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Validating Farmers' Adoption for Salt-tolerated Crop Seeds in Jordan

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Authors' contributions

This work was carried out in collaboration between all authors. Author MM designed the study, wrote the protocol and supervised the work. Authors BAQ and SH carried out field work and performed the survey. Author MM managed the analyses of the study. Authors MAR and AAD coordinate the project work funds. Author JA managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

The information on farmers' adoption of local seed systems is based on field visits undertaken in the Zarqa and Mafraq Regions in Jordan. Farmers' adoption depends upon social relation, locally developed seed exchange methods and private companies which are presented as leverage mechanisms for the survival of local seed systems. Farmers' decision to acquire seeds is an act of making a choice between maintaining old germplasms or searching for renewable physical input (seed) or to take advantage of each merit in specific situations. This clearly underscores the need to value the seed lot yield before putting in place any type of variety selection or seed multiplication. This paper presents a brief overview of the seed system in Jordan with particular emphasis on the role of extension services in local seed supply. Field visits and yield estimates leads to the conclusion that the extension services should focus on farmer yields in order to validate the complementary role of local seed systems, research trials and extension program demonstrations in the development of a national seed industry.

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1. INTRODUCTION

Jordan is among the smallest agricultural countries in the middle east with an estimated field crops area of 175000 ha [1]. Seed is considered a basic input for agricultural development since it ensures grain and forage production.

Seeds mainly obtained from the formal and local seed sources. The share of the formal sector in total seed supply stands low as compared to local seed sources (farm-saved seeds, and seed market). It is estimated that the prevailing system of seed supply depends on farmer seed stock [2]. In Ethiopia for example over 80% of the national seed demand is met through local seed maintenance and exchange [3]. Farmer-to-farmer seed exchange mechanisms form the dominant system of seed supply in developing countries. Research findings elsewhere revealed that farmer-to-farmer seed exchange mechanisms are mostly based on traditional social networks and family relations and can be very effective in the diffusion of new varieties [4] as well as [5]. Franco and Schmidt (cited in [5]), [6,7] found that most farmers obtained seed of new varieties from informal seed sources. Even much of the spread of Green Revolution varieties, rice and wheat for instance, has taken place through farmer-to-farmer contact [8]. However, farmer-to-farmer seed exchange is a neglected area of research though it is a successful living tradition for the rural farming majorities.

Even though the local seed system has been widely reported as an important source of seed, information on the role of extension programs in the local seed system is scarcely documented. It stresses for the extension demonstrations spread in order to validate the complementary role of local seed systems in the development of a national seed industry.

2. MATERIALS AND METHODOLOGY

A case study on local seed exchange has been initiated in the Zarqa and Mafraq Regions using improved triticale and barley seeds since 2010. Triticale is the second important forage crop next to barley in the northern–eastern Regions of Jordan. Of the total triticale seeds produced in the country in 2010-2014, the share of triticale seeds in terms of area and total farmer occupation in the Regions was 22.5% and 29.5% respectively (Tables 1 and 2) (field extension statistics, 2014). Based on the trend of area allocation and production value existing at present, the growing importance of triticale seeds in the northern-eastern Regions of Jordan could easily be predictable. Triticale seeds have thus been chosen for its high yielding and economic importance.

Table 1. Crop planted fields

Crop lots	No.	Valid %
Triticale	13	29.5%
Barley	23	52.3%
Oat	3	6.8%
Sorghum	3	6.8%
Millet	1	2.3%
Sesbania	1	2.3%
Total	44	100%

The following methods were employed to implement the case study: First, interested seed growers from local farmers were identified, who agreed to take trial seeds and multiply them and then disseminate new innovation to farmers. A list of interested farmers was obtained to establish a sampling frame. Then, seventeen farmers from 3 Peasant Associations (PAs) were drawn randomly from the established sampling frame representing three sub-districts in the Zarqa Region of Jordan in 2011 and 2012. Before distributing seeds, training was given to pilot seed growers on the subject related to the required isolation distance; proper application of crop husbandry; seed selection and storage practices, etc. 23 kilograms of trial seeds of newly released triticale seeds (Syria-1) were given to each grower.

Being a new one in the area, the variety Syria-1 is expected to stimulate innovation transfer between local farmers. Eventually, the role of extension programs' demonstrations in enhancing the dissemination of Syria-1 seeds and idea from pilot seed growers to local grain producers and local exchange methods were assessed in the consecutive cropping seasons in 2013 and 2014. The pilot seed growers (3 farmers) have multiplied a total or exceed 1 ton of clean Syria-1 seed from 0.4 ha in 2012, and 60 tons from 10 ha in 2013. They maintained clean seed by carefully selecting healthy spikes, by avoiding shriveled seed and those free from physical impurity. The average clean seed multiplied by each grower ranges from 3-6 tons

per hectare. Of the total multiplied seeds, the largest share (60 tons) was partly reserved as seed for next season and/or as grain for local consumption.

