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The Good Seed Initiative: Field Activities with Food Insecure Farmers in South Asia and East Africa

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KNOWLEDGE FOR LIFE

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Executive Summary

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2. In north-west Bangladesh, during the 2006/07 season, six hundred, mainly food insecure faming families produced 150 tonnes of high quality, climate-change tolerant, improved wheat seed for sale to neighbouring farmers. All farmers profited financially from this activity, with 60% earning in excess of €46, which is more than half the income required to reach the national poverty line. This highly successful, poverty-alleviating activity urgently needs to be scaled out in order to provide sufficient improved wheat seed to significantly reduce Bangladesh's national wheat deficit.

3. In western Bangladesh, one hundred, thousand mainly women farmers have watched the women-to-women rice seed video CDs since 2005. Results suggest that the majority of women from food insecure families can reduce their rice seed requirements by 10% and increase their food security by more than 22 days after practising skills learned from watching the videos twice or more. More follow ups are needed to confirm these impacts.

4. In Njombe district of Tanzania, during the 2007 season, 194 farmers attended one or more training sessions concerning the selection and storage of maize seed to minimise smut infection. In Kongwa district, 147 farmers attended one or more training sessions concerning the selection and storage of sorghum seed to minimise smut infection. Follow up is needed to measure the impact of training on the incidence of smut in the following maize and sorghum crops. Future training should focus on food insecure women farmers and ensure that all trainees receive the necessary information from one session.

5. In Uganda, 21 farmers from the Bakusekamajja Women's Development Association were trained in the production and selection of NERICA rice seed during 2007. Results indicated that this activity was only profitable for ten of the farmers (an average of €3.18) because of the high cost of local labour and the low price paid by the Association. A series of FM radio broadcasts covering all rice-growing areas of the country were made explaining how to produce NERICA rice seed. There is need to reduce input costs and provide training in record-keeping in order to make this activity more profitable.

6. In Bungoma district of Kenya, 50 out-growers received training in IPM. Most farmers who produced cowpea and green gram seed in 2007 received less than €62. This is a poor return for their hard work considering that this is the same amount that they could have earned by working as labourers for the same period. Farmers that produced the more valuable red pepper and eggplant seed made a worthwhile profit. In Molo district, 72 out-growers were also trained in IPM during 2007. Their final harvest was destroyed during serious political violence, however, the data suggests that farmers who produced kale seed would have made a worthwhile profit, while those who produced pea seed would have made very little or no profit. These results show that smallholder farmers are not getting the required response from recommended rates of fertiliser and pesticide applications due to poor inherent soil fertility and the build up of pests that are becoming resistant to pesticides. All out-growers require training in record-keeping to keep track of input costs.

7. Bangladesh, Kenya, Tanzania and Uganda have signed and ratified the Convention on Biodiversity and the Treaty on Plant Genetic Resources for Food and Agriculture. Bangladesh and Tanzania have implemented laws that conform to these agreements by allowing resource poor farmers to sell truthfully labelled/quality declared seed. Kenya does not allow resource-poor farmers to sell seed. Uganda is currently harmonising its seed laws with those of Kenya. The prohibition of trading in seed by smallholder farmers contravenes farmers' rights and prevents *in situ* conservation as guaranteed by the Convention and Treaty.

Background

In Sub-Saharan Africa and South Asia, seed saved from farmers' own harvests is the dominant seed source for 80-90% of smallholder farmers, both for use by the growers' themselves and for sharing through social networks. This seed is available, affordable, trusted by farmers, and can be used to gain natural, social and financial capital. But farmer saved seed stocks face disruption due to natural and civil upheavals, climate change and influxes of exotic pests. Meanwhile farmers' (mainly women's) knowledge in seed selection and storage is being undermined by pressures from agro-chemical companies, stringent seed laws that contravene farmers' rights and the deaths of knowledgeable family members due to HIV/AIDS. As a result poor farmers are not getting the best out of locally-adapted varieties and are last in line to access new varieties. New varieties may contain the outcomes of much, mainly public sector, research investment in genetic traits for tolerance to changing environmental conditions, exotic pests and to meet fluctuating market demands. However, farmers are unable to make informed choices between the performance of these new varieties and their old, indigenous varieties, as commercially produced seed will always out-perform saved seed if it has low viability and is contaminated with disease, off-types or weed seeds.

Unfortunately, where farmers are keen to use new and potentially beneficial varieties, access remains limited. This problem can be addressed by involving farmers in participatory varietal selection (PVS) during the development of the new breeding lines. However, interest in new materials is constrained by small farmers' purchasing power which is too weak to support the creation of commercial seed supply networks along conventional lines. Meanwhile, the public provision of seed of staple, open pollinated maize varieties (OPV) and other crops of interest to smallholder farmers has largely been disbanded in Africa. Only 10-20% of OPV seed used is supplied by the formal sector, with many farmers resorting to recycling seed of hybrid varieties, which has disastrous impacts on yields.

While a number of alternative models are being explored in Sub-Saharan Africa and South Asia to improve access to seed systems by the rural poor, there are also moves to harmonise seed legislation in line with countries whose laws favour commercial breeders' rights at the expense of local farmers' rights. Seed certification under this new legislation is concerned with maximising yield and creating uniformity within the genotype. This is narrow approach threatens to undermine the heterozygosity on which crop diversity and tolerance or resistance to pests depend. There is need to strengthen farmers' rights to enable poor farmers to benefit financially from protecting the crop diversity which guarantees future food security.

The Good Seed Initiative is addressing three key themes in order to promote farmers' rights as both protectors and beneficiaries of biodiversity:

I. Improving the quality (health, purity, viability and freedom from contaminants) and value of farmer-saved and farmer-traded seed (i.e. seed as a resource)
II. Building farmer-centred seed systems, enabling the poor to access and benefit from seed from sources external to the community (i.e. seed as a commodity) and
III. Taking forward learning from these into regional and national seed systems and policies.

In 2003[1], CABI organised a multi-stakeholder regional workshop in East Africa to discuss constraints to the development a more egalitarian approach to the reform of seed policies with farmers, seed companies, NGOs and government research and seed authorities. These were summarised as:

[1] CABI and Danida (2003) Report on East African Workshop on the Good Seed Initiative Sokoine University of Agriculture, Morogoro, Tanzania 36pp

- Major concern over the sustainability of national seed programmes, largely reflecting their dependence on external funding,
- Knowledge of seeds and required skills are still a limiting factor, particularly for the informal sector, extension service providers, movers of seed products, and farmers awareness of seed quality issues,
- Scaling up was seen as a major weakness, given the numbers of farmers and the difficulty of decentralised seed production management,
- Weaknesses in collaboration and networks are seen in problems of information flow between diverse stakeholders,
- A limited focus of the present institutional framework on resource-poor smallholders was noted,
- Processes of seed policy reform were perceived as slow, with limited regional harmonisation and inadequate monitoring of seed quality, Seed supply was not matched to demand,
- Market/delivery systems for quality seed produced by small holders were underdeveloped.

National partners and project sites

This report covers activities that took place during the period October 2006 to November 2007. These activities were in the form of pilot studies in which farmer training sessions for improved seed production were initiated in Tanzania, Uganda and Kenya, and successful work in information dissemination and poverty alleviation was scaled out in Bangladesh. This farmer participatory phase of the GSI was implemented with the help of local scientists, extensionists and NGO workers at five sites and in four countries. The project was managed by Sam L J Page of CABI Europe-UK at the international level, while regional co-ordination of the three sub-projects in East Africa was conducted by Daniel Karanja of CABI Africa:

- In Bangladesh scientists, led by Dr Elahi Baksh of the Wheat Research Centre (WRC) Bangladesh Agricultural Research Institute, worked with field workers from the Department of Agricultural Extension (DAE) and five local NGOs (Dipshika, Augnishika, Solidarity, Protashha and BRIF) to provide whole family training for 600 wheat producers in north-west Bangladesh, in order alleviate poverty through the sale of improved wheat seed.

- Extension officers from the Rural Development Academy (RDA) led by Mr A. K. M. Zakaria, worked with scientists and field workers from two local NGOs, the Agricultural Advisory Service (AAS) and TMSS to extend the screening to 150,000 farmers and assess the impact of watching the rice seed VCDs on household food security, amongst 321 women farmers in Bogra and Natore districts.

- In Tanzania, scientists from Uyole and Hombolo Agricultural Research Institutes, Department of Research and Development, MAFS, led by Dr Ambonesigwe Mbwaga, Lebai Nsemwa and Elias Letayo worked alongside government extension workers to provide training in improved maize and sorghum seed selection and storage to eliminate smut diseases, for 174 farmers in four villages in Njombe district in the Southern Highlands and 147 farmers in five villages in Kongwa district in the Central Lowlands.

- In Uganda, scientists from the National Crop Resources Research Institute (NaCRRI) and Namulonge Agricultural and Animal Research Institute (NARO) led by Dr Godfrey Asea, Dr George Bigirwa and Jimmy Lamo, conducted a training of trainers for 21 farmers from the Bakusekamajja Women's Association in the production, selection and storage of NERICA rice seed and broadcast this information countrywide via FM radio.

- In Kenya Seed Inspectors, led by William Munyao, from the Kenya Plant Health Inspectorate (KEPHIS) provided IPM training to 122 out-growers at two locations in the Rift Valley in order to improve the profitability of smallholder, out-grower, seed-producing enterprises.

Targeting the poorest, food insecure farmers

The GSI aims to improve food security and where possible provide a means of generating an income from seed sales for the poorest and most food insecure farming families. Food insecure households were identified by calculating the 'self-sufficiency index' (SSI) for every household that participated in each of the training sessions, see Box 1.

Box 1.

Assessing household food security

The ability of farmers to achieve household food security is based on their landholding (not including any rented land), number and ages of dependents and expected yield of their staple food crop. This can be expressed according to the following formula:

$$\text{Self-Sufficiency Index (SSI)} = \frac{\text{Potential grain yield} \times \text{Landholding}}{\text{Annual grain requirement}} \times 100\%$$

According to FAO, the recommended annual energy intake for an adult is equivalent to 365 kg of grain, for an adolescent child over 10 years this is 274 kg per year, while for a child under 10 years it is 183 kg. The annual grain requirement for each household can thus be calculated once the numbers of dependent adults, adolescents and children under 10 years are known.

The farmer's own yield data in terms of kg of maize/sorghum/rice per ha is used to calculate the SSI for each household. In cases where the farming families are sharecropping, the amount of grain that is due to the landlord must be subtracted from the potential yield.

The self sufficiency index (SSI) for Landless farmers will normally be zero, while the SSI for Marginal (food insecure) farmers will always be less than 100%. For the purposes of this research, the SSI for Subsistence farmers was set at between 100 and 200%, while for Food Surplus farmers an SSI of more than 200% was used.

Adapted from Page & Chonyera, 1994. Development Southern Africa, 11 (3) 301-320.

This is a quick and accurate method of assessing household food security amongst smallholder farmers as it requires only five simple statistics that can easily be re-called by farmers and by ranking each household according to their SSI it is possible to target the poorest groups with participatory training and other positive interventions.

1. GSI in Bangladesh

The GSI in Bangladesh worked with both government and non-government (NGO) partners to enable 600 of the poorest farming families profit from the sale of seed of new, improved wheat varieties and to disseminate key messages to more than 150 thousand farming families, concerning the production, selection and storage of rice seed for improved food security.

i) Lifting 600 wheat farmers out of poverty

Creating a 'win-win' situation

More than 70% of Bangladesh's smallholder farmers live in poverty, that is, they earn less than Tk9,176 (€93) per year from either farming or other activities. These farmers can be classified as marginal or landless because they are unable to produce sufficient food (mainly rice) to feed all household members for one year, considering the size of their landholdings. Such farmers are obliged to work as labourers, at a rate of Tk60 (€0.60) per day at certain times of the year, in order to purchase additional food and other essential items, including school fees and medication. Intermittent medical crises result in food insecure farmers becoming indebted to their employers and they are thus locked into a spiral of poverty.

Wheat is the second most important food crop next to rice in Bangladesh. The current annual consumption requirement of wheat is about 3.5 million tonnes. However, there is an increasing shortfall of 2.0-2.5 million tonnes per year, which must be met through imports, the cost of which currently stands at USD700 million a year. The rate of increase in wheat consumption is about 3% per year and by 2020 Bangladesh's wheat requirement will be 4.0 million tonnes, so there is urgent need to increase local production of this crop.

Fig. 1: Improved wheat seed plot in Dinajpur

Unfortunately, the wheat area, yields and production have all been declining in Bangladesh since 2000. In the 2005-06 wheat season, the wheat area was estimated to be about 0.48 million ha with production of 0.76 million tonnes. Meanwhile, the national average grain yield had gone down to 1.88t/ha compared with 2.24t/ha in 2000/01 and 2.16t/ha in 2001-02. The declining yields are due to increased susceptibility to disease and climate change which is manifest in shorter winters, with temperatures often rising during the crucial grain-filling stage. Local scientists have used CIMMYT germ-plasm to breed four new, improved wheat varieties, *Shatabdi, Prodip, Sourav, Bijoy,* that are more tolerant to foliar diseases, heat stress and soil salinity (in areas prone to tidal inundation) and can produce 20 to 30% higher yields. Since the Bangladesh Agricultural Development Corporation can only supply 15 to 20% of the national wheat seed requirement, scientists from the Wheat Research Centre of Bangladesh's Agricultural Research Institute were keen to train farmers to multiply this seed. The GSI worked with these scientists to take advantage of Bangladesh's farmer friendly seed laws and enabled the poorest farmers to multiply and sell the new wheat varieties as an income-generating activity.

Learning how to produce high quality wheat seed

Building on previous DfID-funded work, which showed that marginal farmers can produce 200-300kg of high quality wheat seed from small, 20 decimal (0.08ha) plots, last season (2006/07) 600 more mainly marginal and landless farming families were selected for 'whole family' training in the production, selection and storage of wheat seed. Whole family training ensures that wives accompany their husbands at the two hour long, monthly training sessions. Last season this training was conducted with the help of field workers from the Department of Agricultural Extension (DAE) and five local NGOs, namely Augnishikha, Solidarity, Dipshika, Brif and Protashha.

Fig. 2: Merina Begom rougeing out off-types from her wheat seed plot

Together the trained farmers produced more than 150 t of high quality, improved wheat seed during the 2006/07 winter season. By storing the seed in airtight plastic bags or sealed containers for six months, i.e. until the beginning of the 2007/8 wheat season, the farmers were able to maximise their profits. This was not only because seed prices peak at planting time, but also because rising world wheat prices had pushed up the local seed price by 30% over the previous 12 months.

Were the poorest farmers targeted?

Careful analysis of the data on household size, landholding and annual rice (paddy) yield, collected by DAE and the five local NGOs, indicated that more than 80% of the farming families who were selected for whole family training were food insecure, landless or marginal (Rice SSI<100%) see Appendix 1, Tables A-F. For example, the Roy family pictured in Fig. 3, were marginal farmers, having a rice SSI of 30%, considering their household size (6 adults, and 2 children under 10 years) landholding (0.39ha) and annual rice yield (1,980kg/ha). The remaining 20% of farmers that were targeted by the training were mainly subsistence farmers (rice SSI = 100-200%).

Fig. 3: Roy family standing infront of their house and wheat seed store in Madhobpur village, (the seed is stored in sealed plastic bags, inside Hessian sacks)

Did the farmers make a profit?

Following a detailed impact assessment, it was confirmed that all farming families who participated in the training programme gained financially from selling their wheat seed to neighbouring farmers: Each family harvested an average of 251kg of wheat seed from their 0.08ha plot, this was equivalent to 3,138t/ha. With the exception of the landless farmers who were trained by Solidarity (Table 2) all food insecure families retained less than 10kg of wheat grain for food and sold the rest either as grain or as selected, high quality seed (Tables 1-6) and Appendix 1A-F. Average input costs were Tk1,403 per 0.08ha plot, while the price paid for grain was Tk19 per kg and for selected wheat seed this was between Tk34 and Tk50 per kg, depending on the improved variety. Each family, thus made profits from the sale of grain and seed ranging from Tk632 (€4) to Tk12,481, (€120) equivalent to an average of €53 per family overall, see Tables 1-6. This is a 3.9 return on investment, see Table 19, page 33. Farmers trained by Augnishika obtained the highest mean profit, overall, of Tk7,072 (€68.25) see Table 1.

Fig. 4:
Farmers' profit relative to poverty line

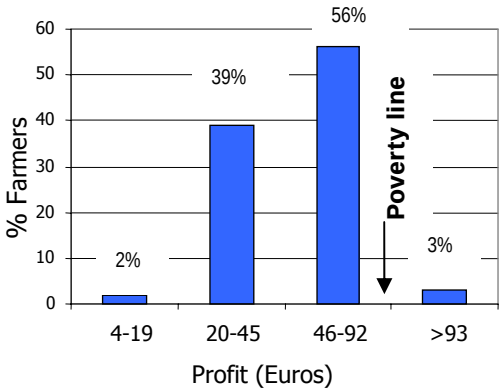


Fig. 4 shows the distribution of farmers in terms of their profit from the sales of grain and seed in relation to the national poverty line. Fifty-six percent of the farmers earned between €46-92 which is more than 60% of the annual income needed to reach the poverty line, while 15 of the wheat seed producers (3%) (highlighted in Appendix I, Tables A to F) earned more than Tk9,176 (€93). These 15 farmers were able to overtake the poverty line as a result of this simple, low input activity. The farmers reported that they had used this profit to settle debts, pay school fees, up-grade houses and rent more land to increase seed production next season.

Recommendations for future work

The outcome of these activities has shown that the GSI can alleviate poverty to a considerable degree amongst the poorest groups. With the appropriate short-term training, involving both men and women, landless and marginal farming families can become respected, quality seed producers within their communities. This is a form of 'bottom-up' technology transfer in which the poorest farmers are the first to benefit from improved seed varieties. A 'win-win' situation was created by enabling resource rich farmers to reduce their country's wheat deficit through the purchase of high quality, improved seed from their resource-poor neighbours. All of these gains depend on Bangladesh's seed regulations which allow farmers to sell 'truthfully labelled' seed (see last section).

There is urgent demand to scale this work out and if sufficient funds were available to reach 10,000 more marginal farming families, it would be possible to produce 1,200 t of improved wheat seed. This is sufficient seed to enable those farmers with larger landholdings to produce enough grain to reduce the national wheat deficit by more than 1%. This would save the Bangladesh government at least USD18 million in import costs, while at the same time enabling 10,000 farming families escape from extreme poverty.

