Table 4. Farmers' Perceptions of Traits of Popular Modern Varieties

Variety	Positive traits	Negative traits
Swarna (late duration)	• high yield (4–5 t/ha), which is 1.5 tons higher than Safri • responsive to fertilizer • high number of medium-slender, fertile spikelets (150–200) • dark green color helps in distinguishing wild rice • can withstand drought • heavy tillering (8–10 tillers) • semi-dwarf (93 cm) and resistant to lodging • suitable to heavy-textured soils and retains moisture • requires low inputs • commands high price in the market • preferred for *basi* (leftover rice from dinner that is dipped in water and eaten the following day for breakfast or lunch) • good eating quality—remains soft after cooking for a long time compared to the other varieties • high milling recovery	• susceptible to diseases (bacterial blight, gall midge) • susceptible to brown plant hopper • poor weed competition due to its short stature, which requires early weeding • duration too long when *rabi* crops need to be grown • requires more water to mature • low yields of straw • less yield than Mahamaya • not photosensitive
Mahamaya (medium duration)	• higher yield potential • resistant to diseases (gall midge) and pests (brown plant hopper) • dark green color helps distinguish wild rice • purple leaf sheath and purple auricle help identify wild rice • early to medium duration—can harvest sooner and grow *rabi* crops • commands high market price • has bold, heavy grains • good quantity and quality of straw • more fertile spikelets • resistant to lodging—intermediate height • responsive to fertilizer • preferred by millers and traders for beaten rice (unbroken *poja*) and for puffed rice (*murmura*) because it expands easily • preferred by poor farmers and agricultural laborers because it remains soft after cooking and makes them feel full even when consumed in small quantity	• susceptible to stemborer • susceptible to sheath blight • not good eating quality • poor milling recovery—has more broken grains after milling

Mahamaya was only released in 1997. Both Swarna and Mahamaya were released for irrigated rice ecosystems, but because of their perceived ability to tolerate drought and their high market demand by traders, these two varieties have become very popular. Millers and traders prefer Mahamaya for making beaten rice and puffed rice. Poor farmers and agricultural laborers who are paid in terms of

rice prefer Mahamaya because they feel that it satisfies their hunger. Mahamaya has bold, coarse grains that they believe last longer in the stomach. Farmers also prefer Swarna for *basi* (leftover rice from dinner, dipped in water with a little salt and eaten the following day for breakfast or lunch).

Male and female farmers' criteria in selecting rice varieties

Despite the active involvement of women in rice production, post-harvest, and seed-management activities, scientists, who are mostly men, often talk with male farmers only. Ignoring women's knowledge and preferences for rice varieties may be an obstacle to adoption of improved varieties, particularly in areas with gender-specific tasks and in farm activities where women have considerable influence. For example, a released variety such as Pant-4 is high yielding but is rejected by women farmers because it is difficult to thresh by hand. In contrast, traditional varieties that are low yielders are still grown because of their desirable taste and their eating and cooking qualities that make them well-suited for rice products that women prepare. Knowing men's and women's criteria in rice varietal selection and access to and control of new seeds, information, etc., will lead to more efficient dissemination of improved rice varieties for rainfed conditions and their subsequent adoption. Thus, in 1998, a team of scientists from the Directorate of Extension, IGAU, conducted focused research in the same villages. Our objective was to test and develop a methodology for eliciting male and female farmers' criteria and to determine whether there are gender differences in these criteria in rice varietal choice.

The majority of the women farmers are illiterate and are less exposed to household surveys; therefore, we used a simple participatory method of eliciting their perceptions regarding the useful traits they consider when selecting rice varieties. Men and women were separately involved in this activity. This method, which is like a game of cards (see methodology section), gave the farmers more time to think as well as to enjoy the process. Tables 5 to 7 show the important traits that male and female farmers consider when selecting rice varieties according to land elevation and size of landholding. The results show that grain yield was the most important criterion for both men and women farmers in selecting rice varieties for all land types and sizes of landholding. Both men and women gave more value to eating quality (taste) and duration/maturity for rice varieties grown on upland fields. However, women were more concerned with market price, drought tolerance, pest and insect resistance, and competitiveness to weeds. On the other hand, men gave more importance to grain size and shape than women did. For midland conditions, women gave higher values to eating quality and market price, while men gave more importance to duration and maturity. For lowlands, eating quality and market price were considerations for both men and women. Women consistently gave higher values to the multiple use of straw for varieties grown in all land types.

We also assessed whether there were differences in criteria between men and women from marginal and large farms. Table 6 shows that there is not much difference between the criteria across size of landholding. Both men and women with large farms gave the highest value to grain yield. Aside from grain yield, both men and women from the same economic category gave more importance to eating quality and market price. Duration/maturity was more important to male farmers from large farms than to women of the same category, similar to marginal farmers. Women from both large and small farms gave a higher value to the multiple use of straw than men did.

