7 Jordan

In search of new benefit-sharing practices through participatory plant breeding

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Supporting agricultural development

Of Jordan's 8.93 million hectares, only 7.8% is arable land. However, the agricultural sector plays an important role through its contribution to national income and employment. Agriculture contributes 7.5% to gross national product, and about 22% of Jordan's population (estimated at 5,835,500) make a living from agriculture.

The country has a Mediterranean-type climate and several agro-climatic zones, which vary considerably in terms of rainfall, temperature, soils and cropping patterns. Agricultural crops are mainly rainfed (98%). Field crops (such as cereals, food and feed legumes), orchards (mainly olive trees) and vegetables are grown on 65.5%, 25.5% and 9.0%, respectively, of agricultural lands. Wheat, barley, lentils, chickpeas and vetches are produced during the main winter growing season. Irrigated agriculture is concentrated in the rift valley (the Jordan Valley), where vegetables and citrus fruits are the main crops. In the southeastern part of the country, cereals and forage crops are grown using pivot irrigation. Sources of water are the Jordan River, springs, wells and several dams.

Jordan's government has been active in creating a supportive institutional environment for agricultural development. This case study looks at agricultural policies, laws and international agreements through the lens of the country's efforts to introduce and institutionalize PPB in collaboration with ICARDA. These PPB activities build on ICARDA's pioneering work in Syria and other countries (see Chapter 6).

ABS issues are still new to the country, but are attracting attention. The ABS team, which is made up of staff from the National Center for Agricultural Research and Extension (NCARE) and ICARDA and is part of the IDRC-supported project on ABS issues, is at the forefront of efforts to gain more recognition.

Policies and laws in the agricultural sector

Government policies support development of the agricultural sector by expanding the area under cultivation and improving the supply of inputs. The government also encourages new technology and crops by: employing better approaches to research and extension, rainwater harvesting techniques and irrigation systems;

controlling input prices; promoting agricultural development projects; and supporting guaranteed minimum prices. The government buys local wheat and barley at international prices to encourage farmers to increase production and helps farmers export their surpluses of other crops.

At the regional and international levels, the government has ratified the following international treaties and conventions regarding biodiversity and the environment:

- Ramsar Convention in 1977
- Convention on Biological Diversity (CBD) in 1993
- Convention to Combat Desertification in 1996
- Cartagena Protocol in 2000
- Kyoto Protocol in 2000
- Plant Genetic Resources for Food and Agriculture in 2001
- Convention on Persistent Organic Pollutants in 2002
- International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) in 2004
- World Heritage Convention
- Regional Convention for the Conservation of the Red Sea and the Gulf of Aden Environment.

In addition, Jordan adopted the Standard Material Transfer Agreement of the governing body of the ITPGRFA in its resolution 1/2006 on 16 June 2006. In October 2004, it became a member of the International Union for the Protection of New Varieties of Plants (UPOV).

National legislation

Although Jordan is strongly aware of environmental and pollution issues, it still has relatively limited knowledge of the importance of plant genetic resources. Jordanian society learns quickly, however, and the establishment of the Genetic Resources Unit and the National Committee will play a major role in increasing awareness in this area.

Quarantine laws in Jordan are not strict enough to inhibit the transfer of genetic materials. The country is freely receiving germplasm, mainly cereals, from international research centers, such as ICARDA. The flow of germplasm abroad is usually not checked either. The Genetic Resource Unit and the Ministry of Agriculture are expected to play key roles in controlling these flows of genetic resources.

Jordan's program for producing and certifying cereal seeds is going well; however, help is needed for variety release, as much effort is going into breeding new varieties from landraces or introduced germplasm.

Existing regulations governing the import and export of seeds and agricultural produce include those on: control of seed production (1987); conditions for variety registration (1990); conditions for seed trade (1990); seed trade of agricultural

crops (1990); licensing seed companies (1990); licensing agricultural companies for seed import (1990); variety registration of agricultural crops (1993); seed production and trade of cereals, forages, vegetables and fruit trees (1996).

Under the agricultural law, seeds and plants imported for multiplication are exempt from taxes. For example, the private sector is allowed to import inbred lines, tax free, to encourage seed production locally. In 2000, the government enacted Law 24 for the protection of new plant varieties, which takes into account WTO and UPOV agreements and conventions. This law describes the requirements for protection of "new plant varieties" and covers other related legal issues, such as right of priority, provisional protection, publication, licensing and ownership, cancellation of registration, general rules and variety denomination. The four essential conditions for obtaining rights to a variety under this law are distinctness, uniformity, stability and novelty. No reference was made to PPB varieties in Law 24. The Ministry of Agriculture was responsible for preparing related regulations and directions and implementing them in the second half of 2002.