Mean profitability of wheat seed production according to socio-economic group, facilitated by DAE and 5 local NGOs

Table 1: Augnishika's farmers in Dinajpur district

Socio-economic group	Number of families	Wheat yield/ 0.08ha plot	Grain			Seed			Total income grain+ seed	Input costs Tk/0.08ha plot	Profit	
			Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka	Euros
Landless	5	263	5	68	1,292	190	34.00	6,460	7,752	1,397	6,355	61.33
Marginal	31	290	5	61	1,105	224	34.00	7,629	8,734	1,489	7,246	69.93
Subsistence	4	323	8	100	1,891	215	34.00	7,310	9,201	1,585	7,616	73.50
Means		292	6	76	1,429	210	34.00	7,133	8,562	1,490	7,072	68.25

Table 2: Solidarity's farmers in Kurigram district

Socio-economic group	Number of families	Wheat yield/ 0.08ha plot	Grain			Seed			Total income grain+ seed	Input costs Tk/0.08ha plot	Profit	
			Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka	Euros
Landless	2	247	47	100	1,900	100	35.00	3,500	5,400	1,558	3,843	37.09
Marginal	45	305	9	168	3,190	129	37.28	4,836	8,026	1,561	6,466	62.40
Subsistence	11	340	7	189	3,584	144	39.09	5,736	9,320	1,578	7,743	74.72
Means		297	21	152	2,891	373	37.12	4,691	7,582	1,566	6,017	58.07

Table 3: Protashha's farmers in Dinajpur district

Socio-economic group	Number of families	Wheat yield/ 0.08ha plot	Grain			Seed			Total income grain+ seed	Input costs Tk/0.08ha plot	Profit	
			Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka	Euros
Marginal	10	222	9	110	2,081	104	46.00	4,870	6,951	1,297	5,654	54.56
Subsistence	8	190	8	106	2,007	77	42.50	3,338	5,344	1,210	4,134	39.90
Food surplus	2	235	15	150	2,850	70	50.00	3,500	6,350	1,351	4,999	48.24
Means		216	11	366	2,313	84	46.17	3,903	6,215	1,286	4,929	47.57

Mean profitability of wheat seed production according to socio-economic group, facilitated by DAE and 5 local NGOs

Table 4: DAE'S farmers in Dinajpur, Punchagaor, Thakurgaon, Rangpur, Nilphamari and Lalmonirhat districts

Socio-economic group	Number of families	Wheat yield/ 0.08ha plot	Grain			Seed			Total income grain+ seed	Input costs Tk/0.08ha plot	Profit	
			Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka	Euros
Landless	14	242	6	122	2,321	107	34.21	3,779	6,099	1,348	4,751	45.85
Marginal	102	233	5	93	1,762	135	34.61	4,704	6,466	1,343	5,123	49.44
Subsistence	48	235	5	74	1,412	155	35.27	5,498	6,911	1,343	5,568	53.73
Food surplus	6	247	10	53	1,013	183	33.00	6,050	7,063	1,332	5,732	55.32
Means		239	7	86	1,627	145	34.27	5,008	6,635	1,342	5,294	51.09

Table 5: BRIFs farmers in Dinajpur, Nilphamari districts

Socio-economic group	Number of families	Wheat yield/ 0.08ha plot	Grain			Seed			Total income grain+ seed	Input costs Tk/0.08ha plot	Profit	
			Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka	Euros
Landless	1	280	0	180	3,420	100	33.00	3,300	6,720	1,378	5,342	51.55
Marginal	161	235	6	135	2,556	95	34.49	3,260	5,816	1,344	4,471	43.15
Subsistence	15	237	6	136	2,590	95	33.00	3,124	5,714	1,352	4,362	42.10
Means		251	4	150	2,855	97	33.5O	3,228	6,083	1,358	4,725	45.60

Table 6: Dipshika's farmers in Dinajpur district

Socio-economic group	Number of families	Wheat yield/ 0.08ha plot	Grain			Seed			Total income grain+ seed	Input costs Tk/0.08ha plot	Profit	
			Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka	Euros
Landless	10	182	3	69	1,307	110	36.30	4,056	5,363	1,322	4,042	39.01
Marginal	53	221	3	94	1,792	123	35.98	4,459	6,251	1,390	4,861	46.91
Subsistence	17	229	4	94	1,794	131	34.82	4,550	6,344	1,428	4,916	47.44
Means		211	3	257	1,631	121	35.70	4,355	5,986	1,380	4,606	44.45

ii) Extending rice self-sufficiency for food insecure farmers

Millions of landless and marginal (food insecure) farming families in Bangladesh are facing declining rice yields as a result of the continuous use of saved seed that is contaminated with both diseases and weed seed. Since seed processing is considered to be 'women's work' and it is difficult for Muslim women to travel outside the village to attend farmer training sessions, which could improve their seed processing skills, a series of five, women-to-women training video CDs (VCDs) were prepared in 2003 with support from extension specialists from Bangladesh's Rural Development Academy, Bogra. In these videos local women explain and demonstrate how to produce, select and store high quality rice seed. This involves simple techniques for selecting out healthy seed and discarding spotted and lightweight seed, checking seed viability, sowing special rice seed plots, rouging out off-types, threshing out only filled grains and storing seed in air-tight, painted pots. The VCDs have been re-edited with additional footage over the past two years and extracts have been made as video-clips for use in television format. It was anticipated that farmers who implement the improved practises that are explained on the rice seed VCDs, would experience significant savings in the amount of seed needed per unit area and in labour costs for weeding, in addition to gaining improvements in their rice yield.

Spreading the message

In order to reach many thousands of women with the information contained on the rice seed VCDs, Agricultural Advisory Service (AAS) field workers identified several different 'service-providers' (organisations that have facilities for showing VCDs) in four upazilas, namely Boraigram, Gurudaspur and Natore Sadar in Natore district and Tarash in Sirajganj district.

Table 7: Attendance at rice seed VCD shows courtesy of 12 service providers

District	Upazila	Type	Name of service provider	No. of shows	Audience			
					Women	% women	Men	Total
Natore	Boraigram	Cable TV operator	Skyvision	30	1,500	38	2,500	4,000
			Two Star	20	600	38	1,000	1,600
			Shetu	25	1,000	33	2,000	3,000
		NGO	Karbala Gram Unnayan Kendro	30	1,000	83	200	1,200
			Jagorani Samaj Unnayan Sangstha	20	200	18	900	1,100
		School	Ramagari High School	20	180	55	150	330
	Gurudaspur	NGO	Esho Kaj Kary	30	700	78	200	900
	Natore Sadar	NGO	Natore Economic Development Assistance	30	1,200	80	300	1,500
Sirajganj	Tarash	School	Dobila BL High School	27	200	57	150	350
			Matia Malipara High School	20	100	33	200	300
			Madhai Nagar High School	25	250	56	200	450
		NGO	Char Kushabari Dakhil Madrasha	20	200	50	200	400
			Totals	297	7,130	47%	8,000	15,130

The service providers selected were village cable TV operators, local NGOs and schools. All were willing to show the VCDs free of charge. A short awareness-raising training session was

given to the staff of these service-providers before they were given the VCDs and they were asked to keep records of the numbers of people who attended the shows. Between 2005 and 2007 the selected service-providers provided a total of 297 rice seed VCD shows, which were open to rural people in their areas. These shows were attended by a total of 7,130 women and 8,000 men over the 2 year period, see Table 7.

The NGOs Karbala Gram Unnayan Sangstha, Esho Kai Kary and Natore Economic Development Assistance performed the best in terms of the number of VCD shows (30) and the percentage number of women (>78%) who attended the shows. However, although the rice seed VCD shows screened by the cable TV operator Skyvision, involved only 38% women, it attracted a much larger total audience of 4,000 men and women, which meant that 1,500 women actually attended and this was the highest amongst all service providers. The service providers were keen to continue this service and requested more VCDs on other agricultural topics.

In 2007, AAS built on the success of this new approach to knowledge dissemination by distributing 223 VCDs to groups of women who had come together in order identify suitable venues for showing the VCD within their own communities and to 32 more service-providers in nine districts, mainly road-side tea stalls but also schools, grocery shops and local NGOs. This led to an additional 8,600 more VCD shows, attended by a total of 157,861 farmers.

Assessing the impact of watching the rice seed VCDs

In order to assess the impact of watching these VCDs on the amount of seed saved and any changes in rice yield, a total of 321 female farmers were interviewed by AAS field staff in 10 villages and in four districts, see Table 8. Seventy percent of the women interviewed had watched the VCDs twice, while 20% of them had watched them only once. The remaining 10% had watched the VCDs three or more times. The women said that they had watched the VCDs in houses of neighbouring, affluent farmers who own VCD players and other similarly resourced local meeting places, such as primary schools, tea stalls, village markets and grocer's shops.

Table 8: Location of survey respondents

District	Upazila	Village	No. of Respondents (100% Women)
Natore	Gurudaspur	Sadhupara	38
		Edilpur	19
	Baraigram	Goalpha	48
		Rathuria	44
Pabna	Atghoria	Kalam Nogor	24
	Ishurdi	Khalispur	25
Jhenaidah	Sadar	Paka	32
		Kastosagra	39
		Berbari	24
Magura	Sadar	Luxmipur	24
Total	6	10	321

Each female respondent was asked about the size of her family's landholding and that of any leased land, the number and ages of her children as well as differences in seed use and rice yield (transplant-aman and boro) before and after watching the VCDs.

The results obtained were analysed and ranked according to each household's household Rice Self-Sufficiency Index (RSSI). The data indicates that 290 out of 321 farming families were

able to use 15% less rice seed per unit area once they had watched the VCDs and learned how to clean, select and improve the storage of their seed. There is also a strong possibility that the cleaned seed produced higher yields during both the boro and t-aman seasons (notwithstanding seasonal variations in temperature, rainfall, input applications and management practises): Sixty-eight landless farming families reported that they saved an average of 4kg of rice seed per acre (σ=3.0) and gained an average increase of 6% in boro production and 3% in t-aman production during the following seasons. This is a total average annual rice yield increase (boro+t-aman) of 103kg per household. This represents 10% of their average household rice deficit of 1,090kg/year and an average of 32 extra days of food for a landless farming family. Forty-seven marginal (food insecure) farming families saved an average of 4kg of rice seed per acre (σ=2.4) and gained an average rice yield increase of 88kg, which is 20% of their average rice deficit of 419kg per household. This represents 22 extra days of food security for this socio-economic group, see Table 10.

Fig. 5: Piara Begum demonstrating how she stores her rice seed since watching the video twice.

Fig. 6: Selected rice plot in Kanupur village, Bogra

One hundred and six subsistence farming families also saved an average of 4kg of rice seed per acre (σ=2.5) and increased their rice yield by an average of 124kg, as a result of watching the VCD. This increase was in addition to their mean annual rice surplus of 622kg per household. Ninety-five food surplus farmers who had a mean rice surplus of 3,226kg per household, saved an average of 5kg (σ=2.8) of rice seed per acre and increased their rice yield by an average of 278kg, see Table 9.

The women reported that they had gained increased respect from their husbands and been rewarded with new saris as a result of these yield increases.

Table 9:
Mean amount of seed saved and rice yield increase after watching the VCD

Socio-economic group	VCD: times seen	Land owned acres	Land rented acres	Rice surplus Kg/family	RSSI %	Seed saved Kg/acre	Yield increase Kg/family	% of rice deficit	Extra days' rice
Subsistence (106)	2	0.5	0	622	146	4	124	n/a	n/a
Food surplus (95)	2	1.2	0	3,226	355	5	278	n/a	n/a

Recommendations for future work

These results suggest that the poorest and most food insecure farming families can reduce their rice seed requirement and increase their food security by approximately four weeks, at no extra financial cost, simply by implementing a series of improved practices, concerning the selection and storage of rice seed, that they have watched twice on a VCD. More follow-ups, focussing on food insecure farming families, over several seasons, are needed to confirm these findings.

Farmer-to-farmer videos offer a mechanism for the rapid dissemination of key extension messages amongst millions of poor farmers in remote rural areas. They also ensure that the original high quality training is maintained no matter how many times the session is repeated. The role of the group facilitator is to answer any questions that may arise during the screening of the VCDs, through leading farmers' discussions and demonstrating any practises that require clarification. However, this method of information transfer depends on the availability of hundreds of potential service-providers with access to reliable power supplies, within the community for its success.

More women-to-women or farmer-to-farmer videos that explain and demonstrate wheat and vegetable seed production, selection and storage will be created in order to scale out the training for wheat seed producers and begin the process of training ultra-poor, landless farmers in the production of high value vegetable seed in Bangladesh. Script research and editing skills that have been developed by the Bangladeshi scientists and field workers will be shared with interested partners in East Africa.

Table 10: Amount of seed saved and reduction in rice deficit after watching the VCD

Name	VCD: times seen	Land owned acres	Land rented acres	Rice deficit Kg/family	RSSI %	Seed saved Kg/acre	Yield increase Kg/family	% of rice deficit	Extra days' rice
Landless farmers (68)									
Sufia	1	0	0.7	-2,647	0	0	80	3	11
Komela	2	0	0.3	-2,100	0	3	120	6	21
Rehana Begum	2	0	0.7	-1,917	0	6	440	23	84
Minara	2	0	0.5	-1,735	0	3	40	2	8
Julia	2	0	0.7	-1,734	0	3	160	9	34
Sofura	2	0	0.2	-1,643	0	6	40	2	9
Shobjan	3	0	0.2	-1,461	0	6	80	5	20
Selina Begum	1	0	0.3	-1,461	0	6	120	8	30
Shaheda	2	0	0.7	-1,461	0	3	160	11	40
Rubya	2	0	0.3	-1,370	0	3	40	3	11
Lucky	2	0	0.3	-1,370	0	3	40	3	11
Tachlema	2	0	0.7	-1,370	0	0	40	3	11
Morjina	1	0	0.3	-1,369	0	6	-40	3	11
Rowshonara	2	0	0.2	-1,279	0	0	40	3	11
Momota	2	0	0.2	-1,279	0	9	40	3	11
Rajea	1	0	0.2	-1,278	0	3	40	3	11
Jahanara Begum	2	0	0.5	-1,278	0	9	120	9	34
Atobjan	2	0	0.7	-1,278	0	6	120	9	34
Rajia	2	0	0.5	-1,278	0	3	240	19	69
Aeysha	1	0	0.2	-1,187	0	3	40	3	12
Sajeda	1	0	0.2	-1,187	0	6	80	7	25
Rani	2	0	0.3	-1,187	0	6	80	7	25
Julekha	2	0	0.3	-1,187	0	-1	120	10	37
Rokea	1	0	0.5	-1,187	0	0	40	3	12
Monowara	1	0	0.7	-1,187	0	6	120	10	37
Monowara	2	0	0.7	-1,187	0	3	280	24	86
Shefaly	1	0	0.7	-1,187	0	3	320	27	98
Nazma Begum	2	0	0.2	-1,096	0	6	40	4	13
Jayeda	1	0	0.2	-1,096	0	6	80	7	27
Parul	2	0	0.5	-1,096	0	0	160	15	53
Somela	2	0	0.5	-1,096	0	0	200	18	67
Saleha	2	0	0.7	-1,096	0	15	360	33	120
Halima	2	0	0.7	-1,096	0	9	320	29	107
Nila Parvin	1	0	0.3	-1,096	0	3	160	15	53
Fatema	2	0	0.2	-1,004	0	3	80	8	29
Kodvanu	1	0	0.2	-1,004	0	6	0	0	0
Samsun Nahar	2	0	0.2	-1,004	0	3	0	0	0
Majeda	1	0	0.2	- 913	0	3	40	4	16
Golapy	2	0	0.2	- 913	0	3	50	5	20
Rekha Begum	1	0	0.2	- 913	0	6	80	9	32
Shahnaz	2	0	0.3	- 913	0	6	40	4	16
Kajoly Begum	2	0	0.7	- 913	0	3	80	9	32
Kohinur	2	0	0.5	- 913	0	6	120	13	48
Alkey	2	0	0.3	- 913	0	3	40	4	16
Sabina	2	0	0.3	- 913	0	3	160	18	64
Ruma	2	0	0.3	- 913	0	12	120	13	48
Sufia Begum	2	0	0.3	- 913	0	6	120	13	48
Morium	1	0	0.3	- 913	0	0	40	4	16
Rehana	2	0	0.0	- 913	0	9	160	18	64
Arjina	2	0	0.3	- 913	0	3	240	26	96
Saleha	1	0	0.5	- 913	0	6	120	13	48
Sheuly	1	0	0.7	- 913	0	6	160	18	64
Peyara	2	0.0	0.3	- 913	0	6	80	9	32
Nargis	1	0	0.2	- 730	0	0	0	0	0
Anjera Begum	2	0	0.2	- 730	0	6	40	5	20
Parul Begum	3	0	0.2	- 730	0	3	0	0	0
Ronia Begum	2	0	0.2	- 730	0	3	40	5	20
Alpona	1	0	0.3	- 730	0	3	40	5	20

Name	VCD: times seen	Land owned acres	Land rented acres	Rice deficit Kg/family	RSSI %	Seed saved Kg/acre	Yield increase Kg/family	% of rice deficit	Extra days' rice
Khodeja Begum	1	0	0.2	-730	0	6	/80	11	40
Ogeda	2	0	0.3	-730	0	0	0	0	0
Sonavan	2	0	0.3	-730	0	6	120	16	60
Popy	2	0	0.3	-730	0	0	120	16	60
Rokeya	2	0	1.0	-730	0	6	80	11	40
Saleha	1	0	0.5	-730	0	3	120	16	60
Maleka	1	0	0.3	- 548	0	9	80	15	53
Sema	2	0	0.3	- 548	0	3	134	24	89
Anowara	2	0	0.2	- 548	0	3	80	15	53
Halejan	4	0	0.2	-365	0	3	40	11	40
Means	2	0	0.4	-1,090	0	4	103	10	36
Marginal farmers (47)									
Rojina	1	0.1	0.0	- 633	31	2	60	9	24
Regia	1	0.3	0.3	- 980	33	6	120	12	30
Gomela	5	0.3	0.0	- 941	36	6	40	4	10
Morgena	2	0.3	0.0	-2,292	37	6	120	5	12
Rabia	2	0.2	0.0	-1,157	40	3	80	7	15
Sofura	1	0.2	0.0	-1,026	44	3	40	4	8
Iron	2	0.3	0.0	- 627	47	3	40	6	12
Halima	2	0.3	0.3	-1,299	53	6	120	9	16
Rehana	1	0.2	0.5	- 649	53	3	120	18	32
Nobiron	2	0.3	0.0	-1,014	57	3	40	4	6
Fatema	2	0.2	0.0	- 507	57	0	40	8	12
Anjuara Begum	2	0.2	0.0	- 456	58	6	40	9	13
Achhea	2	0.3	0.0	- 581	60	6	120	21	30
Razia Sultana	3	0.2	0.0	- 467	61	3	40	9	12
Aklema	2	0.2	0.0	- 416	62	6	40	10	13
Fulijan	2	0.2	0.3	- 389	64	6	120	31	40
Monowara	2	0.2	0.3	- 388	65	6	120	31	40
Rowshonara	2	0.2	0.0	- 376	66	3	0	0	0
Saleha	2	0.3	0.0	- 648	68	0	120	19	22
Sabina	1	0.2	0.0	- 273	70	0	40	15	16
Ragia	2	0.3	0.0	- 558	71	0	40	7	8
Nazma Khatun	2	0.2	0.0	- 296	73	6	80	27	27
Morjina	2	0.3	0.0	- 518	73	3	200	39	38
Sufia Begum	3	0.2	0.0	- 233	74	3	0	0	0
Ranuka	2	0.3	0.0	- 477	75	6	80	17	15
Tachhlema	2	0.3	0.0	-323	80	3	80	25	18
Shorufa	2	0.4	0.0	-154	87	3	120	78	37
Komela Bewa	1	0.2	0.0	- 113	88	3	80	71	32
Lipi Begum	2	0.2	0.0	-113	88	4	40	35	16
Khaleda	2	0.3	0.0	-169	88	0	40	24	11
Shahanara	2	0.3	0.0	-152	90	9	40	26	9
Amena	2	0.3	0.0	-140	90	3	120	86	30
Sajeda	1	0.3	0.3	-73	92	6	80	110	32
Alpona	2	0.3	0.0	- 101	93	3	40	40	10
Maju	2	0.3	0.0	- 101	93	3	80	79	20
Sukhjahan	2	0.2	0.0	- 50	93	0	100	200	50
Amena Begum	1	0.2	0.0	- 50	93	0	80	160	40
Halema	2	1.0	0.0	-274	94	3	640	234	52
Rehena	2	0.3	0.0	-72	95	3	120	167	28
Kulsum	2	0.3	0.0	-72	95	6	120	167	28
Roshida	4	0.5	0.0	- 38	97	6	120	316	34
Sobironnesa	2	0.3	0.0	- 21	99	3	-80	381	-20
Ochhemon	4	1.0	0.0	-20	99	6	120	600	30
Saleha Begum	1	0.2	0.0	-10	99	6	80	800	40
Momotaz Begum	2	0.3	0.0	-10	99	3	80	800	21
Shorvan	2	0.3	0.0	- 9	99	6	94	1,044	25
Means	2	0.3	0.0	-419	73%	4	88	20%	22