Ten farmers were drawn randomly from the sampling frame in the Mafraq Region of Jordan in 2011 and 2012. Before distributing seeds, training was given to ten seed growers on the required cultural practices. 10 kilogram of trial seeds of barley seeds (Rum) was given to five growers and 10 kilograms of ACSAD176 were given to another five. The number of farmers receiving seeds from growers ranges from one to three, that is to say, each seed grower has given the idea to at least one farmer from his neighbors or relatives. About 52.3% of the interviewed seed growers adopted traditional crop barley new variety seeds (Table 1).

The cross tabulation of Regional farmers for triticale seed adoption by extension demonstrations and dissemination revealed that of the seed growers, 21.33% (16 out of 75 farmers) initiated triticale seeds trial before others by adoption in Zarqa, 17.33% by adoption in Mafraq Region in 2013, and 48 % by means of adoption in Zarqa only in 2014-2015 (Table 3).

From this case study, it was observed that farmer-to-farmer innovation transfer and dissemination was found more efficient in extension demonstrations correlated with research station trials than on the local seed supplying systems. Local systems of seed supply through extension programs' demonstrations ensure that all farmers with varying socio-economic status in local seed systems are the beneficiaries. Moreover, farmers know the adaptability, high productivity and quality of seeds; they have confidence and familiarity with extension services.

About 29.5% of the triticale seed growers and 52.3% of barley seed growers explained that the need for high yielding new varieties, in comparison to the traditional wheat and barley varieties, had forced them to disseminate the new crop idea immediately after harvesting. Results showed that triticale had a similar mean seed yield and average profit to that of barley, but was significantly higher forage biomass yielding than barley (Table 4). These results confirm the straw yield superiority reported by Mergoum et al. [9]. Triticale had a higher percent of increase for mean seed yield and average profit than barley mean seed yield and average profit. In addition, McCartney et al. [10] concluded that triticale out-yielded barley. Triticale is an interesting alternative to other cereals in environments where growing conditions are unfavorable [11]. It is a cereal that hailed from wheat (*Triticum* ssp.) parent which was crossed with the environmental tolerant rye (*Secale* spp.) parent [12]. Selling was recorded as the most efficient method for transferring seeds from seed growers to their neighbors, this clearly indicates that farmers can obtain seeds from neighbors trustfully on credit with cash in hand (Table 4).

Table 2. Areas where crops were planted

Crop lots	Area (du)	Mean	*Standard deviation*	Valid %
Triticale	179	13.77	27.13	22.5%
Barley	585	25.44	56.47	73.5%
Oat	5	--	--	0.6%
Sorghum	23	--	--	2.9%
Millet	2	--	--	0.3%
Sesbania	1.5	--	--	0.19%
Total	795.5	--	--	100%

Table 3. Farmers adopt triticale

Governorate	Farmers' adoption	Year	Valid %
Zarqa	16	2011-2013	21.33%
Mafraq	13	2013	17.33%
Zarqa	36	2014-2015	48%
Total	75	**--**	--

Table 4. Average yields and profits

Crop	Average seed yield kg/du	Average straw yield kg/du	Average profit JD/du
Triticale	347.5	673.3	214.77
Barley	286.3	459.6	138
Standard deviation (*Triticale*)	167.68	251.83	85.50
Standard deviation (Barley)	90.86	237.74	99.51
F value	1.708	5.186	.056
Sig (0.05)	.202	.031 *	4.005
Sig	NS	Sig	NS
% of increase	21.37 %	46.5 %	55.63 %

3. LABEL CONCLUSION AND RECOMMENDATIONS

It has been well recognized that the research station trials have succeeded to meet a national seed demand in terms of seed volume and of varieties of farmers' choice due to the presence of a fully fledged distribution channel with guaranteed extension demonstrations, especially in remote and heterogeneous areas. As a result, the prevailing system of seed supply in Jordan remains a formal one, where a farmer has the ability to depend on his own stock, other farmers, and any other sources. Seeds of the cultivated land races are, they are the major source of genes for modern varieties, have come almost entirely from research station trials.

Farmer's decision to exchange seed depends on mutual inter dependence and trust. It is an act of making a choice between maintaining old germplasms or searching for renewable physical input (seed) or to take advantage of each merit in specific situations. This clearly underscores the need to value each merit of a seed yield in specific situations before putting in place any type of variety selection, and seed multiplication.

In local seed systems, farmers have access to seeds largely through extension program demonstrations. This system of innovation dissemination ensures that all adopted farmers with varying socio-economic status in remote and heterogeneous areas are the beneficiaries.

It is therefore recommendable that extension services should focus on farmer's yields to capacitate the complementary role of local seed systems, research trials and extension program demonstrations in the development of a national seed industry.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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