Jordan attended the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil, in 1992, and was part of the discussion surrounding Agenda 21. On 5 June 1992, Jordan signed the agreement on Biodiversity and Climate Change, and, on 9 November 1993, a royal decree was issued to approve implementation of this agreement. This helped Jordan move forward on many aspects of the management of biodiversity, including plant genetic resources; for example, the government formed a national committee for the conservation of biological biodiversity that included representatives from the Ministry of Agriculture, the Ministry of Planning, the Ministry of Tourism and Antiquities, the universities, the Royal Society for the Conservation of Nature, the Society for Protection of the Environment and the Department of Environment.

Researchers and policy analysts realize that one of the major causes of agrobiodiversity degradation is inappropriate legislation and policies. Alternative options are needed in several areas. For example, domestication of international agreements and conventions and harmonization of regional policies and legislation affecting the conservation of agrobiodiversity would ensure a coherent regional approach to addressing some of the legal issues surrounding biodiversity conservation. The initiative of the African Union in developing Model Legislation on the Protection of the Rights of Local Communities, Farmers and Breeders and for the Regulation of Access to Biological Resources could serve as a model. Discussion of this idea continues.

Agriculture Law 44 (2002) and its guidelines cover variety registration, seed production, seed processing, seed marketing, seed quality control and seed trade (import–export). Multiplication, production, processing and marketing of the seeds of any cultivar are prohibited unless the cultivar is registered as described by the law.

Neither Law 24 nor Law 44 takes into consideration the vital role of farmers; they provide protection only to crop varieties developed through conventional methods. A model law is needed that includes the concept of farmers' rights, although developing such a law will require considerable time and effort. Similar

models have been developed by many African nations and India to focus attention on the conservation and sustainable use of biodiversity, food security, protection of community rights (including farmers and breeders), equitable sharing of benefits consistent with the provisions of CBD and the concept of national sovereignty.

Plant breeding research

Jordan is endowed with a wealth of genetic resources, both cultivated crops (barley, wheat, lentils, chickpeas, figs, olives and capers) and wild relatives (particularly barley, wheat, lentils, chickpeas and pistachios). These genetic resources are available from the National Gene Bank (which holds approximately 5,000 accessions) and ICARDA's gene bank (with more than 132,000 accessions, representing over 20% of the world collection held in trust by the CGIAR centers), as well as in situ. Because of the harsh environment, conventional plant breeding has not produced varieties to replace the landraces of the main field crops, with the possible exception of wheat.

NCARE, the country's leading agricultural research agency, has had the task of managing breeding programs in cereal grains since the 1950s. The major output of this ongoing program was the release of six barley varieties, 12 wheat varieties, and one *Vicia* variety. In addition, three chickpea and three lentil varieties were the result of collaboration between NCARE and the University of Jordan in the 1980s. Unfortunately, no new varieties appeared subsequently until 2004, when NCARE submitted three barley varieties and two wheat varieties to the Varieties Release Committee, which is chaired, according to statute, by the director general of NCARE.

Jordan's introduction to PPB took place in 2000 when it engaged in an IDRC-supported ICARDA project entitled From Formal to Participatory Plant Breeding: Improving Barley Production in the Rainfed Areas of Jordan (2000–03). NCARE was a partner in this project and implemented activities in farmers' fields. This established a new direction for the national breeding program: from centralized to decentralized breeding work. The logic of a decentralized approached is illustrated in Figure 7.1. Conventional plant breeding is a cyclical process that takes place largely at one or more research stations with the breeder making all decisions. PPB is the same process, but it takes place mainly in farmers' fields and decisions are made jointly by farmers and breeders.

Introducing PPB in Jordan resulted in a dramatic change in the attitude and behavior of breeders. They came to acknowledge and appreciate the knowledge and skills of farmers (both women and men), and began to look for ways to build on their expertise. They also became aware that benefits include not only the final products of the breeding process (i.e. improved and released varieties), but also the sharing of knowledge and experience, which led to new insights, new experiences, new diversity and a step-wise improvement in farmers' crops and seeds. This was a major discovery and an important step in opening up the conventional approach and system.