2. GSI in East Africa

The GSI worked with five groups of farmers in three East African countries, namely Tanzania, Uganda and Kenya.

i) Improving food security for subsistence farmers in Tanzania

Identifying the cause of declining maize yields in Njombe district

The Southern Highlands of Tanzania receive annual rainfall of more than 1,200mm, making it a high potential area for maize production. However, a baseline survey conducted by scientists from the Uyole Agricultural Research Institute revealed that maize yields in Njombe district are in serious decline. The main reason for this decline was said to be the use of poor quality seed, that is, seed that originates from hybrid varieties. Many farmers use so-called 'recycled hybrid seed' because they cannot afford to buy new hybrid seed each year. The less vigorous progeny often yield less than 50% of that of the original hybrid parent crop. This situation is compounded by the fact that most farmers are unaware of the procedure which needs to be followed when selecting maize seed and instead use randomly selected grain from the threshing floor as seed for the next season's crop. This practise has led to a high incidence of seed transmitted diseases. The most important of these is Smut, caused by *Sporisorium* spp., known locally as *Matupa* (see Fig. 7.). Losses due to smut diseases were reported by farmers to be up to 100kg of maize grain per acre and were attributed to the presence of bad spirits.

Fig.7: Smut disease of maize

Learning how to select and store good maize seed in Njombe district

In order to dispel these superstitions and help farmers improve their family's food security at no extra cost, it was necessary to provide training in the selection and storage of good quality seed. Scientists from Uyole Agricultural Research Institute (UARI) worked with local extension workers to train 83 female and 91 male farmers from four villages in Njombe district. This training was divided into three sessions, the first was in May 2007 and focussed on learning from farmers about their understanding of the causes of declining maize yields, the second, in July, was on the biology and management of Smut disease and the final session in August, was on harvesting, processing and storage of seed and grain. The scientists also prepared full colour posters and leaflets explaining the causes and life-cycles of smut diseases, in the local language, in order to assist with the training process.

Unfortunately only 20% of the farmers were able to attend all three training sessions, while 21% attended two sessions and the majority, 59% were only able to attend one session. Women participants were in the majority in Nyumbanitu and Usalule villages, while men were in the majority in Ihalula and Kilenzi villages, see Table 11. Each family stored approximately 20kg of carefully selected maize seed following the training.

Table 11: Attendance at training sessions in Njombe district

Village	Farmers		No. of training sessions attended		
	No. women	No. men	3	2	1
Usalule	26	18	9	10	25
Ihalula	4	26	5	8	17
Kilenzi	9	25	14	7	13
Nyumbanitu	44	22	6	12	48
Totals	83	91	34	37	103

Fig. 8: Participants at a good maize seed training session in Njombe district

Were the poorest farmers targeted?

Despite being a high rainfall area, average maize yields in Njombe district are extremely low, just 300kg per acre (720kg/ha). Such low yields can be attributed to poor and exhausted soils, lack of crop diversity and shortage of cash for inputs such as fertiliser, pesticides and improved seed. As a result there is an unexpectedly high incidence of food insecurity in this district.

Data collected from 68 households, from which the husband or wife attended the training, revealed that 30% of these households were food insecure (maize SSI <100%) considering their limited landholdings and number of dependents. Twenty seven percent of the households were considered to be subsisting because they had been able to harvest sufficient maize to guarantee food security throughout the year (maize SSI 100-200%) while 44% were food surplus households because they are able to harvest at least twice as much maize as is required to feed all household members for one year (maize SSI>200%) see Table 12. The latter group have larger landholdings in relation to the number of dependants and are thus able to sell surplus maize on a regular basis.

Table 12: Food Security amongst 68 trained farmers in Njombe District

Farmer's name	Village	Land owned acres	Household size			Potential yield kg/acre	Grain req kg	MSSI %
			<10 yrs	10-18yrs	adults			
Food insecure farmers								
R. Fwalo	Ihalula	2	3	3	2	600	2,101	29
F. Myamba	Ihalula	4	3	2	6	1,200	3,287	37
L. Mtewele	Ihalula	4	2	1	4	800	2,100	38
R. Mgina*	Kilenzi	3	4	2	3	900	2,375	38
S. Mdenye	Kilenzi	4	5	5	3	1,400	3,380	41
S. Mandela*	Nyumbanitu	1	1	2	2	600	1,461	41
N. Nyongole	Kilenzi	2	3	1	2	650	1,553	42
J. Mdeka*	Nyumbanitu	1	0	1	2	600	1,004	60
M. Mkalawa	Ihalula	4	3	3	2	1,400	2,101	67
E. Senyika*	Nyumbanitu	2	2	1	3	1,200	1,735	69
A. Bindiga*	Usalule	6	1	6	2	1,800	2,557	70
B. Mgimba	Ihalula	5	0	6	5	2,500	3,469	72
F. Mhami*	Kilenzi	2	2	2	2	1,200	1,644	73
C. Msigwa*	Nyumbanitu	2	2	2	2	1,200	1,644	73
I. Kawogo	Kilenzi	3	1	2	1	900	1,096	82
E. Sanga*	Nyumbanitu	3	2	4	2	1,800	2,192	82
B. Lilawola*	Nyumbanitu	1.5	3	0	2	1,050	1,279	82
C. Mlewa	Nyumbanitu	2	5	0	3	1,800	2,010	90
L. Msemwa	Ihalula	2	0	2	2	1,200	1,278	94
E. Msigwa	Nyumbanitu	2	3	0	2	1,200	1,279	94
Subsistence farmers								
E. Lupenza*	Nyumbanitu	2	1	3	2	1,800	1,735	104
S. Haule	Usalule	1	1	0	2	1,000	913	109
C. Mwinuka	Ihalula	3	2	1	2	1,500	1,370	110
L. Mbwilo*	Usalule	2	2	2	3	2,400	2,009	120
H. Mtemela	Nyumbanitu	2	2	1	3	2,200	1,735	127
E. Chatanda*	Usalule	2.5	2	3	2	2,500	1,918	130
C. Msigwa	Nyumbanitu	1.5	2	0	3	1,950	1,461	133
B. Ndendya	Nyumbanitu	2	2	0	2	1,500	1,096	137
E. Mtemela*	Nyumbanitu	2	2	1	1	1,400	1,005	139
C. Mdetele	Kilenzi	3	1	2	2	2,100	1,461	144
P. Mligo	Ihalula	8	3	8	4	6,400	4,201	152
M. Mlowe	Kilenzi	4	3	1	2	2,400	1,553	155
A. Mkalawa	Ihalula	5	3	0	2	2,000	1,279	156
M. Mtega	Kilenzi	5	2	0	2	2,000	1,096	183
F. Kadege	Usalule	4	1	3	2	3,200	1,726	185
T. Msemwa	Ihalula	3	3	0	2	2,400	1,279	188
E. Chaula*	Usalule	6	4	2	2	3,900	2,010	194
E. Mligo*	Ihalula	6	3	2	2	3,600	1,827	197
Food surplus farmers								
O. Mdetele	Kilenzi	6	2	5	2	4,800	2,466	200
D. Mdemi	Kilenzi	2	3	1	2	1,500	730	206
J. Mbwilo	Usalule	3	0	0	2	1,500	730	206
T. Mlowe	Kilenzi	6	1	3	2	3,600	1,735	208
E. Mbwilo*	Usalule	3.5	1	2	2	3,150	1,461	216
S. Mdetele*	Kilenzi	6	2	2	2	3,600	1,644	219
E. Sanga	Kilenzi	6	2	2	2	3,600	1,644	219
S. Mwalongo	Nyumbanitu	2	1	0	2	2,000	913	219
F. Kidumage*	Usalule	6	2	3	1	4,200	1,553	270
A. Mdetele	Kilenzi	5	3	0	2	3,500	1,279	274
O. Kiswaga	Usalule	4	4	0	2	4,000	1,462	274
O. Kitaponda	Kilenzi	4	2	0	2	3,200	1,096	292
K. Fwalo	Ihalula	8	8	3	2	9,600	3,016	318
A. Mligo	Usalule	6	3	2	2	6,000	1,827	328
W.Mlowe*	Kilenzi	8	2	4	2	7,200	2,192	329
F. Sambala	Kilenzi	8	2	3	2	6,400	1,918	334
M. Mgimba	Ihalula	6	1	3	2	6,000	1,735	346
L. Mandele	Usalule	5	4	0	2	6,000	1,462	410
A. Msigwa	Nyumbanitu	4	2	0	1	2,400	548	437

Farmer's name	Village	Land owned acres	Household size			Potential yield kg/acre	Grain req kg	MSSI %
			<10 yrs	10-18yrs	adults			
A. Myonga	Ihalula	4	1	0	1	3,200	548	583
W. Sambala	Kilenzi	14	1	3	3	12,600	2,100	600
A. Chengula*	Usalule	7	2	1	2	7,000	1,123	623
Z. Sanga	Nyumbanitu	10	0	3	2	10,000	1,552	644
S. Kadege	Usalule	3	0	0	1	2,400	365	658
E. Myamba	Ihalula	20	2	3	2	16,000	1,918	834
D. Mbwilo*	Ihalula	22	3	1	1	11,000	1,188	926
H. Mkalawa	Ihalula	10	0	0	2	9,500	730	1,301
L. Mdetele	Kilenzi	15	0	2	2	21,000	1,278	1,643
F. Kidenya	Kilenzi	5	0	1	1	12,500	639	1,956
J. Manga	Kilenzi	24	0	0	2	16,800	730	2,301

* Women farmers

Identifying the cause of declining sorghum yields in Kongwa district

Rainfall is less than 800mm per annum in the Central Region of Tanzania. Here farming families depend on drought-tolerant sorghum varieties, produced from their own saved seed, for their survival. These people plant indigenous sorghum varieties such as *Lugugu*, *Mtama*, *Mrefu*, and *Mwekundu* as food staples and shorter season commercial types, such as *Macia, Wahi* and *Hakika* to generate income. The indigenous varieties are valued as food crops because they have denser grains and thus a higher calorific value than short season types. They also have better storage qualities and produce long stalks that can be used for the construction of drying and threshing tables and animal shelters, see Fig. 11. Most farmers save seed of both new and indigenous varieties for use during the following season. It should be noted that farmers in low rainfall areas need to store larger amounts of seed to allow for replanting in case the early rains fail.

Fig.9: :Kongwa district during the dry season

Fig 10: Covered kernel smut of sorghum

There are many serious pest problems that are prevalent in this area, including army worm *Spodoptera* sp.; witch-weed, *Striga asiatica* and *Quelea quelea* birds. A baseline survey, conducted by UARI (ARI Ilonga and ARI Hombolo) scientists in 2005, indicated that the presence of Smut disease (known locally as Mang'wilili) was also a serious constraint to sorghum production. Local farmers recognised three types of Smut and reported that they were experiencing significant grain losses as a result of the disease. The common practise of using contaminated grain, taken at random from the grain heap or threshing floor, as seed was identified as the underlying cause of the infection, see Fig 12.

Fig. 11: Indigenous sorghum being dried

Learning how to select and store good sorghum seed in Kongwa district

In order to raise awareness of the different Smut diseases and improve the quality of farmer-saved seed, a three-day training course was designed by local scientists and implemented with the help of extension workers, for farmers in five villages in Kongwa district. This training course covered the symptoms and life-cycle of the different Smuts and best practise concerning the selection and storage of sorghum seed.

Fig 12: Grain heaps in Manungu village. Smut diseases are easily spread here.

Fig. 13: Sorghum seed heads selected from the field by Jeromy Kingamkona

At least 147 farmers (99 men and 48 women) were trained in each of five villages, during three sessions, spread over the 2006/07 sorghum growing season. Unfortunately only 16% of the farmers were able to attend all three training sessions, 30% attended 2 sessions and 54% attended only one, see Table 13. Male participants were in the majority in three of the villages. Each farming family stored an average of 20kg of sorghum seed following the training.

Table 13: Attendance at training sessions in Kongwa district

Village	Farmers		No. of training sessions attended		
	No. women	No. men	3	2	1
Manungu	8	42	9	16	25
Mbande	14	12	7	6	13
Msunjilile	11	23	2	12	20
Vilundilo	1	9	2	3	5
Sejeli	14	13	3	8	16
Totals	48	99	23	45	79

Were the poorest farmers targeted?

Sorghum yields may be as low as 200kg per acre (480kg/ha) in Kongwa district. Landholdings range from 2 to 80 acres per household, with most households owning five or more acres. Larger landholdings are essential to ensure survival in the harsh, drought-prone environment which prevails in the Central Region.

Fig. 14: The Mwenesi household in Manungu village, This food surplus farming family owns 30 acres of land

Data concerning household food security and sorghum seed selection and storage methods were collected from 44 households, in which either the husband or wife had participated in the training. Analysis of this data revealed that food insecure farmers constituted the largest group: 41% of households were unable to be food secure, considering the number of dependents, landholding and sorghum yield last season. Twenty-five percent of the households had a sorghum SSI of between 100 and 200 percent, indicating that they are able to produce sufficient grain to subsist during a non-drought year, while the remaining 34% of households (such as the Mwenesi household

in Fig. 14) were able to produce sufficient surplus grain to sell or to store for up to 10 years, see Table 14.

Table 14: Food security amongst 44 trained farmers in Kongwa district

Farmer's name	Village	Acres owned	Household size			Potential yld kg	Grain req kg	SSSI %	Sorghum var.
			<10 yrs	10-18yrs	adults				
Food insecure farmers									
J. Maganga	Mbande	0	0	0	2	0	730	0	Macia
M. Mgoli*	Sejeli	2.0	4	2	2	400	2,010	20	?
D. Chalinze	Mbande	12.0	1	1	2	300	1,187	25	Pato/Mwekundu
E. Luhungu	Manungu	4.0	4	7	3	1,200	3,745	32	Lug/Wahi
C. Madeha*	Mbande	5.0	4	3	2	1,000	2,284	44	Sila
P. Mziwanda	Manungu	5.0	2	0	2	500	1,096	46	Pato
R. Twalale	Msunjilile	9.0	2	1	2	630	1,370	46	Lug/Wahi
P. Baisilela	Vilundilo	8.0	0	3	2	800	1,552	52	Mtama/Mrefu
S. Chidole	Manungu	10.0	1	1	2	750	1,187	63	Lugugu
E. Lupembe	Msunjilile	5.0	3	1	2	1,000	1,553	64	Mrefu/Macia
G. Mgonela	Manungu	30.0	2	4	2	1,500	2,192	68	Lugugu/Macia
J. Mjilimwa	Mbande	10.0	4	4	5	2,500	3,653	68	Mrefu/Macia
E. Chisawe	Sejeli	10.0	4	4	2	2,000	2,558	78	Mufi/Mfupi
J. Kingamkono	Vilundilo	6.0	2	5	2	2,000	2,466	81	Lugugu
M. Maonezi	Manungu	7.0	2	1	2	1,200	1,370	88	Lug/Macia/Sila
S. Mboutu	Manungu	6.0	1	4	2	1,800	2,009	90	Lug/Hakika
M.Mwikoli	Mbande	8.0	3	3	2	2,000	2,101	95	Macia
M. Murikola	Mbande	8.0	3	3	3	2,400	2,466	97	Wahi/Hakika
Subsistence farmers									
W. Mboutu	Manungu	6.0	3	3	2	2,100	2,101	100	Hakika
J. Semundi	Manungu	36.0	0	6	5	3,600	3,469	104	Lugugu/Hakika
E. Bilinje*	Msunjilile	6.0	3	0	2	1,500	1,279	117	Lugugu
S. Mahinyira	Msunjilile	12.0	5	1	3	3,000	2,284	131	Lugugu
L. Lupembe	Msunjilile	20.0	5	6	3	4,800	3,654	131	Lugugu/Macia
A. Chibada	Sejeli	13.0	3	1	3	2,600	1,918	136	Hakika
M. Chitumai	Sejeli	15.0	7	3	4	4,000	2,835	141	Lugugu
W. Temaunji	Vilundilo	30.0	4	3	7	6,000	4,109	146	Wahi/Mrefu
E. Chitumwai	Sejeli	10.0	2	2	2	2,700	1,644	164	Wahi
R. Ngohola	Msunjilile	10.0	2	0	2	2,000	1,096	183	Macia
R. Lebwanga	Manungu	12.0	3	0	2	2,400	1,279	188	Lugugu/Sila
Food surplus farmers									
J. Lupembe	Msunjilile	20.0	4	2	7	8,000	3,835	209	Lugugu/Macia
N. Madole	Vilundilo	8.0	3	3	2	4,400	2,101	209	Lugugu/Macia
S. Chilingo*	Mbande	20.0	2	2	8	8,000	3,834	209	Lugugu/Macia
J. Mboutu	Manungu	10.0	2	2	2	4,000	1,644	243	Sila/Mrefu
S. Mbalinyi	Vilundilo	5.0	0	0	1	1,000	365	274	Wahi
K. Mchiwa	Manungu	10.0	3	0	2	4,000	1,279	313	Lugugu/Pato
H. Mwenesi	Manungu	10.0	3	0	2	4,000	1,279	313	Wahi
R. Chimarai	Sejeli	8.0	4	2	2	6,400	2,010	318	Lugugu
Y. Chitumwai	Sejeli	80.0	6	4	3	12,000	3,289	365	Lugugu/Macia
S. Senguo	Mbande	5.0	0	0	1	1,500	365	411	Macia
J. Madinda	Mbande	6.0	0	0	2	3,200	730	438	Macia
P. Chimyamapya*	Mbande	16.0	2	1	2	6,400	6,400	467	Wahi
Y. Mwenesi	Manungu	30.0	6	2	2	24,000	2,376	1,010	Lugugu/Wahi
E. Masuonya	Sejeli	20.0	2	2	2	20,000	1,644	1,217	Macia
F. Chilemile	Sejeli	60.0	3	3	2	30,000	2,101	1,427	Macia

Did the message get through?