In summary, the most important traits that both men and women value in selecting rice varieties are grain yield, eating quality (taste), market price, duration/maturity, drought tolerance, and resistance to pests and diseases. Women placed higher weights on multiple uses of straw across all land types and for both large and small landholdings. Men did not consider this as important, obviously

Table 5. Men's and Women's Perceptions of Useful Traits of Rice Varieties by Land Elevation, Raipur, Madhya Pradesh

Traits	Uplands		Midlands		Lowlands	
	Men	Women	Men	Women	Men	Women
Grain yield	19	19	27	25	30	27
Eating quality (taste)	16	11	6	17	11	19
Market price	3	10	8	13	9	13
Duration/maturity	13	10	13	6	7	3
Drought tolerance	6	11	5	3	3	1
Pest/insect resistance	6	10	8	6	6	4
Multiple use of straw	0	8	5	11	6	11
Grain size and shape	16	0	2	2	4	3
Milling recovery	9	0	2	2	4	4
Lodging resistance	3	0	3	4	2	3
Fertilizer responsiveness	6	3	5	3	4	2
Weed competitiveness	7	7	3	1	2	2
Submergence tolerance	5	5	1	2	2	2
Good for rice products	0	0	2	2	1	0.5
Disease resistance	0	0	3	<0.5	3	0.5
Adaptation to soils	3	0.5	2	1	2	1
Adaptation to land level	0	0.5	2	1	0.5	1
Storage quality	0	2	1	<0.5	2	1
Fullness in stomach	0		1	<0.5	1	1
Cooking time	0	3	1	1	0.5	
	100	100	100	100	100	100

Note: Values have been rounded off. Values were computed by weighted-ranking method.

because women are more responsible than men in caring for the livestock. Rice straw is used as feed for the livestock and also mixed with cowdung to make a cake for household fuel. Thus, women consider both grain yield and rice biomass in selecting rice varieties according to their specific environments. A rice variety that has high grain yields but low quantity and quality of rice straw has a lower chance of adoption by women farmers. Men gave more importance to grain size and shape for varieties grown on the uplands. Men owning small farms considered adaptation of the variety to specific soil conditions as being extremely important (second to yield) but were the only group to rank this highly. This may be because poorer farmers cultivate more marginal land (explaining the need for adaptation of the variety to soil type). Women did not rank this characteristic highly, probably because of their role in production (men tend to choose the varieties and clear the land).

Logically, drought tolerance was more important for upland and midland areas than for lowland areas. Women weighted this more highly than men.

While the participatory ranking method was useful in assessing the trade-offs between traits valued by farmers, this method could be improved by including traits mentioned in the open-ended

Table 6. Perceptions of Useful Traits of Rice Varieties, by Size of Landholding and Gender, Raipur, Madhya Pradesh

Traits	Large farmers		Marginal farmers	
	Men	Women	Men	Women
Grain yield	36	34	19	21
Eating quality (taste)	13	12	9	18
Market price	8	12	6	13
Duration/maturity	10	3	7	8
Multiple use of straw	4	7	3	10
Drought tolerance	4	8	4	4
Pest/insect resistance	7	5	6	7
Grain size and shape	8	<0.5	5	2
Milling recovery	1	2	9	6
Lodging resistance	3	2	4	2
Fertilizer responsiveness	3	2	7	3
Weed competitiveness	1	2	2	1
Submergence tolerance	1	5	1	1
Good for rice products	1	<0.5	1	1
Disease resistance		1	2	<0.5
Adaptation to soils		1	12	<0.5
Adaptation to land level		1	1	<0.5
Storage quality		1	1	1
Fullness in stomach		0	1	<0.5
Cooking time		2	1	2
		100	100	100

questionnaires. The cards shown by the researcher limited the choice of desired traits—other traits based on specific cultural practices, such as a preference for purple-colored rice varieties or for varieties suited to the *beushening* method of land preparation, were not mentioned at all. Moreover, other social considerations, such as a preference for late and medium varieties to coincide with a religious festival such as *Diwali* were not captured. Farmers usually harvest rice only after the *Diwali* festival. During this festival, families give special rice as gifts to relatives.

Participatory varietal selection

Although scientists accept that farmers are careful managers and possess a wealth of knowledge about their production systems, this knowledge is not sufficiently used in the formal breeding process (Kshirsager et al. 1998) Several strategies were used to involve farmers in PVS. Farmers volunteered to grow 16 early- to medium-duration group varieties and late-duration varieties on their own fields for three consecutive years. The early/medium-duration group varieties were tested at Tarpongi village on two farmers' fields that have light soils. The late-duration varieties were tested on two farmers' fields at Saguni village under heavy soils. The new varieties had some of the preferred criteria mentioned by farmers obtained in the interview and participatory-ranking activities. Farmers and breeders ranked the rice lines on the station and on farmers' fields in the research sites.