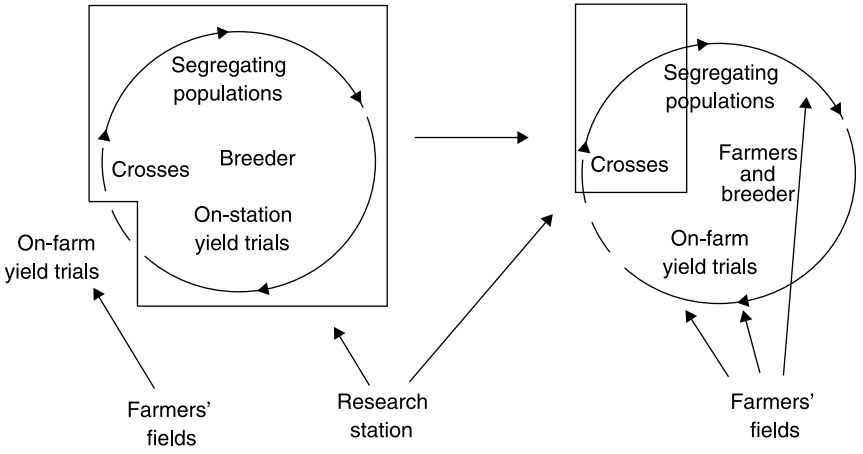

Figure 7.1 Comparison of conventional and participatory plant breeding
Source: Ceccarelli and Grando (2007)

NCARE's objectives in undertaking this project were to promote PPB in Jordan, to improve barley varieties, to enhance the rate of adoption of new varieties through farmer participation in selection and testing, to identify differences between selection criteria used by men and women farmers and by breeders, and to disseminate experimental results.

During the first three years, good results were obtained and the objectives were achieved to a large extent. However, little or no progress was made in terms of the policy and legal implications of these efforts, although the research team spent considerable energy creating awareness of the new breeding approach (among the research and policy communities) and how it could be adapted to and benefit the country. Farmers who took an active part in the research were happy with the results. When the initial project ended, they called on ICARDA and NCARE to continue with the PPB process and expand on it.

The farmers' voices were heard and respected. ICARDA took the lead in developing and implementing a follow-up project entitled Institutionalizing Participatory Plant Breeding within National Plant Breeding Systems: Costs and Benefits of Seed Production (2004–07), also funded by IDRC. It was during implementation of this second initiative that questions of ABS became more central. The team not only continued to improve and expand PPB work in the field, but also aimed to achieve better understanding of the constraints on PPB related to variety release, certified seed production and intellectual property rights. For the first time, the team acknowledged the importance of farmers' rights. Farmers themselves also began to realize that there are important policy and legal issues related to PPB, although they are not always and immediately visible to them.

In 2005, the voices of farmers were heard again when they called on ICARDA and NCARE to implement PPB for other important crops, especially wheat and chickpeas. This new PPB work started in 2005–06, at a time when PPB practices