In October 2007, an impact assessment was conducted amongst 12 farming families who had participated in one or more of the training sessions in Kongwa district. These farmers were selected at random from four villages, namely Manungu, Vilundilo, Mbande and Sejeli. This assessment showed that the key message that had been disseminated during the training sessions: *select your seed in the field, not from the grain heap* had got through to these families. The farmers were also asked to show us their selected and stored seed.

Fig. 15: Sorghum seed storage in Kongwa district

Fig. 15a. Miriam Maonezi's selected sorghum seed stored in airtight plastic bag, tied with string

Fig. 15b. Selected sorghum seed stored in a non-air tight woven bag

Fig.15c. Sorghum seed stored over the kitchen fire in the Mwikoli household

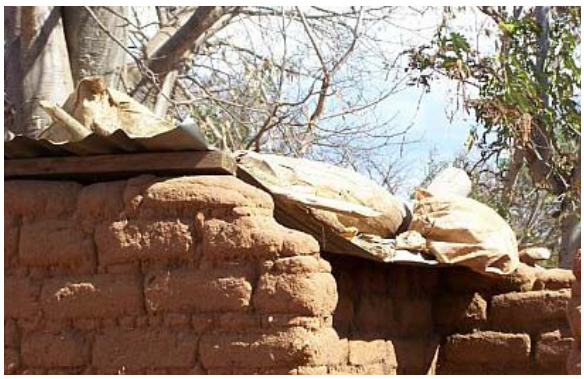


Fig. 15d. The Chitumwayu household's sorghum seed stored in an old grain bag on a hot tin roof

Fig. 15e: Sorghum seed stored directly on top of a thatched roof

It was discovered that the farmers were storing this seed in a variety of ways: either as dried and threshed seeds in sealed or unsealed plastic bags or still attached to the panicle and

placed in trees, on top of tin or thatched roofs or in the rafters above the kitchen fire-place, see Figs 15a-e.

Recommendations for future work

Follow up is needed to determine whether the recommended seed selection and storage methods have had an impact on the incidence of Smut diseases and grain yield amongst the trained farmers in Njombe and Kongwa districts during the 2007-08 cropping season.

Food surplus farmers constituted the largest socio-economic group (44%) of farmers who participated in the GSI training in Njombe district and more than a third (34%) of the farmers who participated in the training in Kongwa district. Future training should focus on farmers from food insecure households as they will benefit most from GSI interventions.

Our observations suggested that seed storage was best in households where women had participated in the training. This is because seed selection and storage is regarded as women's work; therefore the emphasis should be on the provision of women-centred training. Training sessions should be in a venue that is easily accessible to women where informal childcare arrangements, involving the services of older siblings, could be made available.

Analysis of the attendance data shows that more than 50% of farmers were only able to attend one out of three training sessions during the season. This means that most farmers did not receive all the important information that was covered during the training programme. In future a single training session should contain the essential messages, focussing on the fungus' mode of dispersal and the need to select healthy seed in the field. This session should be repeated many times, with the help of extension and NGO field workers, in order to reach thousands of food insecure farmers. Seed selection should be a field activity that is conducted by farmers' groups, just prior to harvest time, with the help of local extension or NGO workers.

Seed storage in air-tight plastic bags or other air-tight containers is recommended in order to prevent pest infestations. However, pests can also be discouraged when seeds are exposed to smoky environments. Drying or storing seed on hot tin roofs will keep it dry and pest-free but may reduce its viability. Farmers should be encouraged to evaluate traditional seed storage methods in a scientific way. For example, a participatory seed germination test could be set up in which the viability of the farmers own stored seeds is compared.

ii) Generating income from the sale of rice seed in Uganda

NERICA rice ("New Rice for Africa") was developed by the Africa Rice Centre, WARDA as a new high yielding, early maturing variety, which is adapted to the rain-fed conditions of tropical Africa. To date, three NERICA rice varieties have been released for production. Since Uganda is aiming to be self-sufficient in rice in order to feed school children and urban dwellers, there is huge demand for increased seed supplies for this crop. This has created a highly lucrative marketing opportunity for thousands of smallholder farmers, since Uganda currently has regulations in place which allow the sale of quality-assured seed. The Bakusekamajja Women's Development Association were keen to be amongst the first to benefit from this opportunity.

Bakusekamajja Women's Development Association, Iganga district

This Association has 453 members, 400 of whom are women farmers. The Association enables farmers to share their skills and also buy inputs and sell produce as a group, in order to save on transport and other costs. These farmers have been selling maize seed to seed companies, notably Victoria Seed Company, for several years and, as a result, have created a great deal of donor interest. The Association is using some of the profits that are generated from seed sales to build secure seed and grain storage structures. These buildings are situated on the road-side, close to the Chairwoman's house.

Learning how to produce, select and market NERICA rice seed

In order to help farmers meet the demand for NERICA rice seed and to provide them with an income generating opportunity, scientists from NaCRRI conducted a pilot 'training of trainers' course, consisting of three monthly training sessions with 21 mainly women farmers, who were selected from the Bakusekamajja Women's Development Association. The training programme was in three parts: the first session covered land preparation and planting and was conducted at the research station, the second covered crop management in the field (see Fig 16) and the third covered seed selection and post harvest processing.

Fig.16: Trainees learning how to select good rice seed in Iganga district

At the beginning of the rainy season each of the trainees were provided with 5 kg of NERICA rice seed, sufficient for a 0.5 acre (0.2ha) plot. They were obliged to purchase inputs such as fertiliser and pesticide and pay for any labour that was required for land preparation, planting and harvesting, at a rate of Ush3,000 (€1.14) per day. Each training session was conducted in time for the activities described to be implemented in the field. The rice seed that was harvested was sold to the Bakusekamajja Women's Association.

Did the farmers make a profit?

At the end of the season, each of the participants was asked to provide information concerning her rice seed yield, input costs, and the amount of seed sold to the Association. This information indicated that the farmers had harvested between 210 and 670kg of NERICA rice seed per 0.5 acre plot (504-1,608kg/ha). Most of them retained a small portion of seed for their own use, then sold the rest to the Bakusekamajja Women's Association, who paid Ush500 (€0.20) per kg for this seed. The Association was planning to sell the rice seed

Table 15: Comparative food security and profitability of NERICA rice seed production for farmers in Iganga district

Name	Village	Land owned acres	Household size			Maize								
			0-10yrs	10-18yrs	Adults									

to Victoria Seed Company at Ush700 (€0.28) per kg. Unfortunately the average cost of production was very high, at Ush162,760 (€65.46) per 0.5 acre plot and, as a result, nine of the farmers (highlighted in red in Table 15) made losses ranging from Ush-8,000 to -117,600 (€-3.22 to –47.30, an average of loss of €-3.18). The mean overall profit was Ush7,915 (€3.03) while the highest profit, earned by just two farmers (highlighted in yellow in Table 15) who had obtained the highest rice seed yields, was Ush147,000 or €56. The Association will make a total profit of Ush1,365,400 or €549.16, when the seed is sold to the local seed company, see Table 15.

Fig. 17: Musa Kasoone standing in his NERICA rice seed plot

Musa Kasoone, who was one of the farmers that attended the pilot training course (see Table 15) said he was very disappointed with the income of Ush17,400 (€7) that he received for his rice seed. He reported that the price that the Association paid to the farmers had been decided by a committee, but no account had been taken of the high cost of inputs. He said that he and the other seed producers will negotiate for a higher price next time and requested additional training in record-keeping for all farmers in the group.

Food security in Iganga district

Each farmer who participated in the training provided information relating to her household's maize SSI (since maize is the staple food crop in the area). Nine out of the 21 households who participated in the training were not food secure and had maize SSI's of less that 100%, four of the households were able to subsist on their annual maize harvest (SSI= 100-200%) while eight were food surplus farmers, reaping up to five times their annual grain requirement, see Table 15. It is of serious concern that three of the food insecure farming families made financial losses from producing NERICA rice seed.

Spreading the message

Each of the trained farmers is now passing on her new skills to at least ten more neighbouring farmers, such as Tabisa Babigumira, pictured in Fig. 18, who was hoping to harvest her first NERICA rice seed in December 2007. These new rice producers will, in turn, train ten more farmers until all 453 members of the association have been trained.

Fig. 18: Tabisa Babigumira and baby in her NERICA rice seed plot

The NaCRRI scientists have also made a series of FM broadcasts to inform farmers across Uganda of the benefits of rice seed production, in six local languages, see Fig 19. A total of four training modules were covered. Each module lasted 30 mins and one module was broadcast each week. The full programme was repeated three times during the rice growing season and took a total of three months. Listeners were invited to phone in with questions following each of the broadcasts.

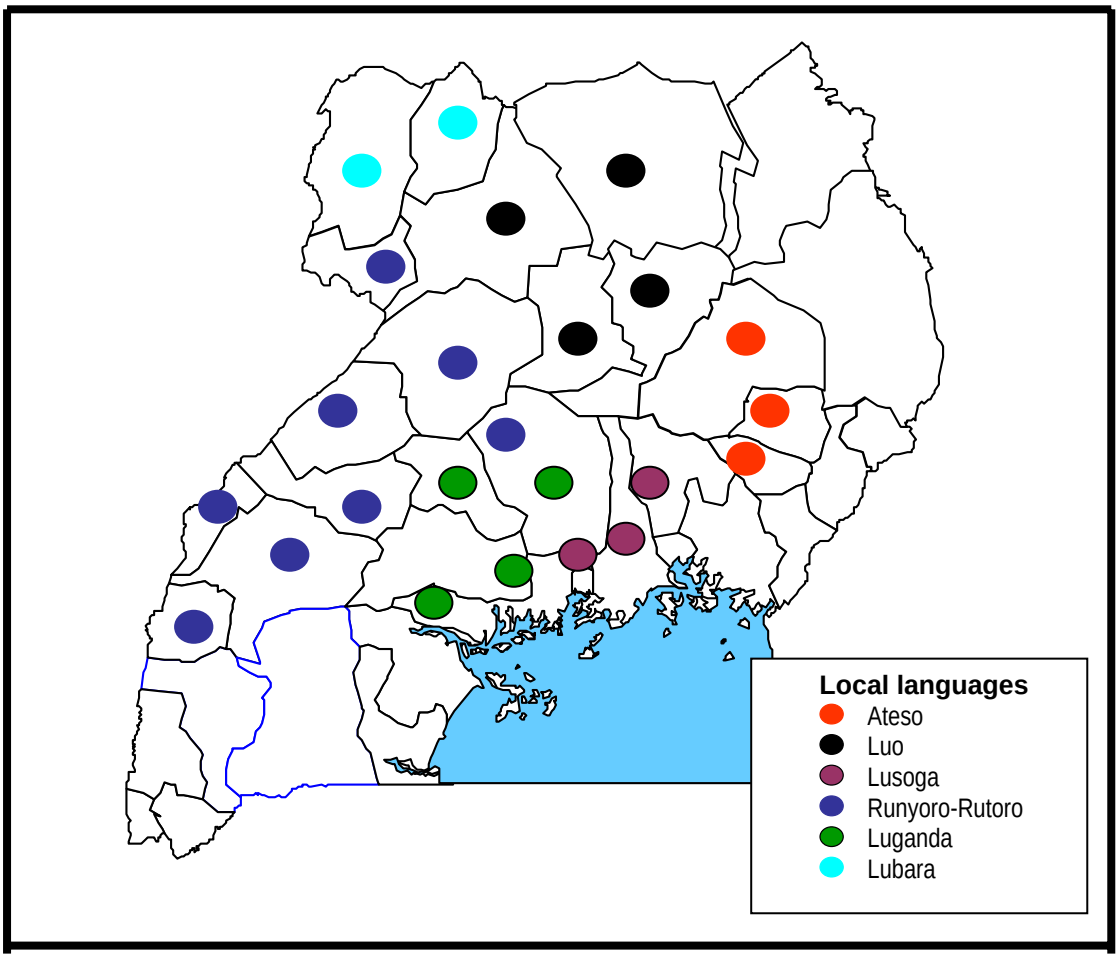
These broadcasts generated keen interest from farmers and NaCRRI scientists reported that at least 20 people had rung the radio station during the

discussion part of each broadcast, mainly asking about rice agronomy and where they could buy and sell NERICA seed, see Table 16. Several farmers took the trouble to travel to the zonal research station, following the broadcast in Luo, in order to ask scientists questions regarding the availability of NERICA rice seed and how to go about becoming a quality assured seed producer. A random sampling of radio listeners in markets and at bus stops indicated that the programmes were extremely popular, with around 50% of them having heard at least one. Several farmers stated that they had bought seed from a local seed company and started growing rice for the very first time, after hearing the programmes.

Table 16:
Some questions and answers during the Ateso radio broadcast on rice seed production

Farmers' questions	Answers from scientists
How can we control birds and rats?	• Cooperate with neighbouring farmers and plant in blocks so that bird damage can be easily controlled. • Prompt weed management. • Slash down surrounding bushes.
How long do the new rice varieties take to mature?	Most varieties mature between 100-120 days
What are the advantages of drilling seed compared to broadcasting it?	• Easy to weed, when crop is in rows. • Uses less seed. • Makes inspection and rouging easy
Is there assured market for NERICA rice?	There is a ready market for both milled rice and rice seed because they are new and preferred but currently insufficient seed is available.
How can we access the new rice seed?	Farmers should be organized in groups before they can get foundation seeds
How can we mill the rice after producing it?	Group action can raise resources and lobby for funds to buy mills

Fig. 19: Rice seed information broadcasts via FM radio: Coverage in Uganda



Recommendations for future work

Nine out of 21 farmers made a loss from producing NERICA rice seed, using recommended inputs. This number would have been reduced to seven if the farmers had sold their seed directly to the seed company. In this case the average profit would have been Ush76,165 (€29.17) a mean return on investment of just 0.5, see Table 19, page 33. Considering that the cost of labour in Iganga district is Ush3,000 per day, all of the farmers would have made a much larger profit if they had worked as labourers for three months, instead of producing rice seed.

The cost of labour for land preparation, planting and weeding in Iganga was said to be USh1,000 more than labour costs in other areas of Uganda. This is due to serious labour shortages in the area as a result of young people moving to the towns, where there are better job opportunities. Farmers could reduce the need for hired labour by growing rice seed in smaller, plots that could be managed by family labour.

The cost of inputs is approximately the same for rice grain and rice seed production, and yet the yield from seed crops is at least 40% less than that of grain crops, due to the wider spacing that is recommended for the seed crop. Extra management practises are also required to ensure that the rice seed is not contaminated with weed seeds or off-types. The selling price for rice grain is Ush400 per kg whereas for rice seed it is Ush700 per kg. Farmers need to be fully aware of the comparative input costs and rates of return for rice grain and rice seed before they can make informed choices when it comes to selecting the most profitable crop that can be grown for cash. The NaCRRI scientists can contribute to this awareness by experimenting with different input regimes for rice seed production to determine which is the most cost-effective input strategy, i.e the one that gives the highest rate of return on investment for resource-poor farmers.

iii) Improving out-grower seed production in Kenya

Seed production in Kenya is regulated by an act of Parliament which controls the bartering, exchange and sale of seed and restricts the right to deal in seed to commercial organisations that have modern seed testing and packaging facilities. The system is regulated by the Kenya Plant Health Inspectorate (KEPHIS) who are responsible for inspecting all seed crops in the field. Farmers and seed companies are obliged to pay for this service. For small farmers this charge is Ksh300 per crop. It is not possible therefore for Kenyan farmers to sell quality-declared or truthfully labelled seed. This means that smallholder farmers must be employed as "out-growers" by commercial seed companies before they can benefit financially from seed production.

There are two main seed companies that operate out-grower schemes in the Rift Valley; these are the Kenya Seed Company and the East African Seed Company. Farmers must agree and sign contracts with one of these seed companies before they are provided with sufficient seed of a particular crop variety for plots ranging from 0.25 to 2 or more acres. Pesticides may also be provided as part of a seed producer's package. Many of the out-growers reported that they were being paid too little by the seed companies in relation to the cost of the inputs (fertiliser and pesticides) and the amount of labour that is needed to produce the high quality seed that is required by seed inspectors. Farmers also complained that their crops are frequently rejected by the seed company due to pest and disease problems and as a result they receive almost nothing for the crop.

Nevertheless farmers in the Rift Valley are keen to attempt to gain a cash income from seed production and regularly sign contracts with one of the seed companies. In Bungoma district during the 2007 season, the Kenya seed company was offering to buy green gram for Ksh60 and cowpea for Ksh40 per kg of inspected seed. Large quantities of green gram and cowpea seed are required by the Kenyan government in order to provide seed relief for farmers in more drought-prone areas of the country. The Kenya Seed company was also paying Ksh250 for red pepper and Ksh180 per kg for eggplant seed. The East African Seed Company was paying Ksh275 for eggplant seed at this time. In Molo district farmers were being offered Ksh100 per kg for Kale seed and Ksh50 per kg for pea seed by local seed companies.

Fig. 20: Daniel Karanja facilitating an out-growers' training session in Malakisi

Learning how to improve seed quality in Bungoma district

GSI worked with local KEPHIS seed inspectors in order to provide training in seed production, selection and processing for two groups of more than 50 out-growers in Bungoma district during the 2007 growing season, in an effort to improve seed quality and reduce the number of crop rejections. The first training session, in April, focused on agronomic practises relating to the production of high quality seed. The August session, was concerned with the management of pests in the field and in storage. The farmers were also given the opportunity of discussing issues surrounding contract negotiation with representatives of the local seed companies. During the last session, in October, farmers participated in an exercise

which enabled them to calculate the amount of profit that they were making from seed production.

Food security in Bungoma district

The average household in Bungoma district consists of 3 adults and 4 children, while the average landholding is 2.6 acres, with more than a third of households owning less than 2 acres. Considering that the average maize yield in this district is 900kg per acre (2,160kg/ha) many households are unable to be self-sufficient in maize for the whole year: 48% of a sample of 27 farmers who attended the final training session were from food insecure households (MSSI<100%) while 45% were from self-sufficient (MSSI=100-200%) and only 7% were from food surplus households (MSSI>200%) see Table 18. The food insecure farming families can either earn money as labourers at a rate of Ksh50 (€0.50) per day or produce cash crops, such as seed, in order to raise sufficient funds to buy the amount of maize meal required to cover their household's food deficit, at a cost of Ksh1,650 per 90kg bag.