Table 7. Comparison between Ranks Attributed by Farmers and Breeders at Different Growth Stages in the PVS Trials, Raipur Villages, Eastern India, and IGAU Station, 1997–99

Trial location	Year	Trial code[2]	Stage[1]	No var.	No F.	No B.	Agreement among farmers	Agreement among breeders	Correlation between farmers' & breeders' rankings
							W	W	r
Station	97	1	F	16	8	1	0.34**	–	–0.20
	97	1	M	16	8	1	0.51**	–	0.11
Tarpongi	97	1	F	16	5	–	0.51**	–	–
	97	1	M	16	4	2	0.55**	0.47	013
	97	2	F	16	5	–	0.50**	–	–
	97	2	M	16	7	2	0.34**	0.53	–0.03
Saguni	97	1	F	16	7	–	0.30**	–	–
	97	1	M	16	6	2	0.44**	0.30	–0.18
	97	2	F	16	5	–	0.79**	–	–
	97	2	M	16	5	2	0.54**	0.56	–0.06
Station	98	1(M)	F	16	8	2	0.32**	0.77	0.16
	98	1(M)	M	16	6	2	0.26	0.60	0.50*
	98	2 (L)	F	16	8	2	0.31**	0.54	–0.04
	98	2 (L)	M	16	6	2	0.67**	0.70	0.28
Tarpongi	98	1(M)	F	16	5	1	0.55**	–	0.46
	98	1(M)	M	16	4	1	0.30***	–	0.20
	98	1(M)	CROP FAILURE						
Saguni	98	2 (L)	F	16	4	1	0.56**	–	0.07
	98	2 (L)	M	16	4	1	0.59**	–	0.02
Khairkhutt	98	2 (L)	F	16	6	1	0.38**	–	0.51*
	98	2 (L)	M	16	4	1	0.44*	–	–0.01
Station	99	1 M)	M	16	7	3	0.49**	0.91**	0.33
Station	99	2 M)	M	16	7	3	0.65**	0.89**	0.62*
Tarpongi 1	99	1 M)	M	16	6	3	0.65**	0.94**	0.61*
Tarpongi 2	99	2 M)	M	16	5	3	0.62**	0.84**	0.46
Station	99	1 (L)	M	16	7	3	0.53**	0.81**	0.15
Station	99	2 (L)	M	16	7	3	0.34**	0.76**	0.11
Saguni 1	99	1 (L)	M	16	7	3	0.50**	0.93**	0.66**
Saguni 2	99	2 (L)	M	16	6	3	0.66**	0.91**	0.64**
Station	99	1	V	20	5	3	0.98**	0.94**	0.90**
Station	99	1	F	20	5	3	0.98**	0.98**	0.91**
Station	99	1	M	20	5	3	0.96**	0.97**	0.89**
Khairkhut	99	2	V	20	5	3	0.98**	0.95**	0.87**
Khairkhut	99	2	F	20	5	3	0.94**	0.99**	0.92**
Khairkhut	99	2	M	20	5	3	0.90**	0.97**	0.41**

Note: – = not tested. W = Kendall's coefficient of concordance. r = Spearman's coefficient of correlation. F = farmers. B = breeders.

1. Stage: V = vegetative stage, F = flowering, M = maturity.
2. Trial code: L = late, M = medium.

Farmers' rankings were compared with breeders' rankings during different stages of crop growth (vegetative, flowering, and maturity) as shown in table 7.

Correlation between breeders and farmers at all sites and in all the years was consistently low. Very few of the trials showed significant or highly significant agreement between farmers and breeders (trials that showed any significant agreement were mainly in 1999). In general, agreement was insignificant or even negative (although not strongly so). It was impossible to make an assessment of agreement between farmers and breeders in 1997 and 1998. However, in 1999, although there was high agreement in varietal ranking among farmers and among breeders, there was generally low agreement between farmers and breeders, which may indicate that farmers and breeders consider different criteria. Farmers' rankings are not correlated with yield, indicating that farmers consider other criteria in their rankings.

Assessment of late-duration varieties included in PVS in Saguni, Raipur

The breeders' top five favorite late-duration varieties in the 1999 trials included Swarna, BKP-232, R650-1817, R304-34, and R738-1-64-2-2 (all modern varieties). These varieties also ranked in the top five in yield. The farmers' top five favorite varieties included Swarna, Safri-17, R738-1-64-2-2, Mahsuri, and R650-1817. These were not always the highest yielding varieties—in fact, Mashuri gave one of the lowest yields and Safri-17 (a traditional variety) was somewhere in the middle. These varieties were likely selected for other reasons than yield. Varieties preferred by both groups (ranking on average in the top 5) included Swarna (first choice of both farmers and breeders, and also high yielding), R650-1817, and R738-1-64-2-2. These are all modern varieties, and are also the three varieties that had the highest yields in the trials (table 8).