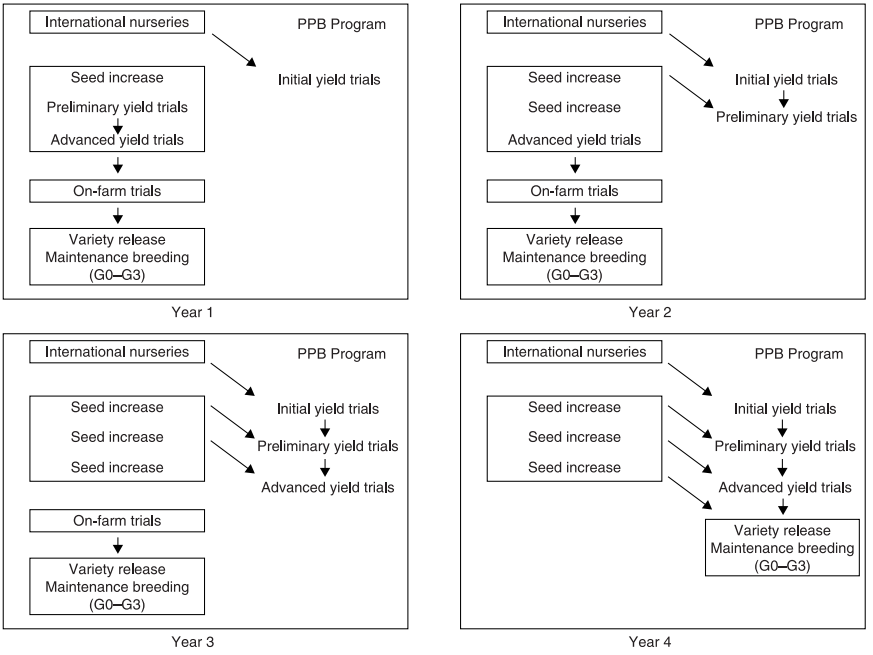

Figure 7.2 Transformation of NCARE's conventional plant breeding system into a PPB system

Source: Al-Yassin (2005)

were being integrated into university curricula with input from seed specialists. The aim was not only to broaden the scientific base for PPB, but also to build up strong evidence for policymakers that the science was backed by practice, which would lead to better adoption and adaptation. ICARDA and NCARE appealed to the inter-country Consultative Group for Participatory Plant Breeding for support to influence the policy agenda further. In May 2005, ICARDA held an important meeting with the consultative group, in which NCARE expressed its intention to modify the entire breeding program for all cereal grain crops and use a PPB approach, marking the beginning of the institutionalization process. The step-wise procedure it proposed is shown in Figure 7.2.

PPB methods

The PPB model consists of several stages (Figure 7.3). Farmer initial trials (FITs) were conducted to measure yields of early segregated populations. These were unreplicated trials on 200 plots of 12 m^2 encompassing 170 varieties plus controls (one or two controls repeated 30 times). Breeding material selected from the FITs was tested the second year in farmer advanced trials (FATs), with the number of varieties and controls varying from village to village. For the FATs, plot size was 45 m^2 to produce sufficient quantities of the selected seeds to be planted on larger

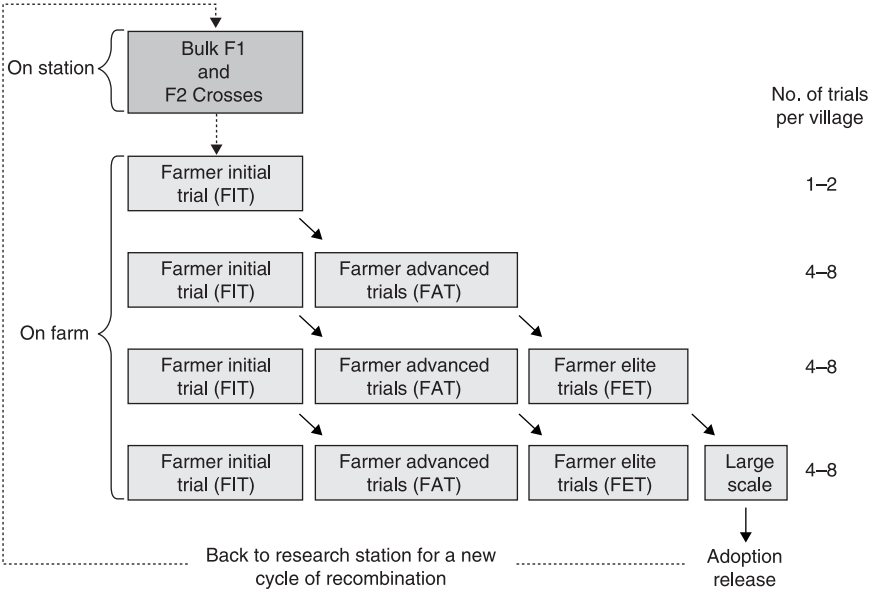

Figure 7.3 Model of the PPB system organized with farmers in Jordan
Source: ICARDA (2007)

plots in the third stage. The number of FATs in each village depended on how many farmers were willing to engage in this type of trial. In a given village, the FATs evaluated the same varieties, regardless of the number of farmers. Each farmer decided on the rotation, seeding rate, soil type, the amount of fertilizer used and the timing of application. Thus, the FATs took place under a variety of field conditions and management systems. During selection, farmers exchanged information about agronomic management, and relied greatly on this information in deciding which varieties to select. Thus, favouring characteristics of the crops in terms of their response to environmental or agronomic factors started at an early stage of the selection process.