Did the farmers make a profit?

The results of this record-keeping exercise indicated that it is extremely difficult for farmers to make a worthwhile profit from producing either cowpea or green gram seed: Although only one farmer had made a loss of Ksh1,370, nine out of 11 cowpea seed producers and four out of six green gram seed producers earned less than Ksh6,000 (€62) following the three-month cropping season. This is less than the amount that a husband and wife could have earned from labouring on neighbouring farms for the same period. Furthermore, only two of the food insecure farmers had made sufficient profit from seed production to cover the cost of buying the amount of maize needed to eliminate their household's food shortfall, see Table 18.

Farmers (highlighted in yellow in Table 18) who made worthwhile profits of more than Ksh18,000 (€186) had each taken advantage of the high price of Ksh275/kg being paid for eggplant seed by the East Africa Seed Company and Ksh250/kg being paid for red pepper seed by the Kenya Seed Company.

The out-growers' cowpea yields ranged from 95 to 300kg per acre and their green-gram yields ranged from 180-300kg per acre, while their eggplant yields ranged from 45 to 188kg per acre. Expected yields quoted by the seed companies are 600kg per acre for cowpea, 550kg per acre for green-grams and 180kg for eggplant var. Long Purple. The mean farmers' production costs for cowpea, green gram and egg plant are compared in Table 17. The mean total production cost for cowpea is Ksh4,596 per acre, that for green gram is Ksh7,540 per acre, while that for eggplant is Ksh12,521 per acre. Additional costs could be incurred due to the need to rent land (@ Ksh1,500-3,500 per acre) purchase sacks or hire transport. The mean return on investment for cowpea seed was thus 0.7, see Table 19, page34. This rate of return would have been 4.2 if the expected yield had been achieved.

Table 17: Mean farmers' production costs per acre (Ksh) for 3 different seed crops

Seed crop	Seed	Land preparation	Planting	Weeding	Fertiliser	Pesticides	Harvesting, threshing, winnowing	Inspection
Cowpea	188	974	377	647	529	860	721	300
Greengram	125	1,397	418	890	1,795	1,588	1,027	300
Egg plant	216	3,952	1,048	1,500	1,800	2,276	1,429	300

Our data suggests that recommended inputs, such as fertilisers and pesticides, are failing to provide out-growers in Bungoma district with the expected yield increases. Possible underlying causes of this problem are suggested at the end of this section.

Table 18: Profitability of contract seed production in Bungoma district

Farmer name	Village	Acres owned	Potential maize yield kg	Household size			Grain req. kg	MSSI %	Maize shortfall cost Ksh	Seed type	Area covered acres	Production costs Ksh	Income. Ksh	Profit/ Loss Ksh	Covered maize shortfall?
				adults	10-18 yrs	<10yrs									
Food insecure farmers															
B. Sudu	Ataba-obur	0	0	2	2	4	2,010	0	36,795	cow pea	0.6	10,020	14,000	3,980	no
P. Boya	Korosiondet	0.1	90	2	1	4	1,736	5	30,195	cow pea	1.0	4,500	8,400	3,900	no
S. Csabinu	Ataba-obur	1.5	1,350	3	5	6	3,563	38	40,572	greengram	1.5	10,760	19,200	8,440	no
H. Osilong	Malakisi	1.5	1,350	4	2	6	3,106	44	32,175	eggplant	1.0	6,595	8,100	1,505	no
J. Chemorior	Korosiondei	1.0	225	2	2	3	1,821	49	29,370	cow pea	0.25	1,870	3,280	1,410	no
O. Munyanya	Malakisi	2.0	1,800	4	2	6	3,106	58	23,925	red pepper	1.0	19,160	37,500	18,340	no
P. Munika	Bulukha	1.0	900	2	0	4	1,462	62	10,230	greengram	1.0	9,350	10,800	1,450	no
D. Obusie	Ataba-obur	3.0	2,700	3	4	11	4,204	64	27,390	greengram	1.5	11,020	18,000	6,980	no
W. Tom	Bulukha	2.0	1,800	4	4	1	2,739	66	17,160	cow pea	0.25	3,720	7,200	3,480	no
P. Ojilongo	Malakisi	1.5	1,350	2	2	4	2,010	67	12,045	eggplant	0.5	4,645	8,100	3,455	no
Catherine Atii	Katakwa	2.0	1,800	2	4	1	1,997	90	3,630	greengram	1.0	6,640	12,000	5,360	yes
J. Masika	Bulukha	2.0	1,800	3	2	2	2,009	90	3,795	cow pea	1.0	4,920	8,400	3,480	no
G. Omase	Ataba-obur	1.5	1,350	2	0	4	1,462	92	1,980	greengram	1.5	5,900	15,000	9,100	yes
Subsistence farmers															
L. Wacuka	Linanlany	3.0	2,700	4	2	2	2,374	114	0	greengram	1.0	11,860	18,000	6,140	n/a
S. Baraza	Kawalun	3.0	2,700	2	4	3	2,375	114	0	cow pea	1.0	5,960	6,000	40	n/a
S. Otwani	Rwatama	3.0	2,700	2	3	4	2,284	118	0	eggplant	0.25	6,295	10,800	4,505	n/a
S. Odeke	Korosiondet	1.5	1,350	2	0	2	1,096	123	0	cow pea	2.0	5,370	16,880	11,510	n/a
D. Cherop	Korosiondet	1.5	1,350	2	0	2	1,096	123	0	cow pea	1.5	3,680	12,640	8,960	n/a
C. Kisach	Korosiondet	3.8	3,420	3	4	3	2,740	125	0	cow pea	1.0	7,540	8,400	860	n/a
F. Chembe	Korosiondet	2.5	2,250	1	2	4	1,645	137	0	cow pea	1.0	3,190	3,800	610	n/a
J. Chemengu	Korosiondet	4.5	4,050	3	4	2	2,545	159	0	cow pea	0.25	3,780	7,600	3,820	n/a
B. Odeke	Korosiondet	2.0	1,800	2	0	2	1,096	164	0	eggplant	0.8	5,983	33,000	27,018	n/a
R. Wepukhulu	Bulukha	2.4	2,160	2	0	3	2,160	169	0	cow pea	2.4				n/a
M. Ake Mayo	Katomei	4.0	3,600	2	2	4	2,010	179	0	cow pea	1.0	4,580	12,000	7,420	n/a
J. Okapes	Tamulega	2.0	1,800	2	0	1	913	197	0	cow pea	0.25	2,330	960	-1,370	n/a
Food surplus farmers															
B. Mouhisi	Korosiondet	2.5	2,250	2	0	2	1,096	205	0	cow pea	1.0	4,920			n/a
W. Enyota	Okimaru	15.0	13,500	3	0	2	1,461	924	0	eggplant	0.25	3,430	5,310	1,880	n/a

Learning how to improve seed quality in Molo district

The out-growers in Molo district were growing either peas or kale as seed crops, with some farmers having sufficient land to produce both crops. Again the GSI provided support to KEPHIS field staff in their endeavours to provide training which would lead to improvements in the quality of this seed. Three training sessions were conducted in which seed certification and seed selection, in addition to pest identification and management, were discussed.

Food security in Molo district

Farmers in Molo district are fortunate in that the local soils are more fertile and, with the use of recommended fertilisers, they are able to obtain maize yields of 1,800kg per acre (4,320kg/ha). As a result the majority of farming families produce maize that is surplus to requirements, considering their landholdings and household size (MSSI>200%). Only 12% of farmers who participated in the training were food insecure (MSSI<100%) while 21% were subsistence farmers (MSSI=100-200%). Many of the farmers in this study had each recently been re-settled on five acres of land and this has led to violent clashes between the indigenous farmers and the re-settled farming families.

Did the farmers make a profit?

The Molo farmers also took part in a record-keeping exercise; however, this exercise could not be completed by November 2007 as their seed crops were not yet ripe. Unfortunately serious political violence broke out in Molo just as the crops were about to be harvested at the end of December. One of the farmers reported (via his mobile phone, from a refugee camp) that most of the seed crops had been destroyed and he and his colleagues were trying to salvage what they could in the presence of hired security guards. This farmer estimated that his pea yield would have been 500kg per acre and his kale yield would have been 700kg per acre, while harvesting and processing costs would have been approximately Ksh5,000 per acre under normal conditions. Table 20 shows the amount of profit that the Molo out-growers would have made based on this information. These results suggest that pea seed production is not profitable, while kale seed production could realise a mean profit of Ksh45,395 (€466) per acre. This is more than three times the amount that a husband and wife could earn as labourers, during the seven months that it takes to produce kale seed and a return on investment of 2.5, see Table 19.

Table 19: Comparative return on investment for four different seed crops

Seed Crop	Mean input costs per ha	Mean profit per ha	Mean return on investment per ha
Wheat in Bangladesh	Tk17,538	Tk68,013	3.9
Kale in Kenya	Ksh45,000	Ksh111,000	2.5
Cowpea in Kenya	Ksh5,087	Ksh3,538	0.7
Rice in Uganda	Ush813,800	Ush380,825	0.5

Recommendations for future work

The data that was collected from out-growers in Bungoma and Molo districts indicates that these farmers are not getting the expected seed yields from cowpea, green gram and peas, despite applying recommended inputs. Out-growers are obliged to use high levels of expensive chemical inputs in order to comply with the strict standards set by government and enforced by seed inspectors. Chemical inputs such as pesticides and fertilisers are supposed to exclude a wide range of pests and diseases and maximise crop yields. However, smallholder farmers do not normally have access to reliable soil testing and pest identification services, and this has serious implications for the profitability of out-grower seed production. For example many local soils are acidic and require the application of large amounts of lime in order to increase pH and release the applied nutrients to growing plants. Lime is an extremely bulky and heavy soil amendment and is very expensive to transport to remote rural areas. Many soils are also deficient in organic matter and certain micro-nutrients as a result

of continuous cropping and use of NPK fertilisers. Only regular soil testing and the application of organic soil amendments and synthetic micro-nutrients can address this problem. The resources necessary to implement such practises are unavailable to most smallholder farmers.

Furthermore, many of the recommended pesticides are highly toxic and require the use of expensive and uncomfortable safety equipment, such as overalls, rubber boots, gloves, masks or respirators. The cost of this equipment is beyond the means of most smallholder farmers. There is also evidence that farmers, who have not received adequate IPM training, see all insects as potential pests because they are unable to distinguish between damaging pests, harmless insects or natural enemies. These farmers will apply pesticides regularly and indiscriminately, regardless of the threat, to ensure that their crops are not condemned by visiting seed inspectors. Such excessive use of pesticides is leading to the loss of natural enemies and the build up of pests that are resistant to pesticides in some areas. Farmers in these areas complain that their pesticides are no longer effective and respond by increasing the application rate or by spraying mixtures of two or more pesticides (see Fig. 21) thus compounding the problem.

Fig.21: Bungoma farmer preparing to spray a mixture of 2 pesticides

The above constraints mean that recommended fertilisers and pesticides are unlikely to provide the intended outcome as far as increased yields and improved pest management are concerned. This makes out-grower seed production an extremely risky business for resource-poor, often food insecure, smallholder farmers. Furthermore, out-growers are subject to what may be unwitting exploitation by seed companies because they do not keep records and consequently quickly loose track of all the expenditures that they incur on inputs (especially when they are supplied on credit) and labour costs throughout the season. Unfortunately, these farmers regard all the income that they receive from seed companies as profit. It is of great concern that out-growers have reported that some seed companies have threatened to cease doing business in their area once they have been trained, because they know "too much".

Implementation of the following recommendations will make out-grower seed production more sustainable and lead to increased profitability for resource-poor farmers:

- Seed companies should ensure that the price that is paid to out-growers takes into account smallholder production costs in less fertile areas.
- Seed inspectors should supply a list of prohibited pests and seed-transmitted diseases for each crop to assist farmers in their choice of pest management methods.
- IPM should be promoted as a safer, cheaper and more environmentally-friendly alternative to the continuous use of toxic pesticides.
- Seed companies should provide a soil testing service to help farmers manage soil fertility and make more judicious use of fertilisers.
- Farmers should be encouraged to form groups so that they can purchase inputs in bulk, share transport costs and negociate fairer prices.
- Agrochemical companies should not regard out-grower schemes as an opportunity for selling more fertilisers and pesticides.

Table 20: Estimated profitability of pea and kale seed production in Molo

Name	Village	Seed type	Area acres	Input costs Ksh		Expected yield kg/plot	Estimated income Ksh	Estimated profit/ Ksh	Equivalent in Euros
				Land prep	Harvesting*				
Farmers who made a loss									
J Wachira	Temoyetta	Peas	1	27,500	5,000	500	25,000	-7,500	-74.80
J Kimani	Temoyetta	Peas	1	23,560	5,000	500	25,000	-3,560	-35.50
P Murango	Temoyetta	Peas	3	62,000	15,000	1,500	75,000	-2,000	-19.95
J Barus	Baringo	Peas	2	41,060	10,000	1,000	50,000	-1,060	-10.57
Farmers who made a profit that was less than the amount that they could have earned if they had been labourers									
P Nderi	Temoyetta	Peas	1	27,560	5,000	700	35,000	2,440	24.33
J Ngure	Temoyetta	Peas	1	16,650	5,000	500	25,000	3,350	33.41
L Githaiga*	Temoyetta	Peas	1	16,630	5,000	500	25,000	3,370	33.61
J Rimiru	Temoyetta	Peas	1	15,930	5,000	500	25,000	4,070	40.59
D Wanjuki	Temoyetta	Peas	1	15,800	5,000	500	25,000	4,200	41.89
J Mwangi	Temoyetta	Peas	1	15,530	5,000	500	25,000	4,470	44.58
M Nganga*	Temoyetta	Peas	1	14,730	5,000	500	25,000	5,270	52.56
Farmers who were expected to make a worthwhile profit									
P Murango	Temoyetta	Kale	1	42,930	5,000	700	70,000	22,070	220.10
J Wamboi*	Temoyetta	Kale	0.5	7,445	2,500	350	35,000	25,055	249.87
D Mburu	Temoyetta	Kale	1	28,800	5,000	700	70,000	36,200	361.02
J Wachira	Temoyetta	Kale	1	28,150	5,000	700	70,000	36,850	367.51
P Maingi	Rwangondu	Kale	1	24,050	5,000	700	70,000	40,950	408.39
J Kiarii	Temoyetta	Kale	1	23,270	5,000	700	70,000	41,730	416.17
P Waweru	Temoyetta	Kale	1	22,750	5,000	700	70,000	42,250	421.36
G Ngugi	Temoyetta	Kale	1	22,250	5,000	700	70,000	42,750	426.35
J Wamahia	Mawihgu	Kale	1	20,650	5,000	700	70,000	44,350	442.30
J Ngure	Temoyetta	Kale	1	20,550	5,000	700	70,000	44,450	443.30
W Mwangi	Temoyetta	Kale	1	19,980	5,000	700	70,000	45,020	448.98
R Nguku	Temoyetta	Kale	1	19,970	5,000	700	70,000	45,030	449.08
P Nganga	Rwangondu	Kale	1	18,750	5,000	700	70,000	46,250	461.25
P Karomo	Rwangondu	Kale	1	18,750	5,000	700	70,000	46,250	461.25
J Mungai	Temoyetta	Kale	1	18,750	5,000	700	70,000	46,250	461.25
S Thuku	Temoyetta	Kale	1	18,750	5,000	700	70,000	46,250	461.25
P Ndurou	Temoyetta	Kale	1	18,750	5,000	700	70,000	46,250	461.25
L Githaiga*	Temoyetta	Kale	1	18,550	5,000	700	70,000	46,450	463.25
E Waitiki	Temoyetta	Kale	1	17,750	5,000	700	70,000	47,250	471.22
L. Wanjiru	Temoyetta	Kale	1	19,380	5,000	700	70,000	45,620	454.97
S Karanja	Baringo	Kale	1	17,320	5,000	700	70,000	47,680	475.51
P Nguku	Temoyetta	Kale	1	17,220	5,000	700	70,000	47,780	476.51
J Rimiru	Temoyetta	Kale	1	15,230	5,000	700	70,000	49,770	496.36
B Muthoga	Temoyetta	Kale	1	14,430	5,000	700	70,000	50,570	504.33
J Mwangi	Temoyetta	Kale	1	14,120	5,000	700	70,000	50,880	507.43
M Nganga*	Temoyetta	Kale	1	12,350	5,000	700	70,000	52,650	525.08
M Kamau	Rwangondu	Kale	2	72,800	10,000	1,400	140,000	57,200	570.46
D Wanjuki	Temoyetta	Kale	1.5	33,300	7,500	1,050	105,000	64,200	640.27
J Njenga	Kentoiletty	Kale	2	62,800	2,400	1,400	140,000	74,800	745.98
D Ngugi	Temoyetta	Kale	2	49,080	10,000	1,400	140,000	80,920	807.02
J Mjoroge	Temoyetta	Kale	2	48,900	10,000	1,400	140,000	81,100	808.81
M Nyaguthi*	Temoyetta	Kale	2	48,848	10,000	1,400	140,000	81,152	809.33
J Njoroge	Temoyetta	Kale	2	47,850	10,000	1,400	140,000	82,150	819.28
J Kinyua	Temoyetta	Kale	2	45,198	10,000	1,400	140,000	84,802	845.73
J Chege	Temoyetta	Kale	2	38,260	10,000	1,400	140,000	91,740	914.92
S Kimani	Temoyetta	Kale	2	37,600	10,000	1,400	140,000	92,400	921.51
M Kimani	Temoyetta	Kale	2	37,500	10,000	1,400	140,000	92,500	922.50
P Rugame	Baringo	Kale	2	37,260	10,000	1,400	140,000	92,740	924.90
J Muiru	Temoyetta	Kale	2	37,260	10,000	1,400	140,000	92,740	924.90
R Mwangi*	Temoyetta	Kale	2	37,260	10,000	1,400	140,000	92,740	924.90

Name	Village	Seed type	Area acres	Input costs Ksh		Expected yield kg/plot	Estimated income Ksh	Estimated profit/ Ksh	Equivalent in Euros
				Land prep	Harvesting*				
J Mwangi	Temoyetta	Kale	2	34,960	10,000	1,400	140,000	95,040	947.83
M Kihiuhi	Temoyetta	Kale	2	33,650	10,000	1,400	140,000	96,350	960.90
J Wachira	Rwangondu	Kale	2	30,420	10,000	1,400	140,000	99,580	993.11
J Njongoro	Temoyetta	Kale	2	30,200	10,000	1,400	140,000	99,800	995.31
J Barus	Baringo	Kale	2	29,340	10,000	1,400	140,000	100,660	1,003.88
J Macharia	Rwangondu	Kale	2	33,600	5,000	1,400	140,000	101,400	1,011.26
S Karuri	Ngarua	Kale	2	28,600	10,000	1,400	140,000	101,400	1,011.26
M Wanjiru	Temoyetta	Kale	2	28,240	10,000	1,400	140,000	101,760	1,014.85
P Thuku	Temoyetta	Kale	2	27,840	10,000	1,400	140,000	102,160	1,018.84
P Githinji	Temoyetta	Kale	2	27,276	10,000	1,400	140,000	102,724	1,024.47
W Kinu	Temoyetta	Kale	2	23,980	10,000	1,400	140,000	106,020	1,057.34
J Boro	Temoyetta	Kale	2	25,590	5,000	1,400	140,000	109,410	1,091.15
J Kaguvi	Rwangondu	Kale	3	84,400	15,000	2,100	210,000	110,600	1,103.01
M Mbara	Baringo	Kale	2	18,500	10,000	1,400	140,000	111,500	1,111.99
G Njuguna	Githiringa	Kale	4	146,800	20,000	2,800	280,000	113,200	1,128.94
D Mungai	Temoyetta	Kale	2	12,940	10,000	1,400	140,000	117,060	1,167.44
S Njoroge	Baringo	Kale	4	133,420	20,000	2,800	280,000	126,580	1,262.38
G Gachini	Temoyetta	Kale	4	132,620	20,000	2,800	280,000	127,380	1,270.36
M Njoka	Temoyetta	Kale	3	56,400	15,000	2,100	210,000	138,600	1,382.26
J Kihenja	Temoyetta	Kale	3	65,700	5,000	2,100	210,000	139,300	1,389.24
P Kamau	Rwangondu	Kale	4	73,700	5,000	2,800	280,000	201,300	2,007.56
D Kanyord	Baringo	Kale	7	134,300	35,000	4,900	490,000	320,700	3,198.34

3. GSI and National Seed Policies

Good seed is a basic commodity that the poorest farmers can use to generate income. However, the GSI has highlighted major contradictions between the seed policies that are being implemented by some countries and international agreements that uphold farmers' rights as guardians and beneficiaries of genetic diversity, including seed:

i) The United Nations Convention on Biological Diversity

At the 1992 Earth Summit in Rio de Janeiro, world leaders agreed on a comprehensive strategy for "sustainable development" -- meeting our needs while ensuring that we leave a healthy and viable world for future generations. One of the key agreements adopted at Rio was the *Convention on Biological Diversity* (CBD). This pact among the vast majority of the world's governments sets out commitments for maintaining the world's ecological underpinnings as we go about the business of economic development. The Convention establishes three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources.

