropriate time	14	14%
Weed control and diseases	2	2%
The high cost of manpower	5	5%
Higher prices to ensure farmland	1	1%
The spread of vole	1	1%
Low rainfall	5	5%
Increasing in costs and rising prices of agricultural inputs (pesticides, and fertilizers, seed,..)	6	6%
Availability of seed types	1	1%
There are no problems	29	29%

Source: Research Sample

Table 9. Suggestions Related to Planting Wheat.

Suggestions	Frequency	Percent (%)
Provide mechanisms	26	21.5%
Provide inputs	31	25.6%
Support farmers by the government	3	2.5%
Activation of Agricultural Extension	7	5.8%
Protect farmland from fragmentation	4	3.3%
Marketing problems	2	1.7%
No Comment	48	39.7%
Total	121	100.0%

Source: Research Sample

Table 10. Evaluation of the Project.

Evaluation	Frequency	Percent (%)
Very useful	46	46.0
Useful	33	33.0
Normal	14	14.0
Unhelpful	1	1.0
Non participation on project (don't know)	6	6.0
Total	100	100.0

Source: Research Sample

Table 11. Percentage of farmers benefited from the Project.

Evaluation Percentage (%)	Frequency	Percent (%)
<30	33	33
30-50	17	17
50-70	25	25
80-100	14	14
Missing Value	11	11
Total	100	100

Source: Research Sample

that only 30% benefited from the project from their point of view through the adoption of the technologies (table 11).

CONCLUSIONS AND RECOMMENDATIONS

The Project "Enhancing Food Security in Arab Countries" disseminated to farmers new agricultural practices, technology, and high yielding varieties. Results showed that transferring the new technology to all farmers is very important and will be very helpful in food security issues. For example, by implementing the full package of integrated cropping practices in farmer's fields, wheat grain yield was raised to more than 76% comparing with traditional methods. Not only the yield can be increased by the new technologies but also the income of the farmers, this was obviously appeared when applying zero tillage.

In some demonstrations farmer income was increased to more than US $ 610 when applying zero tillage. The project introduced a number of improved varieties to the farmers in the target site. Availability of such varieties with good quantity among farmers will enhance the spread and adoption of these varieties and will add to the efforts of food security in the country.

The net return for wheat enterprise was estimated at US$ 743 /ha, the variable costs were estimated at US$ 774.5 / ha with fixed costs at US$ 862.6 / ha. The total cost of wheat was estimated at US$ 1637 / ha and the total return is estimated at 2380 JD/ ha.

The highest variable cost was the cost of labor followed by the cost of harvesting by combine. Regarding to the fixed cost, the cost of land rent was the highest followed by the cost of seed. The cost can be reduced through reducing seed rate, using the harvesting combine from the MoA instead of renting high cost private combines, and reducing the labor cost.

The recommended and promising technologies proved to be an appropriate and effective method that can be used in Jordan to increase both wheat yield and farmers income and therefore contribute to food security. Based on this study, it was shown that farmers need support to continue farming their land successfully. The best way to support them is to provide them with the more practical incentives in the form of: improved varieties seed supply, accesses to machinery especially the zero till seeder, field learning of farming technology including herbicides for weed control. These incentives must be also combined with increasing the public awareness of the improved crop managements and varieties among the farming community and the stakeholders.

ACKNOWLEDGMENTS

By completing this study the authors would like to acknowledge Arab Fund for Economic and Social Development, Kuwait Fund for Arab Economic Development, Islamic Development Bank, and OPEC Fund for International Development and International Center for Agricultural Research in the Dry Areas (ICARDA) for their financial support to this research within the Framework of "Enhancing Food Security in Arab Countries" project. The authors would like also to thank the technical team, who provided valuable input to

and guidance for this analysis, they are: Dr. Yasser Mohawish, and Dr. Iyad Musallam.

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