The model in Figure 7.4 shows how formal and informal seed systems are integrated in the PPB process. During selection and testing, i.e. the FITs, FATs and farmer elite trials (FETs), which represent a gradual scaling-out sequence, the required amount of seed of each variety usually varies from 50 to 100 kg. Likewise, the number of varieties planted in each village ranges from 15 to 30. In the conventional seed system, varieties are produced, cleaned and treated on station. Now, the objective is to have these processes take place in villages using locally manufactured seed cleaners. These cleaners should include a device to treat the seed to make it disease resistant and they must be able to process about 400 kg of seed an hour. The community-based seed multiplication system is a model for informal seed dissemination and also represents a concrete way to improve local access to clean seeds and generate benefits for local people.

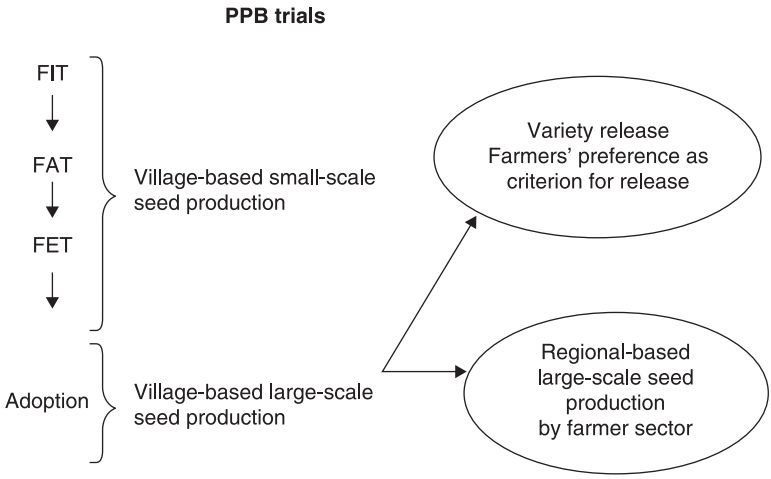

Figure 7.4 Linking PPB and variety release with informal and formal seed production
Source: Ceccarelli and Grando (2007)

During the PPB trials, both the national conventional breeding program and the PPB program were operating. No new varieties of wheat or chickpeas have reached the scale-out phase yet, because of frequent droughts. However, barley PPB varieties have now reached the farmers' multiplication phase. The key issues that have emerged are seed handling, legislation and benefit sharing.

In 2004, NCARE submitted three barley varieties and two wheat varieties, produced from the conventional breeding program, to the Varieties Release Committee. The released barley varieties are Athroh (six-row), Yarmouk (two-row, Esp/1808-4L//Harmal) and Muta'a (two-row, Roho/A.Abiad/6250); the wheat varieties are Ammon (BW, Tsi/vee's') and Um Qais (DW, Om rabi5). Unfortunately, only Um Qais has reached farmers' fields. The others are still at the multiplication stage, because of frequent crop failures resulting from drought.

However, about 30 barley PPB varieties were scaled out to six regions. These varieties are adapted to diverse conditions found in farmers' fields and are in demand as they respond to the interests and needs of larger farmers, seed growers, sheep owners, combine harvesters, farmers in low-input agriculture and women farmers doing handicrafts. Some of these varieties are shown in Table 7.1.

Policy and legal context for ABS in Jordan

The evolution of the PPB process led almost naturally to the realization by the research team that the breeding programs were not just a matter of technical expertise, but that important policy and legal issues also have an impact on PPB. The success of the barley program and the expansion to other crops created a need to address these issues, reinforced by growing international awareness and pressure to deal with them.

Table 7.1 Farmer-adopted PPB barley varieties with specific adaptation to diverse conditions found in farmers' fields