Bangladesh, Kenya, Tanzania and Uganda are amongst 189 countries that are parties to this Convention which they went on to ratify in September 2003. This means that all policies and legislation that has been enacted in these states since 2003 must support the goals of the CBD.

The CBD is highly relevant to national and regional seed policy as it is concerned with the conservation of traditional crop varieties and landraces which will ensure future food security both nationally and globally and several of its Articles relate to access and control of indigenous seed:

The CBD recognises the sovereign rights of states over their biological and genetic resources (Art 3 and 15) stipulating that access to genetic resources can only occur on mutually agreed terms and with the prior and informed consent of states (Art 15.5); it stresses the need to harmonise national programmes and policies with the aims of the CBD (Art 6a and b); requires signatories to protect and promote the rights of communities, farmers and indigenous peoples concerning the customary use of biological resources and knowledge systems to promote *in situ* conservation (Art 8j and 10); emphasises the need to regulate GMOs (Art 8g); defends an effective protection of intellectual property rights (Art 16.2) that enables developing countries, which provide genetic resources, to have access to technology which makes use of those resources, on mutually agreed terms, including technology protected by patents and other intellectual property rights (Art 16.3); requires the equitable sharing of benefits arising from the commercial use of communities' biological resources and local knowledge (Art 15.7); asserts that intellectual property rights must be supportive of and not run counter the objectives of the CBD (Art 16.5) and requires the sustainable use of the components of biodiversity and the protection of customary use, i.e. farming activities in cooperation with the private sector (Art 10 c and e)

Selected parts of Articles from the UN CBD that relate to access and control of seed

Article 6. General Measures for Conservation and Sustainable Use

Each Contracting Party shall, in accordance with its particular conditions and capabilities:

(a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting Party concerned; and

(b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

Article 8. In-situ Conservation

Each Contracting Party shall, as far as possible and as appropriate:

(g) Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health;

(j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;

(k) Develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations;

Article 10. Sustainable Use of Components of Biological Diversity

Each Contracting Party shall, as far as possible and as appropriate:

(a) Integrate consideration of the conservation and sustainable use of biological resources into national decision-making;

(b) Adopt measures relating to the use of biological resources to avoid or minimize adverse impacts on biological diversity;

(c) Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements;

(e) Encourage cooperation between its governmental authorities and its private sector in developing methods for sustainable use of biological resources.

ii) Farmers' Rights and TRIPS

One of the central agreements of the World Trade Organisation (WTO), the *Agreement on Trade-Related Aspects of Intellectual Property Rights* (TRIPS), obliges its member states to adopt either patents, a *sui generis* system, or a combination of both, for the protection of new plant varieties. The patenting of living organisms or their parts or components means legally granting private monopoly control rights over them and over their offspring.

Aware of the need in Africa for an IPR protection system that is compatible with WTO regulations yet that reflects and protects the essential nature of Africa's rich diversity of

cultures so that Africans can continue to evolve, thrive and give all of humanity the services they have been giving it with respect to the conservation and sustainable use of its biodiversity, the Organisation for African Unity provided in 1999 a model legislation for the protection of the rights of local communities, farmers and breeders and for the regulation of access to biological resources, and invited the 53 member states to use it as a framework for the elaboration of national IPR legislations. Major elements of the AML are:

- The right of a community to their biological resources, traditional knowledge and technologies over rights based on individual or corporate monopoly interests.
- The right of African states and people to ensure the conservation, evaluation and sustainable use of their biological resources, traditional knowledge and technologies, and to govern access to them.
- The right of local communities to have access, use, exchange or share their biological resources as established by customary law and practice.
- The right of African states to protect farmers' rights and community intellectual property to biological resources according to customary law and practice.
- The right to forbid the patenting of life in any of its forms.

In June 1998, at the 68th session of the OAU in Ouagadougou, ministers formally adopted a Model Law for the protection of the rights of local communities, farmers and breeders and for the regulation of access to biological resources (AML) and recommended its use to all member governments.

In July 1999 the African Ministers of Trade, by mouth of the Kenyan minister, registered at the WTO the *African Common Position* demanding that a *sui generis* system of protection of new plant varieties should include systems that protect the rights of communities and that TRIPS be harmonised with the *Convention on Biological Diversity* and the *International Undertaking on Plant Genetic Resources*

Selected paragraphs of the AU Model Law for the Protection of the Rights of Local Communities, Farmers and Breeders and for the Regulation of Access to Biological Resources (AML)

Farmers' agricultural varieties shall be protected from monopoly control under the customary practices and laws of local farming communities, whether such laws are written or not. Farmers' rights include protection of traditional knowledge, equitable sharing of benefits from the use of such knowledge, participation in decisions relating to biological resources, the right to save, use, exchange and sell farm-saved seed and the use of new breeders' varieties to develop farmers' varieties.

Notwithstanding plant breeders' rights, any person may propagate, grow and use plants of that variety for other than commercial purposes. They may sell plants and propagating material as food, use them as an initial source of variation for developing new varieties, and obtain such a protected variety for gene banks or plant genetic resource centres.

In the public interest, the government may restrict plant breeders' rights in cases where, for example, food security is adversely affected, requirements of the farming community for propagating material are not met, or the development of indigenous technologies is at stake.

iii) International Treaty on Plant Genetic Resources for Food and Agriculture

The *International Treaty on Plant Genetic Resources for Food and Agriculture* came into force in June 2004. Bangladesh signed and ratified this treaty in 2003. Kenya and Uganda submitted their accession instruments to this Treaty in 2003, while Tanzania did so in 2004.

The objectives of this Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security.

It states that each Contracting Party shall ensure the conformity of its laws, regulations and procedures with its obligations as provided in this Treaty.

The treaty recognises the crucial role that farmers have played and are continuing to play in the conservation and development of plant genetic resources and calls on all Contracting Parties to

- Promote or support, as appropriate, farmers and local communities' efforts to manage and conserve on-farm their plant genetic resources for food and agriculture (Art 5c);

- Allow farmers the right to equitably participate in sharing benefits arising from the utilization of plant genetic resources for food and agriculture; and to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture (Art 9.2).

Article 9 of the FAO International Treaty on Plant Genetic Resources

– Farmers' Rights

9.1 The Contracting Parties recognize the enormous contribution that the local and indigenous communities and farmers of all regions of the world, particularly those in the centres of origin and crop diversity, have made and will continue to make for the conservation and development of plant genetic resources which constitute the basis of food and agriculture production throughout the world.

9.2 The Contracting Parties agree that the responsibility for realizing Farmers' Rights, as they relate to plant genetic resources for food and agriculture, rests with national governments. In accordance with their needs and priorities, each Contracting Party should, as appropriate, and subject to its national legislation, take measures to protect and promote Farmers' Rights, including:

(a) protection of traditional knowledge relevant to plant genetic resources for food and agriculture;

(b) the right to equitably participate in sharing benefits arising from the utilization of plant genetic resources for food and agriculture; and

(c) the right to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture.

9.3 Nothing in this Article shall be interpreted to limit any rights that farmers have to save, use, exchange and sell farm-saved seed/propagating material, subject to national law and as appropriate.

FAO Commission on Plant Genetic Resources, November 1994
Background Study Paper No. 3
Providing farmers' rights through *in situ* conservation of crop genetic resources

The market can play a positive role in conservation, by providing additional income to farms that produce landraces or value added status to products that use them. In many parts of the world, landraces already have special market niches in urban areas, commanding higher prices than other crop varieties. The keys to a market incentive program are to identify specific constraints that limit continuing landrace utilization by farming communites and their capacity to market landrace products at local, national and international levels.

Do national seed laws conform to the CBD, African Model Law and the FAO treaty on plant genetic resources?

- In Kenya, 'Chapter 326 – Seeds and Plant Varieties' is the key Act of Parliament that regulates transactions in seeds and prohibits the sale of seeds that have not been certified and packaged in the prescribed manner, by persons who have not been registered by government organisations. This legislation effectively prevents resource-poor farmers from selling seed, whether it is indigenous or originates from public or private sectors. Only varieties that have been found to be distinct, uniform and stable and have out-performed existing varieties are eligible for certification. Landraces are thus unacceptable under these criteria. This Act is currently being reviewed in order to reduce the level of government regulation in favour of the seed industry. There is pressure to hasten this review process and to harmonise the new 'liberal' regulations with those of other countries of East Africa, including Tanzania and Uganda.

- The Ugandan parliament will soon have a hearing on the draft Plant Variety Protection Bill that was approved by the cabinet early in 2007. If passed unmodified, this bill is likely to entrench the rights of breeders and companies while curtailing the rights of small farmers to exchange, save and breed new varieties using hybrid seeds. It has been suggested that this Bill has deliberately excluded community rights as set out in the AU Model Law.

- Tanzania has two seed laws, one which is concerned with the regulation of seed companies and the other which enables smallholder farmers to produce and sell 'Quality Declared Seed'. This latter law was drawn up in 2001 with the help of SIDA and FAO. QDS farmers receive training from extension or NGO field staff and must show that they have a reliable source of foundation seed. The official seed certification authority spot-checks about 10% of the QDS seed.

- Bangladesh's seed industry was privatised by a new Seed Act in 1997. The new Act included the category of 'truthfully labelled seed' which was introduced to enable farmers to multiply and sell uncertified seed. Truthfully labelled seed can be produced by groups of poor farmers who are trained by NGOs and linked with organisations that can supply foundation seed. These farmers must take responsibility for the quality of their seed and can be legally prosecuted by dissatisfied customers.

Table 21:
Comparing the compliance of national seed laws with international agreements

Country	Compliance with national seed laws		
	CBD, Art. 8	ITPGRFA, Art. 6	AU Model law
Bangladesh	Yes	Yes	-
Tanzania	Yes	Yes	?
Uganda	No	No	No
Kenya	No	No	No

Appendix I: Income generation from wheat seed production in Bangladesh.

Table A: Augnishika - Profitability of wheat seed production in Dinajpur district.

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Landless Farmers													
Md Shahojahan	0	Shatabdi	280	0	80	1,520	200	34.00	6,800	8,320	1,390	6,930	101.9
Boiju Imam	0	Shatabdi	275	0	75	1,425	200	34.00	6,800	8,225	1,380	6,845	100.7
Mrs S Khatun	0	Sourav	258	8	100	1,900	150	34.00	5,100	7,000	1,395	5,605	82.4
Ruman Begom	0	Sourav	232	7	25	475	200	34.00	6,800	7,275	1,395	5,880	86.5
Md N Islam	0	Sourav	270	10	60	1,140	200	34.00	6,800	7,940	1,425	6,515	95.8
Marginal Farmers													
Miss Orsima	2	Shatabdi	220	0	20	380	200	34.00	6,800	7,180	1,390	5,790	85.1
Md H Uddin	2	Shatabdi	280	0	20	380	260	34.00	8,840	9,220	1,400	7,820	115.0
Md J Islam	2	Sourav	270	10	60	1,140	200	34.00	6,800	7,940	1,435	6,505	95.7
Md F Uddin	2	Shatabdi	290	0	90	1,710	200	34.00	6,800	8,510	1,390	7,120	104.7
Horendranath Ray	4	Shatabdi	300	20	30	570	250	34.00	8,500	9,070	1,450	7,620	112.1
Falgun Ray	5	Shatabdi	300	0	50	950	250	34.00	8,500	9,450	1,550	7,900	116.2
Montu Mormo	5	Shatabdi	280	10	50	950	220	34.00	7,480	8,430	1,400	7,030	103.4
Rajen Chandra	12	Shatabdi	320	20	100	1,900	200	34.00	6,800	8,700	1,480	7,220	106.2
Bishwanath Ray	13	Shatabdi	270	10	10	190	250	34.00	8,500	8,690	1,390	7,300	107.4
Md A Rahman	21	Shatabdi	290	10	60	1,140	220	34.00	7,480	8,620	1,400	7,220	106.2
Binoy Kumar Ray	23	Shatabdi	300	0	0	-	300	34.00	10,200	10,200	1,550	8,650	127.2
Narayon Chandra Ray	24	Shatabdi	350	10	70	1,330	270	34.00	9,180	10,510	1,739	8,771	129.0
Vaduram Roy	30	Shatabdi	316	0	0	-	316	34.00	10,744	10,744	1,550	9,194	135.2
Samsul Islam	36	Shatabdi	290	0	80	1,520	210	34.00	7,140	8,660	1,450	7,210	106.0
Sirajul Islam	37	Sourav	335	15	100	1,900	220	34.00	7,480	9,380	1,540	7,840	115.3
Sree Laksman Ray	44	Shatabdi	280	0	70	1,330	210	34.00	7,140	8,470	1,440	7,030	103.4
Upendra Chandra	46	Shatabdi	280	0	80	1,520	200	34.00	6,800	8,320	1,510	6,810	100.1

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Md Asraful	48	Shatabdi	280	0	80	1,520	200	34.00	6,800	8,320	1,390	6,930	101.9
Marginal farmers													
Thakur Das	50	Shatabdi	220	0	20	380	200	34.00	6,800	7,180	1,440	5,740	84.4
Md Abdur Rahman	50	Sourav	270	0	50	950	220	34.00	7,480	8,430	1,435	6,995	102.9
Kalipad Ray	51	Shatabdi	300	0	100	1,900	200	34.00	6,800	8,700	1,739	6,961	102.4
Md Ajijul Islam	58	Sourav	260	0	70	1,330	190	34.00	6,460	7,790	1,415	6,375	93.8
Trilochon Ray	61	Shatabdi	305	15	50	950	240	34.00	8,160	9,110	1,610	7,500	110.3
Tarapad Ray	63	Shatabdi	290	0	50	950	240	34.00	8,160	9,110	1,420	7,690	113.1
Gaurango Chandra	64	Shatabdi	350	15	75	1,425	260	34.00	8,840	10,265	1,739	8,526	125.4
Samsul Huda	73	Sourav	280	0	80	1,520	200	34.00	6,800	8,320	1,440	6,880	101.2
Dhaneshar Roy	80	Shatabdi	320	0	200	2,250	120	34.00	4,080	6,330	1,550	4,780	70.3
Md Rahim	80	Shatabdi	280	0	80	1,520	200	34.00	6,800	8,320	1,420	6,900	101.5
Sree Mohendranath	82	Shatabdi	315	15	50	950	250	34.00	8,500	9,450	1,610	7,840	115.3
Hasan Imam	96	Sourav	270	0	90	1,710	180	34.00	6,120	7,830	1,430	6,400	94.1
Rubel Mia	97	Shatabdi	280	0	0	-	280	34.00	9,520	9,520	1,450	8,070	118.7
Subsistence farmers													
Ajith	101	Shatabdi	340	12	178	3,382	150	34.00	5,100	8,482	1,719	6,763	99.5
Sree Probas Chandra	107	Sourav	340	20	100	1,900	220	34.00	7,480	9,380	1,540	7,840	115.3
Dinesh Chandra Ray	110	Shatabdi	310	0	70	1,330	240	34.00	8,160	9,490	1,480	8,010	117.8
Md Safikul Islam	168	Shatabdi	300	0	50	950	250	34.00	8,500	9,450	1,600	7,850	115.4
Means			290	5	66	1,207	219	34.0	7,451	8,658	1,487	7,171	105.5

Table B: DIPSHIKA - Profitability of wheat seed production in Dinajpur district.