Table 8. Assessment of Late-Maturing Varieties Included in PVS, Saguni, Raipur, Madhya Pradesh, Eastern India

Variety	Ranking
Swarna (check)	Favorite of both farmers and breeders Consistently ranked highly in the top 5 by both groups in the field sites and on-station
Safri-17 (check)	Always ranked in the top 5 by farmers, but not so well ranked by breeders
R738—64	**This is ranked in the top 5 by farmers and breeders in the farmers' fields, but less well ranked in on-station trials.**
R304-34	**Ranked first by breeders, but not liked by farmers, even though yield is quite good (5 t/ha)** **Ranked low by both groups in field sites** **Bold grains, not susceptible to disease, commands high market price**
Mahsuri	On-station, ranked within top 5 by farmers, on station and in one farm site, although yield is consistently low Ranked consistently low by breeders
IR54896	On-station, ranked highly by breeders Yield is good, but farmers don't like it (one of their least favorites) Ranked low by all in farm trials

Assessment of medium-duration varieties in Tarpongi, Raipur, Madhya Pradesh

In Tarpongi, the top ranking medium-duration varieties for breeders were R574-11, IR42342, Chepti gurmatia, BG380-2, R703-1-52-1, and OR1158-261. All of these were also the top six

yielding varieties. All are modern varieties except for Chepti gurmatia. For farmers, the top ranking varieties included BG380-2, OR1158-261, R714-2-9-3-3, IR63429, and R574-11. These are all modern varieties, but not always top yielding. R714-2-9-3-3 gave medium yields, while IR63429 gave relatively low yields when compared with the other varieties. Farmers and breeders agreed only on R574-11, BG380-2, and OR1158-261 as their favorite varieties (table 9).

Table 9. Assessment of Medium-Duration Varieties Included in PVS, Raipur, Madhya Pradesh

Variety	Ranking
R714-2-9-3-3	Ranked highly by farmers on farmers' fields and in 2nd on-station replication, and is among the farmers' favorites Consistently marked low by breeders
R574-11	**Top ranked by farmers and by breeders in station trials. Also, highest yield** **On-farm, is still in top 1-2 for breeders but drops to 8-10th rank for farmers** **Yield on farm is less (4th and 6th rank)**
OR1158-26	Ranked about 5-6 (on average) in all sites except in one field, where it was #1 among farmers Yield ranges from 3-8 t/ha Among the top varieties for farmers and breeders
IR63429	**Ranked well by farmers in all sites but consistently ranked low by breeders** **Lower-yielding variety compared to others, but farmers seem to like it in any case** **Early, long grain, intermediate height**
IR42324	Consistently highly ranked by breeders, but given low rank by farmers in all sites except station replication #1 Consistently high yield, but even with highest yield on farm, farmers don't like it
Chepti gurmatia (local check)	Consistently ranked well by breeders, also one of the top 5 yielding varieties However, it ranks in the middle with farmers
BG380-2	**Ranked highly by breeders and farmers in field and on-station** **Generally has good yield**

During the *kharif* season 2000, the medium-duration varieties that were further evaluated on-station and on farmers' fields were IR4234 (breeders' choice), R574-11 (farmers' choice), BG380-2 (common choice), and Chepti gurmatia (best local choice). The late-duration varieties were BKP-232 (farmers' choice), R304-34 (breeder's choice), R650-1817 (common choice), and Swarna (local check).

The challenge facing plant breeders in IGAU and IRRI is to develop new cultivars that are better than Swarna and Mahamaya, while also meeting the other requirements and criteria that farmers have for their given rice environments. While it is impossible to combine all the requirements in one single variety, giving farmers (both men and women) an opportunity to test the performance of different rice genotypes on their own fields and to evaluate their cooking and eating qualities can lead to more efficient rice varietal improvement in the Chhattisgarh region in Madhya Pradesh.

Conclusions

This paper focused on methodologies for improving our understanding of the criteria used by farmers (both men and women) in selecting specific rice varieties and of how these criteria are considered in participatory breeding strategies in the rainfed lowland environments of the Chhatisgarh region in Madhya Pradesh, eastern India. Different methods for understanding farmers' criteria in

selecting rice varieties were used. These methods were (1) a questionnaire with open-ended questions eliciting positive and negative attributes of the most popular modern and traditional varieties, (2) a participatory weighted-ranking method, disaggregating the perceptions of men and women by land types and size of landholdings, and (3) participatory varietal selection, where farmers evaluated several prereleased and local varieties on their fields as well as on-station. The results of the study highlight the importance farmers attach to characteristics other than grain yield: eating quality (taste), market price, duration/maturity, drought tolerance, and pest and insect resistance.