Region	*Nr*	*Name*
Ramtha E	1	Arar/Lignee527//Arar/PI386540
	2	Moroc9-75//WI2291/CI01387/3/H.spont.41-1/Tadmor
	3	ArabiAbiad/Arar//H.spont.41-5/Tadmor/3/H.spont.41-1/Tadmor
	4	Arar/H.spont.19-15//Hml/3/H.spont.41-1/Tadmor/4/WI2291/Tadmor
	5	Moroc9-75//WI2291/WI2269
	6	Roho/4/Zanbaka/3/ER/Apm//Lignee131/5/Akrash//WI2291/WI2269/3/WI2291/WI2269//WI2291/Bgs
Ramtha W	1	Alanda/3/CI08887/CI05761//Lignee640/4/Alanda/Lossaika
	2	Cerise/Lignee1479//Moroc9-75/PmB/3/JLB37-74/H.spont.41-5//JLB37-74/H.spont.41-5
	3	ArabiAbiad/Arar//H.spont.41-5/Tadmor
	4	ChiCm/An57//Albert/3/Alger/Ceres362-1-1/4/Arta
	5	Soufara-02/3/RM1508/Por//WI2269/4/Hml-02/ArabiAbiad//ER/Apm
	6	Roho/4/Zanbaka/3/ER/Apm//Lignee131/5/WI2291/Tadmor//Arta
Khanasri	1	Kv//Alger/Ceres.362-1-1/3/WI2269/4/Sara
	2	Moroc9-75//WI2291/CI01387/3/H.spont.41-1/Tadmor
	3	WI3159/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131
	4	Roho/4/Zanbaka/3/ER/Apm//Lignee131/5/Arta
	5	Arta//Moroc9-75/ArabiAswad/3/WI2291/Tadmor//Arta
	6	ArabiAbiad/Arar//H.spont.41-5/Tadmor
	7	ChiCm/An57//Albert/3/Alger/Ceres362-1-1/4/Arta
Ghweir	1	ChiCm/An57//Albert/3/Alger/Ceres362-1-1/4/Arta
	2	Zanbaka/5/Pyo/Cam//Avt/RM1508/3/Pon/4/Mona/Ben//Cam/6/Sara
	3	WI3167/4/Arta/3/Hml-02//Esp/1808-4L
	4	Arta//Moroc9-75/ArabiAswad/4/Akrash//WI2291/WI2269/3/WI2291/WI2269//WI2291/Bgs
	5	Sara/4/H.Spont.96-3/3/Roho//Alger/Ceres.362-1-1
Rabbah	1	Arta//Moroc9-75/ArabiAswad/6/WI2291/4/7028/2759/3/69-82//Ds/Apro/5/Zanbaka/3/ER/Apm//Lignee131
	2	WI3277/4/Arta/3/Hml-02//Esp/1808-4L
	3	WI3159/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131
	4	Sara/4/H.Spont.96-3/3/Roho//Alger/Ceres.362-1-1
	5	Zanbaka/5/Pyo/Cam//Avt/RM1508/3/Pon/4/Mona/Ben//Cam/6/Arta
Mohai	1	ChiCm/An57//Albert/3/Alger/Ceres.362-1-1/4/Arta
	2	Limon/Bichy2000/5/Roho/4/Zanbaka/3/ER/Apm//Lignee131

Source: Compiled by the author.

Thus, the team began to discuss policies and laws related to genetic resources with farmers. Many farmers chose to be represented by the farmers' union in fora where policies and laws related to benefit sharing are formulated. A growing interest in questions concerning traditional knowledge and benefit sharing emerged among farmers during meetings organized by the ABS team on 3 and 4 March 2009. They made this interest known to policymakers in several ways. First, they contributed to the gene bank database by evaluating almost 50% of Jordanian landraces of both wheat and barley, which they valued properly. Second, during the 8th Conference of the General Union of Arab Peasants and Agricultural Cooperatives in Amman on 22 March 2009, they claimed rights to their traditional knowledge and shared benefits from the use of germplasm.

The farmers were encouraged to push forward on the ABS issue when a farmer patented an extraordinary grapevine variety and gave it his name, Mansour 2000, but then did not benefit from its development. Taking notice of this, the farmers' union called on the government to pass a new bylaw for benefit sharing, in line with Article 9 of the ITPGRFA. This brief story illustrates that farmers are no longer just passive "recipients" of new technologies, policies and laws.

In due time, these efforts generated a response. Recently, NCARE developed a draft proposal on intellectual property rights and ABS issues. The proposal is still waiting to be approved and, if all goes well, implemented. Unfortunately, neither farmers nor their representatives contributed to it.

Variety release

In Jordan, variety release is usually the responsibility of the Varieties Release Committee, which is appointed by the Minister of Agriculture and chaired by NCARE's director general. This committee makes decisions based on scientific reports prepared by breeders. The reports cover performance, agronomic characteristics, reaction to pests and diseases and quality characteristics of the new variety. The members of the Varieties Release Committee represent the national research centers, the universities, the Jordan Cooperative Corporation (JCC), the extension service, NGOs and the private sector. All these stakeholders are involved in either the implementation of PPB or teaching PPB principles and methods. The National Research Center is the body responsible for submitting candidate varieties to the Varieties Release Committee (through its Field Crops Department).