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income			Tk/0.08ha	USD
Landless farmers													
Md Woed Ali	0	Shatabdi	100	0	20	380	80	35.00	2,800	3,180	1,260	1,920	28.2
Sotai Chandra	0	Sourav	160	0	120	2,280	40	34.00	1,360	3,640	1,255	2,385	35.1
Md Shahidul Islam	0	Shatabdi	150	0	50	950	100	35.00	3,500	4,450	1,315	3,135	46.1
Md Halima	0	Shatabdi	160	0	40	760	120	35.00	4,200	4,960	1,285	3,675	54.0
Moti Bina Bala	0	Shatabdi	220	0	160	3,040	60	35.00	2,100	5,140	1,390	3,750	55.1
Babi Akter	0	Shatabdi	200	12	88	1,672	100	35.00	3,500	5,172	1,370	3,802	55.9
Merina Begom	0	Shatabdi	180	0	60	1,140	120	35.00	4,200	5,340	1,305	4,035	59.3
Joydev Ray	0	Sourav	210	10	50	950	150	34.00	5,100	6,050	1,305	4,745	69.8
Prisila	0	Shatabdi	240	10	50	950	180	35.00	6,300	7,250	1,425	5,825	85.7
Md Rasul Ali	0	Bijoy	200	0	50	950	150	50.00	7,500	8,450	1,305	7,145	105.1
Marginal farmers													
Md Nobir Uddin	1	Sourav	140	0	120	2,280	20	34.00	680	2,960	1,255	1,705	25.1
Mazeda Begom	3	Shatabdi	220	0	70	1,330	150	35.00	5,250	6,580	1,450	5,130	75.4
Sree Subal Barman	4	Bijoy	220	0	100	1,900	120	50.00	6,000	7,900	1,380	6,520	95.9
Md Abdul Jalil	8	Shatabdi	193	13	80	1,520	100	35.00	3,500	5,020	1,260	3,760	55.3
Md Abul Kalam	8	Bijoy	240	10	80	1,520	150	50.00	7,500	9,020	1,405	7,615	112.0
Md Taslimuddin	18	Shatabdi	160	0	40	760	120	35.00	4,200	4,960	1,255	3,705	54.5
Md Sabed Ali	18	Sourav	250	0	50	950	200	34.00	6,800	7,750	1,470	6,280	92.4
Sreemoti Zarna Rani	21	Sourav	132	12	0	-	120	35.00	4,200	4,200	1,305	2,895	42.6
Mrs Fahima	27	Shatabdi	120	0	40	760	80	35.00	2,800	3,560	1,255	2,305	33.9
Md Mozammel Haque	33	Shatabdi	104	0	24	456	80	35.00	2,800	3,256	1,305	1,951	28.7
Md Saiful Islam	33	Shatabdi	240	10	50	950	180	35.00	6,300	7,250	1,450	5,800	85.3
Md Moynul Islam	34	Bijoy	260	0	110	2,090	150	50.00	7,500	9,590	1,425	8,165	120.1
Md Nazmul Hosen	34	Sourav	240	0	40	760	200	34.00	6,800	7,560	1,450	6,110	89.9

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income			Tk/0.08ha	USD
Sree Narayon Chandra	36	Shatabdi	190	0	70	1,330	120	35.00	4,200	5,530	1,315	4,215	62.0
Jandrina	36	Shatabdi	240	10	70	1,330	160	35.00	5,600	6,930	1,420	5,510	81.0
Motiful Islam	36	Bijoy	260	0	110	2,090	150	50.00	7,500	9,590	1,425	8,165	120.1
Md Soimuddin	37	Shatabdi	190	0	130	2,470	60	34.00	2,040	4,510	1,295	3,215	47.3
Akdalish	38	Sourav	142	2	0	-	140	35.00	4,900	4,900	1,260	3,640	53.5
Sadek Ali	40	Sourav	280	0	60	1,140	220	35.00	7,700	8,840	1,450	7,390	108.7
Md Abdul Mannan	42	Shatabdi	135	0	35	665	100	35.00	3,500	4,165	1,305	2,860	42.1
Birash	44	Sourav	300	10	250	4,750	40	35.00	1,400	6,150	1,729	4,421	65.0
Tabita	46	Sourav	195	0	45	855	150	35.00	5,250	6,105	1,280	4,825	71.0
Md Rezaul Karim	46	Shatabdi	200	0	60	1,140	140	35.00	4,900	6,040	1,390	4,650	68.4
Rehena Begom	47	Sourav	185	5	100	1,900	80	35.00	2,800	4,700	1,260	3,440	50.6
Md Baset Ali	48	Shatabdi	190	15	150	2,850	25	35.00	875	3,725	1,280	2,445	36.0
Md Bablu Mandal	55	Shatabdi	105	0	25	475	80	35.00	2,800	3,275	1,260	2,015	29.6
Josgina	58	Shatabdi	180	0	130	2,470	50	35.00	1,750	4,220	1,380	2,840	41.8
Md Uzira	61	Sourav	165	0	45	855	120	35.00	4,200	5,055	1,260	3,795	55.8
Akram	64	Shatabdi	230	0	160	3,040	70	35.00	2,450	5,490	1,420	4,070	59.9
Sree Vupen Chandra	66	Sourav	140	0	20	380	120	34.00	4,080	4,460	1,255	3,205	47.1
Md Sakhina	66	Sourav	200	0	60	1,140	140	35.00	4,900	6,040	1,420	4,620	67.9
Md Moshiur Rahman	67	Sourav	240	0	40	760	200	34.00	6,800	7,560	1,450	6,110	89.9
Upendra Nath Roy	68	Shatabdi	360	20	100	1,900	240	35.00	8,400	10,300	1,729	8,571	126.0
Md Idris Ali	70	Shatabdi	180	0	80	1,520	100	35.00	3,500	5,020	1,260	3,760	55.3
Asok	70	Shatabdi	260	0	160	3,040	100	35.00	3,500	6,540	1,415	5,125	75.4
Md Aminul Islam	71	Shatabdi	280	10	90	1,710	180	35.00	6,300	8,010	1,420	6,590	96.9
Nazrul	71	Shatabdi	200	0	50	950	150	35.00	5,250	6,200	1,410	4,790	70.4
Shabita Bala	75	Sourav	263	13	110	2,090	140	35.00	4,900	6,990	1,430	5,560	81.8
A.Aziz	77	Sourav	170	0	30	570	140	35.00	4,900	5,470	1,260	4,210	61.9
Fulmoti Bala	79	Sourav	280	10	70	1,330	200	35.00	7,000	8,330	1,455	6,875	101.1

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income			Tk/0.08ha	USD
Nazir	79	Sourav	290	10	180	3,420	100	35.00	3,500	6,920	1,455	5,465	80.4
Abed Ali	85	Shatabdi	260	0	260	4,940	0	35.00	-	4,940	1,425	3,515	51.7
Md Enamul	88	Shatabdi	190	0	150	2,850	40	34.00	1,360	4,210	1,305	2,905	42.7
Md Ezabul Islam	88	Shatabdi	280	15	145	2,755	120	34.00	4,080	6,835	1,315	5,520	81.2
Anamul	88	Sourav	295	0	215	4,085	80	35.00	2,800	6,885	1,400	5,485	80.7
Fazlu	90	Sourav	315	5	150	2,850	160	35.00	5,600	8,450	1,550	6,900	101.5
Vobesh	90	Shatabdi	180	0	160	3,040	20	35.00	700	3,740	1,365	2,375	34.9
A. Razzak	91	Shatabdi	240	0	160	3,040	80	35.00	2,800	5,840	1,425	4,415	64.9
Asis	92	Shatabdi	320	15	85	1,615	220	35.00	7,700	9,315	1,739	7,576	111.4
Shaheed	93	Shatabdi	220	0	70	1,330	150	35.00	5,250	6,580	1,420	5,160	75.9
Narash	96	Shatabdi	280	0	200	3,800	80	35.00	2,800	6,600	1,420	5,180	76.2
Khaleque	99	Shatabdi	290	0	90	1,710	200	35.00	7,000	8,710	1,530	7,180	105.6
Rabin	99	Shatabdi	280	0	80	1,520	200	35.00	7,000	8,520	1,420	7,100	104.4
Subsistence farmers													
Ruhul	100	Shatabdi	240	0	60	1,140	180	35.00	6,300	7,440	1,428	6,012	88.4
Khagendra Nath	102	Shatabdi	360	10	70	1,330	280	35.00	9,800	11,130	1,744	9,386	138.0
Mohendra	105	Shatabdi	280	0	220	4,180	60	35.00	2,100	6,280	1,415	4,865	71.5
Md Mithu	107	Shatabdi	190	0	100	1,900	90	35.00	3,150	5,050	1,280	3,770	55.4
Rafik	109	Sourav	249	9	200	3,800	40	35.00	1,400	5,200	1,450	3,750	55.1
Sochi	109	Shatabdi	280	0	160	3,040	120	35.00	4,200	7,240	1,415	5,825	85.7
Jagendra	112	Shatabdi	160	0	140	2,660	20	35.00	700	3,360	1,365	1,995	29.3
Moslemuddin	112	Shatabdi	120	0	40	760	80	35.00	2,800	3,560	1,255	2,305	33.9
Sochindra Nath	113	Shatabdi	320	0	0	0.00	320	35.00	11,200	11,200	1,739	9,461	139.1
Anil	114	Shatabdi	150	0	135	2,565	15	35.00	525	3,090	1,365	1,725	25.4
Md Jahangir	116	Sourav	260	0	60	1,140	200	34.00	6,800	7,940	1,420	6,520	95.9
Monzu	117	Sourav	320	20	80	1,520	220	35.00	7,700	9,220	1,689	7,531	110.8
Md Jobaidul Islam	121	Shatabdi	140	0	60	1,140	80	35.00	2,800	3,940	1,255	2,685	39.5

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income			Tk/0.08ha	USD
Sree Dilip Kumar	132	Sourav	140	0	0	0.00	140	34.00	4,760	4,760	1,255	3,505	51.5
Muslim	136	Shatabdi	170	0	170	3,230	0	35.00	0.00	3,230	1,365	1,865	27.4
Md Anowarul	137	Sourav	250	0	70	1,330	180	34.00	6,120	7,450	1,430	6,020	88.5
Md Tohirul Islam	178	Shatabdi	260	20	40	760	200	35.00	7,000	7,760	1,410	6,350	93.4
Means			218	2.6	94.6	1,797	123	35.78	4,428	6,160	1,390	4,770	70.2

Table C: Soliderity - Profitability of wheat seed production in Kurigram district.

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD
Landless farmers													
Md Abdul Jalil	0	Shatabdi	210	80	50	950	80	35.00	2,800	3,750	1,530	2,220	32.6
Md Khalilur Rahman	0	Sourav	284	14	150	2,850	120	35.00	4,200	7,050	1,585	5,465	80.4
Marginal farmers													
Md Abu Bakkar Siddik	4	Sourav	290	0	160	3,040	130	35.00	4,550	7,590	1,555	6,035	88.8
Md Siddik Hosen	5	Sourav	312	12	200	3,800	100	35.00	3,500	7,300	1,535	5,765	84.8
Md Khairul Islam	6	Sourav	307	17	190	3,610	100	35.00	3,500	7,110	1,525	5,585	82.1
Md Hasimuddin	7	Sourav	302	12	160	3,040	130	35.00	4,550	7,590	1,605	5,985	88.0
Md Soyod Ali	13	Prodip	342	12	210	3,990	120	50.00	6,000	9,990	1,679	8,311	122.2
Dilip Kumar Sarkar	15	Shatabdi	272	2	190	3,610	80	35.00	2,800	6,410	1,510	4,900	72.1
Sreedhar Chandra	15	Shatabdi	332	12	200	3,800	120	35.00	4,200	8,000	1,555	6,445	94.8
Md Jakir Hosen	16	Sourav	317	7	150	2,850	160	35.00	5,600	8,450	1,605	6,845	100.7
Ramproshad	17	Shatabdi	215	0	40	750	175	35.00	6,125	6,875	1,530	5,345	78.6
Md Mohosin Ali	17	Sourav	342	2	240	4,560	100	35.00	3,500	8,060	1,511	6,549	96.3
Md Safikul Islam	18	Sourav	312	12	200	3,800	100	35.00	3,500	7,300	1,535	5,765	84.8
Sree Noresh Chandra	18	Shatabdi	350	2	228	4,332	120	35.00	4,200	8,532	1,669	6,863	100.9
Md Saifur Rahman	19	Prodip	300	0	200	3,800	100	50.00	5,000	8,800	1,709	7,091	104.3
Md Gazi Rahman	23	Prodip	322	12	150	2,850	160	50.00	8,000	10,850	1,679	9,171	134.9
Md Kudrat Ali	28	Prodip	362	2	200	3,800	160	50.00	8,000	11,800	1,679	10,121	148.8
Md Repon	31	Sourav	292	12	170	3,230	110	35.00	3,850	7,080	1,555	5,525	81.3
Sree Noresh Chandra	34	Shatabdi	322	12	190	3,610	120	35.00	4,200	7,810	1,657	6,153	90.5
Md Mizanur Rahman	37	Shatabdi	290	15	195	3,705	80	35.00	2,800	6,505	1,520	4,985	73.3
Md Nur Islam	39	Prodip	362	2	200	3,800	160	50.00	8,000	11,800	1,679	10,121	148.8
Md Jasmat Mia	40	Sourav	282	12	160	3,040	110	35.00	3,850	6,890	1,555	5,335	78.5
Sree Monindranath	43	Shatabdi	400	7	233	4,427	160	35.00	5,600	10,027	1,749	8,278	121.7

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD
Sree Shachindranath	44	Shatabdi	334	24	230	4,370	80	35.00	2,800	7,170	1,553	5,617	82.6
Md Enamul Haque	45	Prodip	362	12	170	3,230	180	50.00	9,000	12,230	1,679	10,551	155.2
Suvash Chandra	45	Shatabdi	200	0		0	200	35.00	7,000	7,000	1,515	5,485	80.7
Khokon Chandra	47	Shatabdi	332	12	210	3,990	110	35.00	3,850	7,840	1,565	6,275	92.3
Md. Safiar Rahman	48	Shatabdi	200	0	60	1,125	140	35.00	4,900	6,025	1,515	4,510	66.3
Md Lion Mia	49	Sourav	287	7	160	3,040	120	35.00	4,200	7,240	1,525	5,715	84.0
Md Khalil	49	Prodip	350	12	178	3,382	160	50.00	8,000	11,382	1,679	9,703	142.7
Md Aminul Hoque	51	Shatabdi	180	0	20	375	160	35.00	5,600	5,975	1,320	4,655	68.5
Md Asraful Alam	53	Sourav	322	12	150	2,850	160	35.00	5,600	8,450	1,639	6,811	100.2
Milon Chandra	58	Shatabdi	350	0	250	4,750	100	35.00	3,500	8,250	1,575	6,675	98.2
Sree Chintaram	62	Shatabdi	342	12	250	4,750	80	35.00	2,800	7,550	1,495	6,055	89.0
Brazendranath	66	Shatabdi	240	40	40	750	160	35.00	5,600	6,350	1,515	4,835	71.1
Ranobir chandra	67	Shatabdi	205	0	30	563	175	35.00	6,125	6,688	1,320	5,368	78.9
Sree Okhsoykumar	72	Shatabdi	322	2	200	3,800	120	35.00	4,200	8,000	1,550	6,450	94.9
Sree Jotish Chandra	79	Shatabdi	282	12	170	3,230	100	35.00	3,500	6,730	1,529	5,201	76.5
Md Fazlul Mondal	79	Sourav	322	12	150	2,850	160	35.00	5,600	8,450	1,739	6,711	98.7
Harikrisno	80	Shatabdi	200	0	40	750	160	35.00	5,600	6,350	1,320	5,030	74.0
Sree Chiniram Barman	81	Shatabdi	332	12	240	4,560	80	35.00	2,800	7,360	1,555	5,805	85.4
Sree Narayon Chandra	86	Shatabdi	322	22	220	4,180	80	35.00	2,800	6,980	1,505	5,475	80.5
Md Sayod Ali	87	Shatabdi	337	12	125	2,375	200	35.00	7,000	9,375	1,659	7,716	113.5
Sree Ratikanto Barman	88	Shatabdi	332	22	230	4,370	80	35.00	2,800	7,170	1,563	5,607	82.5
Md Nurnabi	95	Sourav	372	2	260	4,940	110	35.00	3,850	8,790	1,500	7,290	107.2
Sree Bishnupad	95	Shatabdi	380	2	278	5,282	100	35.00	3,500	8,782	1,555	7,227	106.3
Sree Narod Chandra	96	Shatabdi	332	12	200	3,800	120	35.00	4,200	8,000	1,505	6,495	95.5
Vabesh Chandra	99	Shatabdi	185	5	0	0	180	35.00	6,300	6,300	1,320	4,980	73.2
Subsistence farmers													
Md Eakub Ali Sardar	104	Prodip	402	12	170	3,230	220	50.00	11,000	14,230	1,739	12,491	183.7

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD
Md Pamuddin	108	Prodip	322	12	150	2,850	160	50.00	8,000	10,850	1,689	9,161	134.7
Md Abdul Wahed	113	Sourav	342	2	240	4,560	100	35.00	3,500	8,060	1,495	6,565	96.5
Sree Goneshor Chandra	115	Shatabdi	375	0	235	4,465	140	35.00	4,900	9,365	1,563	7,802	114.7
Md Joynal Abedin	116	Sourav	322	2	160	3,040	160	35.00	5,600	8,640	1,500	7,140	105.0
Vudeb Chandra	116	Shatabdi	322	12	190	3,610	120	35.00	4,200	7,810	1,540	6,270	92.2
Md Abdul Salam	142	Sourav	352	12	220	4,180	120	35.00	4,200	8,380	1,490	6,890	101.3
Konok Chandra Ray	145	Sourav	332	22	140	2,660	170	35.00	5,950	8,610	1,639	6,971	102.5
Md Kuddus	152	Prodip	322	2	180	3,420	140	50.00	7,000	10,420	1,679	8,741	128.5
Md Abu Bakkar Siddik	171	Sourav	322	2	200	3,800	120	35.00	4,200	8,000	1,502	6,498	95.6
Md Abul Kasem	175	Sourav	322	2	190	3,610	130	35.00	4,550	8,160	1,520	6,640	97.6
Means			310	12	175	3,220	130	37.54	4,958	8,178	1,564	6,615	97.3

Table D: BRIF - Profitability of wheat seed production in Dinajpur and Nilphamari districts.