Both men and women have similar criteria in choosing rice varieties. However, straw quality for multiple uses is an important consideration for women farmers but not for men. Farmers, particularly women who do most of the weeding, prefer rice varieties that are inherently dark green or purple to distinguish them from wild rice and enable the farmer to eradicate the wild rice at an early stage of crop growth. Wild rice is a prevalent pest and a constraint to high rice productivity in the Chhattisgarh region. The attributes considered by men and women farmers, however, are not generally used as screening criteria in most formal breeding programs, where the emphasis is mainly on grain yield. Quality attributes should be emphasized more than they have been in the past in breeding programs for rainfed areas. Because of the proximity of the villages to the market, farmers prefer to grow varieties that not only meet their own consumption needs but also those of consumers, including millers and traders. Therefore, farmers maintain their rice diversity and grow both traditional and modern varieties that meet their varied interests and needs. Using approaches like farmer participatory breeding and varietal selection from many rice lines provides an opportunity to farmers to choose varieties suitable to their environment and needs as well as access to new seeds.

Breeding lines R574-11, BG308-2, and IR42342 performed well over the three years of the project in the medium-duration group and showed tolerance to drought. Breeding lines R304-34 and IET-14444 (R738-1-64) also proved promising. A large quantity of seeds have been multiplied by one of the farmers of Saguni village where blight is a problem.

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Seed Security in Badakshan, Afghanistan

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Abstract

Badakshan is located in the extreme northeastern corner of Afghanistan and has not yet come under Taliban control. The province is virtually cut off from the rest of the country and is traditionally food deficient. The 20-year-old conflict in the region has further aggravated the situation, causing massive population displacement and almost complete destruction of civil institutions and infrastructure. The situation has become so serious that food aid has to be distributed in the period of grain deficit, starting from before the harvest. Simultaneously, efforts are being made to rehabilitate and improve the agricultural systems of these farming communities.

In all formal and informal surveys in the area over the last three years, the farmers have identified good seed of wheat cultivars and fertilizer as being their main priority. Currently the seed of high-yielding cultivars acquired from the Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT) are available, but such varieties do not always perform well under farmer's conditions. The potential of these varieties can not be realized without the use of fertilizers. Almost all the available animal dung is used to as fuel and little is available for use as manure. The small amounts of chemical fertilizer available are totally inadequate in quantity and exorbitant in price. In response to these needs, improved varieties of wheat, potatoes, and vegetables are being provided to over 100 villages in five isolated districts bordering Tajikistan. Three to eight farmers in each village are testing the new planting materials under their local conditions. These farmer-led, on-farm evaluations are also serving as demonstration plots for the remainder of the farmers in the village. The farmers will compare the performance of the varieties provided with their existing varieties. Cultivation of the better of the two will be encouraged through farmer-to-farmer exchanges and credit through village organizations for the inputs. This procedure will be repeated every growing season whenever new potential materials, including varieties, landraces, and different crop species are available. A secondary goal is to enhance on-farm genetic diversity among and within different crop species. These activities will be gradually transformed into participatory breeding, allowing the community to gain full control over the type and amount of varieties being produced and exchanged with their neighbors. Participation in the management and decision making for seed security by the farming community will contribute to reestablishing local food security and peace in the area.

Introduction

Focus Humanitarian Assistance (FOCUS) is an international group of agencies established in Europe, North America, and South Asia to complement the provision of emergency relief, principally in the developing world. It helps people in need reduce their dependency on humanitarian aid and facilitates their transition to sustainable, self-reliant, long-term development. FOCUS is affiliated with the Aga Khan Development Network, a group of institutions working to improve opportunities and living conditions for people of all faiths and origins in specific regions of the developing world. Underlying the establishment of FOCUS by the Ismaili Muslim community is a history of successful initiatives to assist people struck by natural and man-made disasters in South and Central Asia, and Africa.

Assisting farmers in disaster situations to restore agricultural systems was identified as a priority in the Global Plan of Action for the Conservation and Sustainable Utilisation of Plant Genetic Resources for Food and Agriculture. The plan was adopted by over 150 countries at the International Technical Conference on Plant Genetic Resources (Leipzig, Germany, June 1996). The conference

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recognized that disasters, civil strife, and war pose challenges to agricultural systems. Often, adapted crop varieties are lost and cannot be recuperated locally. Food aid, combined with the importation of often poorly adapted seed varieties, can undermine food security and increase the costs of donor assistance. In such situations, the goal is to deliver seed of adapted varieties and landraces as needed to help reestablish indigenous agricultural systems in areas affected by disaster. In turn, this can play a major role in restoring local food security.

Afghanistan

Afghanistan is one of the poorest countries in the world. This millenium, the country passed the mark of 21 years of conflict, which has brought complete destruction and immense suffering to its people. After the fall of the Soviet-backed government in 1992, the prospects for peace have receded, with continuing civil war fragmenting the country into struggles between the various political and military groups in shifting alliances. Currently, more than 80% of the country is under the Taliban, while the remainder is under a united front. However, the Taliban movement is not yet recognized by the international community, except for Pakistan, Saudi Arabia, and the United Arab Emirates.