Currently, the Varieties Release Committee guidelines do not allow for consideration of farmers' opinions; thus, there are several cases of varieties that were released but never grown by farmers and varieties grown by farmers that have not been released. When any new variety is not adopted, the considerable investment made in its development brings no benefit. It has been shown that the economic cost to farmers of releasing an inferior genotype is much less than the economic cost of not releasing a superior genotype.

In 2007, the Varieties Release Committee took steps toward accepting data from PPB trials as the basis for variety release. On 14 May 2009, the minister of

agriculture reinforced the committee's position by attending a national workshop and spending an entire day making field visits in the Maru area. This push has motivated the ABS project team (led by NCARE and ICARDA) to publish new guidelines for releasing PPB varieties in Jordan.

Jordan may benefit from a national law on farmers' rights, but so far it has not been feasible to define clear ABS principles, especially concerning seed multiplication and distribution. Farmers usually raise ABS issues at their meetings, such as recognizing the different levels of participation that affect ABS from developed varieties. However, the farmers have their own interpretation of benefit sharing. Some of them have multiplied seeds and taken the initiative of distributing half to other farmers in the PPB research area for free. Another farmer is selling his new variety to any farmer who asks for it and writes their names in a notebook to be able to track the seed diffusion process. Thus, more than one "model" for equitable benefit sharing of newly developed varieties is in the making in the informal seed multiplication system. How to translate this into adequate policy and legislation remains a challenge.

Seed multiplication: formal versus informal

The seed multiplication and dissemination system is the responsibility of the JCC. It deals only with the seeds of officially released varieties, starting with maintenance breeding (growing first-generation or breeder seeds) until sufficient quantities for large-scale commercialization have been produced. This work started in 1982 with 12 wheat varieties and three barley varieties. Soon, it was noticed that eight wheat varieties and one barley variety were not being used by farmers, and multiplication of those seeds was stopped. The production of chickpea and lentil seeds began in 1992, but was interrupted a few years later.

After harvest, seed lots are stored at JCC stations and official samples are retrieved and submitted to the Central Seed Testing Laboratory in NCARE for quality testing. Samples that meet national seed standards are cleaned, treated and stored for the next planting season. JCC storage facilities are located at seed processing centres (Table 7.2). Seed lots are sprayed with insecticides during storage to protect them from infestation by pests. About 25% of cleaned and treated seeds are stored as surplus to supplement shortages during drought years. The surplus seeds are renewed regularly to maintain their vigour.

Despite the fact that the JCC is responsible for providing "certified" seeds of released varieties, about half of the land devoted to these crops is planted with uncertified seeds purchased from farmers. As this informal seed system is active,

Table 7.2 Location and capacity of seed storage facilities

Location	*Crops*	*Capacity (t)*	*Annual supply (t)*	*Facilities*
Ramtha	Wheat, barley	6,000	2,000	Warehouse
Mushaqar	Wheat, barley	4,000	2,000	Warehouse, silo

the ABS team aims to empower farmers to produce certified seeds, for example, by providing them with seed cleaners. Helping them to market PPB improved seeds will be a completely new way of generating benefits for farmers.

Conclusions

Key ABS issues emerged during the introduction, testing and upscaling of PPB. Although Jordan has adopted a comprehensive framework of agricultural policies and laws, ABS issues, especially in relation to PPB, have not yet been dealt with in a clear, concise, practical manner. The ABS team has made a start by identifying key issues in relation to the various elements of PPB, but the general lack of knowledge among researchers, policymakers and farmers has been a challenge.

Farmers speak out when they have the chance, and giving them such opportunities, through meetings, workshops and conferences, has pushed the PPB agenda forward. But farmers do not yet have any formal representation in important policy and legal fora. "Farmers' rights" is now a concept being discussed in the country, but whether it can be captured in legislation remains to be seen. Through trial and error, PPB research has created new ways to obtain access to genetic resources as well as new forms of benefit sharing, but, as yet, no clear guidelines exist for formal recognition in policies and laws. Farmers are trying out various ways to share benefits, some following more conventional practice, others more open to novel practice. The ABS team is working with these farmers, to document their practices and analyze the pros and cons of the various models for benefit sharing.

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