The nation's agricultural system has suffered from physical damage to irrigation structures, from mines, and from the disruption of normal markets and input-delivery mechanisms. Security concerns, high transport prices, and continual currency depreciation all combine to cause shortages of agricultural inputs such as seeds, fertilizers, chemicals, credit, and labor, resulting in increased food scarcity. The civil unrest has caused the country to move from near self-sufficiency in the mid-1970s to a dependency on imports in recent years.

Badakhshan

Badakshan, one of the most remote areas in Afghanistan, is located in the northeastern corner bordering Kunar, Lagham, Kapisa, and Thakar provinces. In addition, the province borders Pakistan in the southeast, China in the east, and Tajikistan in the north. It is one of the two major areas not under the control of the Taliban. The Panj River (Amu Darya) separates its long border with Tajikistan. The province is normally linked with the rest of country a by narrow, drivable road through the province of Takhar on the West. Currently, after Takhar the road intercepts the frontline with the Taliban. The province is thus virtually cut off from the rest of the country. On the eastern side, the road is linked with the Gorno-Badakshan province of Tajikistan through a narrow bridge over the Panj River at Ishkashem.

Badakshan lies in the Hindu Kush mountain range with the Wakhan rising up into the Pamir Mountains. The Hindu Kush mountain system is characterized by young, rugged ranges with sharp peaks and deep valleys. The eastern half of the province lies between 1,300 meters (Darwaz) to 3,000 meters (Wakhan). The western half is at a lower elevation, with Keshem, the lowest point, at 960 meters. Inside the province, most of the districts are isolated from each other for a greater part of the year by heavy snowfall in the winter, landslides in spring, and floods in the summer. Because of the rugged mountain terrain, much of the land area is uninhabitable. Connecting dirt roads are either very rough or do not exist. Donkeys, horses, and walking constitute the major means of transport. It is common for villagers to walk three to four days to the nearest market. There is virtually no effective government operating in the province at the current time. The villages and larger towns in

the province have no electricity, no running water, no sanitation facilities, few medical facilities, and poor schools.

Badakshan province has historically been isolated and neglected. It has always been considered a poor province; even before the war, local agricultural production met only 50% of the needs. The few development initiatives ever started were abandoned after the communist takeover and the subsequent fight between the Taliban and the Northern Alliance. It is estimated that agricultural production is down by at least 40% as a result of the war (UNIDATA 1966).

Agriculture

The province has a highly diversified cropping system. Crop production, horticulture, and livestock are the main sources of income for most households. It is difficult to obtain reliable statistics on agricultural production. Figures on land holdings provided by farmers during interviews tend to be grossly underestimated for fear of government taxation and to qualify for humanitarian assistance. The majority of households own less than one hectare, and further fragmentation of land holdings occurs because of the traditional inheritance laws. Smaller farmers usually sharecrop the land owned by farmers with relatively larger holdings (more than two hectares). Many districts do not produce enough food, for example, surveys have shown that food deficits in Sheghnan, Ishkashem, and Wakhan range from two to six months.

Autumn and spring wheat is the main grain crop. Other crops include pulses (broad beans, vetches, field peas, grass peas) often grown as a companion crop with spring barley. Finger millet and chick-peas are also planted in spring. Small quantities of oil-seed crops such as sesame and flax are occasionally grown for oil, but the wild mustard that grows as a weed in the wheat fields is harvested by women and children for oil and cooking. Maize is grown at lower elevations (below 1600 m) from Darwaz through Shekay as a second crop after wheat. Cotton is also grown in small quantities in some villages from Darwaz downstream, where it is used for stuffing quilts and pillows, and the oil extracted from the seed is used for lamps.

Vegetables include spinach, onions, beans, occasionally tomatoes, carrots, squash, and a variety of herbs. Several kinds of potatoes of varying lengths of maturity are grown. These vegetables provide a supplementary diet during the hungry months of spring and early summer before the harvest. Fruit trees, particularly mulberries, are important. Other common trees include fruit trees such as walnut, apricot, plum, sour cherry, apple, and grape, and timber trees such as poplar, willow, and walnut. Several wild plants play an important role and include wild mustard, wild rhubarb, wild orchid tuber, black cumin, licorice, and mushrooms, in addition to the wild herbs of medicinal value. Opium poppy is not cultivated on a commercial basis, although small patches may be planted by addicts for their own use.

Livestock are a main source of the household economy in rural areas. The sale of livestock is the primary means for much of the population to earn income for purchase of other food and essential items, especially wheat, during the spring months when they run out of food stock. The province has huge common grazing areas that support herds of livestock belonging to the local people as well as to nomads.

Humanitarian assistance

The chronic food-deficit situation in the province results in a cycle of poverty leading to hunger, and hunger leading to even greater poverty, which is very difficult to reverse. Because of its remoteness, very few assistance agencies are able to work in the province.

In response to the food deficit in the region, FOCUS is implementing a relief program. The program has included the distribution of 10,000 tons of food aid to 250,000 people over the last years. Food rations were provided for every household in about half of the province. In some districts, food was provided in a food-for-work program. FOCUS is able to carry out its activities in Badakshan for several reasons: FOCUS is affiliated with the Aga Khan Development Network, which has been active in Tajikistan and Pakistan on the northern and southern borders of Badakshan. During the last three years, good working relationships have been established with local leaders and with international organizations. A participatory model for rehabilitation comprising situation assessment, health, food assistance, village organization, agriculture, physical infrastructure, education, and economic initiatives is being considered.

Agricultural interventions

Agricultural interventions by FOCUS have been initiated this year in the districts along the Panj River (Darwaz, Sheghnan, Ishkashem, Zebak, and Wakhan). Although Zebak is not strictly along the river basin, its farming systems resemble those of Ishkashem. These districts are among the most food-deficient areas in the province. FOCUS is able to access these areas across the river from Gorno-Badakshan in Tajikistan where the Aga Khan Development Network has a comprehensive development program, of which agriculture is an important component.

The populated areas of the Sheghnan, Ishkashem, Wakhan, and Zebak districts are at an altitude of 2200 to 3000 meters. Population densities are low. Although there is a comparatively large area of land per capita, low temperatures, short growing seasons, low rainfall, and poor soils combine to lower productivity. Darwaz, on the other hand, is at a lower altitude (minimum 1300 meters) and has a longer growing season with higher rainfall and temperatures.

Table 1. Characteristics of the Target Areas

	Ishkashem	Zebak	Wakhan	Sheghnan	Darwaz
Number of villages	30	14	16	17	54
Households (farms) per village	39	45	68	160	132
People per household	9.0	9.3	8.7	8.3	8.7
Land resources: ser* per household	21	11	25	12	6
Number of animals per household	15	10	12	14	6
Number of households surveyed	1200	635	1084	2555	2648

* A *ser* is a local measure of land area based on seeding rate, ranging from 20 to 35 *sers* of wheat seed per hectare.

Needs assessment

Only 2% of eastern Badakshan is suitable for agriculture, and its soil quality is often poor and deficient in nutrients. A large portion of the agriculture is based on irrigation from rivers and torrents. Extensive systems of irrigation channels have been developed by the communities over centuries, bringing water long distances along the mountainsides. There is also a considerable amount of farming that depends on moisture from rainfall and melting snow, which is less productive.

The general constraints on crop and livestock production in the area include the following:

- lack of access to good, pure seed for cereal crops
- lack and/or cost of inputs such as fertilizers and plant-protection materials
- diseases, pests, and weeds
- lack of irrigation water and the state of the water system
- remoteness of markets and lack of transport facilities
- lack of agricultural and livestock services
- taxes (generally as a part of their crop yield)
- displacement of technical staff and farmers and destruction of institutions

In all formal and informal agricultural surveys, the farmers' priorities have always been fertilizers and good seed of improved varieties. Most farmers are aware of the possibilities of increasing their production through these inputs, especially fertilizers. The soil is generally very shallow and lacks sufficient nutrients to support intensive crop production. With shortages of fuel, especially firewood, most of the available animal dung is used for cooking and for heating in winter. The population of trees remaining is barely sufficient for watershed purposes and needs to be replenished. Lack of sufficient fodder for feeding livestock during the winter also limits the amount of animal dung available for the household. Small amounts of fertilizers are sometimes available in the markets but are usually of poor quality and very costly. Most farmers lack resources at planting time and have to pay high interest to borrow money for purchasing small amounts of fertilizer against the expected harvest.

The attitude of farmers towards weeds is rather tolerant, as many are also seen as serving a useful purpose. At a certain level, weeds in the wheat are considered to improve the quality of the straw as fodder. The presence of some wild rye is said to improve the quality of bread. Wild mustard is harvested separately by the women and processed for lamp and cooking oil. Some families consume plants of edible species weeded in the fields, such as *Chenopodium* spp.

Wheat is a staple food in all the communities of eastern Badakshan and is grown on both irrigated and rain-fed land. Altitude and snow cover tends to dictate whether wheat is sown as a spring or an autumn crop. Wakhan, Ishkashem, Zebak, and southern Sheghnan grow mostly spring wheat, while northern Sheghnan and Darwaz grow winter wheat.

Overall, wheat yields per hectare vary from 0.5 to 2.0 tons under irrigation and from 0.3 to 0.7 tons in rain-fed areas. The yields vary enormously with location, altitude, soil quality, the availability of farmyard manure (chemical fertilizer in the area is a rarity), susceptibility to fungal diseases such as rust and smut, pests such as locusts, weeds, and the genetic origin and purity of the seed planted.

Little or no introduction of improved varieties had taken place in eastern Badakshan prior to 1979. AfghanAid has recently established demonstration plots of improved varieties from the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT) as part of an integrated development program in Badakhshan, including the districts of Ishkashem and Zebak. Almost all farmers grow a number landraces that are of local origin and of very mixed appearance, often heavily infested with weeds, particularly wild wheat, wild oats and mustard. *Sorkhak,* an indigenous red-grained wheat, is generally planted in the autumn, while safidak, an amber/light-grained wheat, is planted in the spring. A few farmers have part of their fields under seed from other districts, including from Pakistan and Tajikistan. Some of this is of improved origin but by now very mixed with other varieties and weeds.

In Darwaz, different types of wheat are cultivated with different lengths of straw, some with awns and some awnless. Winter-wheat types clearly owe their origin to Russian varieties and to the facultative varieties introduced elsewhere in the province under various United Nation and aid programs. Local cultivars are almost exclusively sown on rain-fed land.

Participatory seed-security strategy

Seed security (farmers' access to adequate, good-quality seed of the desired type at the right time) is the first defense for food security (the access by all people at all times to enough food to maintain an active and healthy life). This is especially true for war-torn Afghanistan in general and for neglected Badakhshan in particular. As recognized at the World Food Summit held in Rome (FAO 1996), poverty and impoverishment precondition people to a state of vulnerability—vulnerable to life-cycle hunger, vulnerable to seasonal hunger, and vulnerable to the impact of disaster. This also describes the state of food security today in eastern Badakshan.

The loss of access to seeds and food are often interconnected. While seeds are crucial to agricultural recovery, human energy is equally important. Seed relief is being viewed as an integral part of the emergency package. There are several examples from other parts of the world that show that the action taken to restore seed security quickly after disaster is an effective way to help restore food security in an area. During the 1991/92 drought in Southern Africa, an emergency seed-production project, jointly coordinated by the Southern African Development Community (SADC) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), was highly successful compared to the projects in which seed was imported. Their success was due to the distribution of better-quality adapted varieties. The Seeds of Hope initiative helped rebuild domestic food security through the rehabilitation of seed security following the civil war in Rwanda in 1994. Adapted varieties and landraces were assembled and multiplied in neighboring countries and reintroduced into Rwanda.

The seed program aims to ensure availability of the right kind of seed in the right place. Adapted varieties are obtained from similar agroclimatic conditions in Tajikistan and delivered across the Panj River to several distribution points. Transportation within Afghanistan is mostly by volunteers, by donkeys made available by the communities for this purpose. This helps to keep the costs of introducing the varieties to a minimum. The amounts being distributed have been minimized to enable the local seed-production and -distribution systems to continue functioning smoothly.

Early in spring of this year, seeds of high-yielding varieties of wheat, maize, other cereals, potatoes, and vegetables appropriate to the agroecological conditions of the area were introduced through

on-farm, farmer-managed observation sites in the target districts. All the villages in the Wakhan, Ishkashem, Zebak, Sheghnan, and Darwaz districts are participating. The farmers are selected through village committees, traditionally known as *shuras*. Attempts are being made to involve as many different farmers as possible by restricting the distribution of only one kind of crop commodity to each participating farmer.

Initially, for each kind of crop, varieties that are widely adapted and available in sufficient quantity are being introduced. This will be followed by varieties and landraces with superior traits such as higher yield, better adaptability, improved disease and pest resistance and stress tolerance, and more consumer acceptability. In future, different kinds of lentils, forages, fruit and timber trees, and herbs of medicinal value will also be introduced into the farming systems. It is expected that the introduction of useful germplasm will be repeated every growing season whenever new potential materials are available and the farmers—through their village committees—are in favor of it. Rather than replacing existing germplasm, the goal is to increase the range of germplasm available on-farm. This will contribute to enhancing on-farm genetic diversity among and within different crop species.

The emphasis is on farmer and community empowerment. Participating farmers and their neighbors will judge the usefulness of the materials being introduced and their subsequent multiplication and distribution. Farmer-to-farmer seed exchange forms the basis of the local seed system in the region. It is a part of the local culture that anyone with seed of improved varieties is obliged to share the seed produced at the first harvest with his extended family. Such acts of cooperation reinforce family ties with distant blood relatives. In some cases, extra amounts of seed will be distributed on credit if the demand for the varieties introduced cannot be met by the local seed systems. Credit systems in which farmers pay for the inputs at harvest are also being used for supplying fertilizers.

These activities will be gradually transformed into participatory breeding, allowing the community to gain full control over the type and amount of varieties being produced and exchanged with their neighbors. Participation in the management and decision making for seed security by the farming community will contribute to reestablishing local food security and peace in the area.

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