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Landless farmer													
Md. Sanower Rahman	0	Shatabdi	280	0	180	3,420	100	33.00	3,300	6,720	1,378	5,342	78.6
Marginal farmers													
Saidul Islam	3	Prodip	240	0	120	2,280	120	45.00	5,400	7,680	1,383	6,297	92.6
Sree Ranjith Roy	3	Sourav	200	20	140	2,660	40	33.00	1,320	3,980	1,408	2,572	37.8
Md Kafil Uddin	5	Sourav	245	15	200	3,800	30	33.00	990	4,790	1,393	3,397	50.0
Md Jamiar Rahman	7	Shatabdi	190	10	160	3,040	20	33.00	660	3,700	1,220	2,480	36.5
Zikrul	8	Shatabdi	210	0	150	2,850	60	33.00	1,980	4,830	1,242	3,588	52.8
Mrss Rabea	9	Shatadi	200	0	100	1,900	100	33.00	3,300	5,200	1,358	3,842	56.5
Md Jahidul Islam	9	Sourav	240	0	90	1,710	150	33.00	4,950	6,660	1,368	5,292	77.8
Tafila Begom	10	Shatadi	240	0	110	2,090	130	33.00	4,290	6,380	1,373	5,007	73.6
Md Bitto Mia	10	Shatabdi	190	25	85	1,615	80	33.00	2,640	4,255	1,228	3,027	44.5
Md Juel	10	Shatabdi	240	0	160	3,040	80	33.00	2,640	5,680	1,388	4,292	63.1
Md Abdur Rashid	10	Shatabdi	210	0	90	1,710	120	33.00	3,960	5,670	1,227	4,443	65.3
Shadesh Prosad Ray	12	Prodip	250	0	140	2,660	110	45.00	4,950	7,610	1,378	6,232	91.6
Md Hobibur Rahman	13	Prodip	255	15	200	3,800	40	45.00	1,800	5,600	1,415	4,185	61.5
Md Khalilur Rahman	13	Shatabdi	220	0	100	1,900	120	33.00	3,960	5,860	1,354	4,506	66.3
Bideshi Bala	14	Shatabdi	260	0	140	2,660	120	33.00	3,960	6,620	1,408	5,212	76.6
Binodh Chandra Ray	14	Shatabdi	220	12	120	2,280	88	33.00	2,904	5,184	1,360	3,824	56.2
Md Nazrul Islam	15	Shatabdi	200	0	90	1,710	110	33.00	3,630	5,340	1,244	4,096	60.2
Md Faridul Islam	15	Shatabdi	210	0	130	2,40	80	33.00	2,640	5,110	1,356	3,754	55.2
Sree Binimadhab Dash	16	Shatabdi	260	10	150	,850	100	33.00	3,300	6,150	1,223	4,927	72.5
Md Sadekul Islam	16	Sourav	180	0	90	,710	90	33.00	2,970	4,680	1,220	3,460	50.9
Rezaul Karim	16	Shatabdi	220	0	180	,420	40	33.00	1,320	4,740	1,357	3,383	49.8
Md Dudu Mia	16	Shatabdi	210	0	80	1,520	130	33.00	4,290	5,810	1,350	4,460	65.6
Sree Jointo	16	Sourav	270	0	150	2,850	120	33.00	3,960	6,810	1,376	5,434	79.9

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Md Hamidul Islam	16	Sourav	280	0	80	1,520	200	33.00	6,600	8,120	1,356	6,764	99.5
Sree Horycharon Ray	17	Sourav	230	0	70	1,330	160	33.00	5,280	6,610	1,370	5,240	77.1
Sree Shopon Kumar	18	Shatabdi	290	0	170	3,230	120	33.00	3,960	7,190	1,360	5,830	85.7
Md Gazi Sekh	19	Sourav	260	0	130	2,470	130	33.00	4,290	6,760	1,378	5,382	79.1
Md Azizar Rahman	19	Sourav	260	0	180	3,420	80	33.00	2,640	6,060	1,350	4,710	69.3
Sree Horibabu	20	Sourav	245	5	80	1,520	160	33.00	5,280	6,800	1,380	5,420	79.7
Md Montu Mia	20	Shatabdi	240	0	180	3,420	60	33.00	1,980	5,400	1,352	4,048	59.5
Parul Begom	20	Shatadi	220	0	135	2,565	85	33.00	2,805	5,370	1,242	4,128	60.7
Md Lokman Ali	21	Shatabdi	180	0	100	1,900	80	33.00	2,640	4,540	1,220	3,320	48.8
Md Monsur Ali	21	Prodip	265	10	175	3,325	80	45.00	3,600	6,925	1,390	5,535	81.4
Samsul Huda	22	Shatabdi	200	0	100	1,900	100	33.00	3,300	5,200	1,350	3,850	56.6
Susil Babu	22	Prodip	265	15	110	2,090	140	45.00	6,300	8,390	1,438	6,952	102.2
Md Ferdaus Alam	22	Prodip	240	20	160	3,040	60	45.00	2,700	5,740	1,428	4,312	63.4
Md Babul	22	Sourav	170	0	90	1,710	80	33.00	2,640	4,350	1,220	3,130	46.0
Sree Onil Chandra Ray	22	Shatadi	227	7	130	2,470	90	33.00	2,970	5,440	1,355	4,085	60.1
Sree Krishna Ray	23	Sourav	260	0	140	2,660	120	33.00	3,960	6,620	1,388	5,232	76.9
Sree Nipendro	23	Shatabdi	270	0	210	3,990	60	33.00	1,980	5,970	1,374	4,596	67.6
Md Sofiul Islam	23	Sourav	210	20	110	2,090	80	33.00	2,640	4,730	1,348	3,382	49.7
Sree Jagonnat Chandra	24	Sourav	250	0	130	2,470	120	33.00	3,960	6,430	1,356	5,074	74.6
Sree Kali	25	Shatabdi	200	0	130	2,470	70	33.00	2,310	4,780	1,354	3,426	50.4
Md Shahidul Islam	25	Shatabdi	210	0	90	1,710	120	33.00	3,960	5,670	1,354	4,316	63.5
Md Deloar Hossen	25	Shatabdi	230	15	55	1,045	160	33.00	5,280	6,325	1,356	4,969	73.1
Jahurul Islam	25	Sourav	280	12	108	2,052	160	33.00	5,280	7,332	1,372	5,960	87.6
Md Hafizuddin	26	Prodip	240	20	140	2,660	80	45.00	3,600	6,260	1,360	4,900	72.1
Md Jamaluddin	28	Shatabdi	210	0	130	2,470	80	33.00	2,640	5,110	1,224	3,886	57.1
Md Abdul Mannan	28	Prodip	260	20	160	3,040	80	45.00	3,600	6,640	1,406	5,234	77.0
Md Jakaria	28	Shatadi	225	0	125	2,375	100	33.00	3,300	5,675	1,234	4,441	65.3

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Md Azizar	29	Shatabdi	230	0	170	3,230	60	33.00	1,980	5,210	1,376	3,834	56.4
Mazedul Islam	29	Shatadi	260	0	100	1,900	160	33.00	5,280	7,180	1,362	5,818	85.6
Md Rashid	29	Shatabdi	280	10	90	1,710	180	33.00	5,940	7,650	1,360	6,290	92.5
Sree Dhanchay	30	Shatabdi	260	0	140	2,660	120	33.00	3,960	6,620	1,356	5,264	77.4
Md Mamunur Rashid	30	Shatabdi	250	0	160	3,040	90	33.00	2,970	6,010	1,373	4,637	68.2
Indrovushon	30	Shatabdi	250	0	190	3,610	60	33.00	1,980	5,590	1,378	4,212	61.9
Rashidul Islam	31	Shatadi	160	10	70	1,330	80	33.00	2,640	3,970	1,220	2,750	40.4
Mrss Bina Begom	31	Shatadi	240	0	110	2,090	130	33.00	4,290	6,380	1,378	5,002	73.6
Sree Dhiren Chandra	32	Sourav	210	10	80	1,520	120	33.00	3,960	5,480	1,358	4,122	60.6
Monsur Ali	32	Shatabdi	280	0	260	4,940	20	33.00	660	5,600	1,373	4,227	62.2
Md Salam Mia	33	Sourav	250	0	130	2,470	120	33.00	3,960	6,430	1,360	5,070	74.6
Moksedur Rahman	33	Shatadi	190	0	110	2,090	80	33.00	2,640	4,730	1,220	3,510	51.6
Bikash Chandra Ray	34	Sourav	230	11	99	1,881	120	33.00	3,960	5,841	1,352	4,489	66.0
Md Abdul Khalek	34	Shatabdi	210	0	120	2,280	90	33.00	2,970	5,250	1,356	3,894	57.3
Maleka	34	Sourav	260	20	180	3,420	60	33.00	1,980	5,400	1,372	4,028	59.2
Huzur Ali	35	Sourav	280	0	130	2,470	150	33.00	4,950	7,420	1,357	6,063	89.2
Sudhir Ray	36	Sourav	290	0	170	3,230	120	33.00	3,960	7,190	1,388	5,802	85.3
Sree Krisno Charon Ray	36	Shatadi	265	5	140	2,660	120	33.00	3,960	6,620	1,354	5,266	77.4
Md Islam Mia	37	Prodip	265	0	165	3,135	100	45.00	4,500	7,635	1,388	6,247	91.9
Md Sahidul Islam	37	Shatabdi	240	30	170	3,230	40	33.00	1,320	4,550	1,357	3,193	47.0
Md Abdus Sattar	38	Shatadi	220	7	125	2,375	88	33.00	2,904	5,279	1,393	3,886	57.1
Md Enamul	40	Sourav	250	0	130	2,470	120	33.00	3,960	6,430	1,357	5,073	74.6
Elias Ali	40	Shatadi	225	20	145	2,755	60	33.00	1,980	4,735	1,388	3,347	49.2
Md Jiktol	40	Shatabdi	250	0	120	2,280	130	33.00	4,290	6,570	1,354	5,216	76.7
Md Abdur Sattar	40	Prodip	230	0	150	2,850	80	45.00	3,600	6,450	1,360	5,090	74.9
Sree Dhiren Chandra Roy	41	Sourav	190	0	160	3,040	30	33.00	990	4,030	1,040	2,990	44.0
Sree Motilal	42	Shatabdi	300	15	215	4,085	70	33.00	2,310	6,395	1,368	5,027	73.9

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Enamul Hauque	43	Sourav	210	0	170	3,230	40	33.00	1,320	4,550	1,298	3,252	47.8
Sree Nogendro	43	Shatabdi	290	0	250	4,750	40	33.00	1,320	6,070	1,354	4,716	69.4
Md Aijul Haque	44	Shatabdi	220	10	130	2,470	80	33.00	2,640	5,110	1,356	3,754	55.2
Saiadur	44	Shatabdi	180	0	60	1,140	120	33.00	3,960	5,100	1,220	3,880	57.1
Md Azam Ali	45	Sourav	280	0	160	3,040	120	33.00	3,960	7,000	1,370	5,630	82.8
Abdul Jalil	46	Sourav	220	0	80	1,520	140	33.00	4,620	6,140	1,356	4,784	70.4
Ruhul Amin	47	Prodip	210	0	120	2,280	90	45.00	4,050	6,330	1,406	4,924	72.4
Md. Solimuddin	47	Shatabdi	220	10	130	2,470	80	33.00	2,640	5,110	1,368	3,742	55.0
Md. Abdul Khaled	49	Shatabdi	210	20	110	2,090	80	33.00	2,640	4,730	1,438	3,292	48.4
Azizul Islam	50	Sourav	190	0	170	3,230	20	33.00	660	3,890	1,220	2,670	39.3
Sree Gonesh Chandro	50	Shatabdi	268	13	135	2,565	120	33.00	3,960	6,525	1,368	5,157	75.8
Md Azizur Rahman	51	Sourav	211	11	120	2,280	80	33.00	2,640	4,920	1,229	3,691	54.3
Md Mahubar	52	Shatabdi	270	0	140	2,660	130	33.00	4,290	6,950	1,352	5,598	82.3
Md Atoar Hossen	52	Prodip	230	0	140	2,660	90	45.00	4,050	6,710	1,383	5,327	78.3
Nuramin	52	Sourav	160	0	120	2,280	40	33.00	1,320	3,600	1,220	2,380	35.0
Sree Onil Chandro	53	Shatabdi	190	0	80	1,520	110	33.00	3,630	5,150	1,220	3,930	57.8
Md Aminul	53	Sourav	270	0	170	3,230	100	33.00	3,300	6,530	1,352	5,178	76.1
Sree Mono	54	Shatabdi	210	25	90	1,710	95	33.00	3,135	4,845	1,360	3,485	51.3
Md Mahabubar Rahman	54	Sourav	220	0	180	3,420	40	33.00	1,320	4,740	1,368	3,372	49.6
Sazu	54	Sourav	250	0	70	1,330	180	33.00	5,940	7,270	1,352	5,918	87.0
Abdul Kader	55	Shatabdi	280	0	160	3,040	120	33.00	3,960	7,000	1,373	5,627	82.8
Md Sultan Ali	55	Prodip	240	10	150	2,850	80	45.00	3,600	6,450	1,388	5,062	74.4
Md Abdul Wahed	55	Shatabdi	280	0	160	3,040	120	33.00	3,960	7,000	1,360	5,640	82.9
Md Baset	55	Sourav	240	0	150	2,850	90	33.00	2,970	5,820	1,352	4,468	65.7
Md Moktar Hossen	55	Shatadi	225	0	145	2,755	80	33.00	2,640	5,395	1,355	4,040	59.4
Misses Nur Jahan	55	Shatabdi	245	0	165	3,135	80	33.00	2,640	5,775	1,350	4,425	65.1
Md. Sohidul Islam	56	Shatabdi	200	15	105	1,995	80	33.00	2,640	4,635	1,348	3,287	48.3

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Sree Omala Chandra Roy	56	Sourav	230	10	160	3,040	60	33.00	1,980	5,020	1,403	3,617	53.2
Sree Prodip Chandra Ray	56	Shatadi	205	5	135	2,565	65	33.00	2,145	4,710	1,352	3,358	49.4
Md. Jonab Ali	56	Shatabdi	170	0	100	1,900	70	33.00	2,310	4,210	1,348	2,862	42.1
Hamidur Rahman	56	Shatadi	260	10	70	1,330	180	33.00	5,940	7,270	1,360	5,910	86.9
Sree Obinash	57	Shatabdi	265	0	185	3,515	80	33.00	2,640	6,155	1,368	4,787	70.4
Sree Bimol Chandra	57	Shatabdi	200	20	40	760	140	33.00	4,620	5,380	1,348	4,032	59.3
Md Mejor Ali	57	Prodip	260	0	140	2,660	120	45.00	5,400	8,060	1,368	6,692	98.4
Sree Provash Chandra	58	Shatabdi	290	20	180	3,420	90	33.00	2,970	6,390	1,360	5,030	74.0
Brittolal	58	Sourav	220	0	160	3,040	60	33.00	1,980	5,020	1,352	3,668	53.9
Sree Protap Candra	59	Shatabdi	260	0	110	2,090	150	33.00	4,950	7,040	1,388	5,652	83.1
Md Abdul Khalek	60	Shatabdi	260	0	160	3,040	100	33.00	3,300	6,340	1,398	4,942	72.7
Md Mominul Islam	60	Prodip	220	0	180	3,420	40	45.00	1,800	5,220	1,393	3,827	56.3
Md Hossen Ali	61	Prodip	230	0	110	2,090	120	45.00	5,400	7,490	1,378	6,112	89.9
Sree Nittom Chandro	61	Shatabdi	280	0	150	2,850	130	33.00	4,290	7,140	1,352	5,788	85.1
Debendranath Ray	61	Sourav	231	13	98	1,862	120	33.00	3,960	5,822	1,352	4,470	65.7
Md Nuralam	62	Shatabdi	230	0	110	2,090	120	33.00	3,960	6,050	1,355	4,695	69.0
Jahurul Islam	62	Shatadi	285	0	195	3,705	90	33.00	2,970	6,675	1,393	5,282	77.7
Md Abul	62	Sourav	180	20	100	1,900	60	33.00	1,980	3,880	1,356	2,524	37.1
Sree Anando Barman	62	Shatadi	245	0	185	3,515	60	33.00	1,980	5,495	1,383	4,112	60.5
Md Hasan Ali	62	Sourav	180	20	150	2,850	10	33.00	330	3,180	1,220	1,960	28.8
Sree Razendro	63	Shatabdi	180	0	120	2,280	60	33.00	1,980	4,260	1,220	3,040	44.7
Sree Jogoth Chandro	64	Shatabdi	256	0	136	2,584	120	33.00	3,960	6,544	1,370	5,174	76.1
Md Motiar Rahman	64	Shatabdi	220	0	100	1,900	120	33.00	3,960	5,860	1,348	4,512	66.4
Ranjon Kumar Ray	64	Sourav	250	10	110	2,090	130	33.00	4,290	6,380	1,352	5,028	73.9
Md Abdul Mannan	64	Shatabdi	210	20	110	2,090	80	33.00	2,640	4,730	1,360	3,370	49.6
Sree Shudhir Chandro	64	Shatabdi	280	0	140	2,660	140	33.00	4,620	7,280	1,356	5,924	87.1
Md Nazrul Islam	67	Shatabdi	190	0	110	2,090	80	33.00	2,640	4,730	1,220	3,510	51.6

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Md Atikur Rahan	69	Shatabdi	235	0	145	2,755	90	33.00	2,970	5,725	1,372	4,353	64.0
Md Azahar	69	Shatabdi	225	5	100	1,900	120	33.00	3,960	5,860	1,348	4,512	66.4
Alauddin	69	Shatabdi	290	0	170	3,230	120	33.00	3,960	7,190	1,388	5,802	85.3
Md Abdus Samad	69	Prodip	260	0	160	3,040	100	45.00	4,500	7,540	1,372	6,168	90.7
Md Akramuddin	69	Prodip	210	0	130	2,470	80	45.00	3,600	6,070	1,382	4,688	68.9
Md Atiar Rahman	69	Shatabdi	250	10	120	2,280	120	33.00	3,960	6,240	1,372	4,868	71.6
Sree Bishesar Chandra Ray	69	Prodip	210	20	110	2,090	80	45.00	3,600	5,690	1,356	4,334	63.7
Moksedul Hoque	72	Shatabdi	300	0	260	4,940	40	33.00	1,320	6,260	1,428	4,832	71.1
Anower Hossain	72	Shatabdi	260	0	60	1,140	200	33.00	6,600	7,740	1,348	6,392	94.0
Md. Anisur Rahman	72	Shatabdi	250	20	150	2,850	80	33.00	2,640	5,490	1,358	4,132	60.8
Sree Horipadh Ray	73	Shatabdi	280	0	160	3,040	120	33.00	3,960	7,000	1,357	5,643	83.0
Md Shahidul Islam	74	Shatabdi	220	0	140	2,660	80	33.00	2,640	5,300	1,370	3,930	57.8
Abdul Mozid	74	Sourav	180	40	120	2,280	20	33.00	660	2,940	1,220	1,720	25.3
Md Atikul	75	Shatabdi	260	0	170	3,230	90	33.00	2,970	6,200	1,357	4,843	71.2
Md. Ekamul Hoque	76	Shatabdi	260	0	180	3,420	80	33.00	2,640	6,060	1,360	4,700	69.1
Md Aijuddin	79	Shatabdi	250	10	120	2,280	120	33.00	3,960	6,240	1,360	4,880	71.8
Md Ajahar	80	Sourav	255	0	105	1,995	150	33.00	4,950	6,945	1,360	5,585	82.1
Md Nasir Uddin	80	Shatabdi	280	0	200	3,800	80	33.00	2,640	6,440	1,356	5,084	74.8
Sree Jogobandhu	80	Shatabdi	285	0	145	2,755	140	33.00	4,620	7,375	1,370	6,005	88.3
Sree Onanto Kumar Roy	81	Shatabdi	210	20	170	3,230	20	33.00	660	3,890	1,388	2,502	36.8
Md Samsul Haque	83	Prodip	210	0	130	2,470	80	45.00	3,600	6,070	1,354	4,716	69.4
Md Abdul Malek	86	Shatabdi	230	0	180	3,420	50	33.00	1,650	5,070	1,356	3,714	54.6
Sree Birendro	86	Shatabdi	245	0	165	3,135	80	33.00	2,640	5,775	1,388	4,387	64.5
Md Hasanur Rahman	89	Shatadi	210	0	110	2,090	100	33.00	3,300	5,390	1,232	4,158	61.1
Aiub Ali	89	Sourav	240	0	160	3,040	80	33.00	2,640	5,680	1,404	4,276	62.9
Md Elias	89	Sourav	280	10	150	2,850	120	33.00	3,960	6,810	1,350	5,460	80.3
Sree Khusbonath Roy	89	Sourav	220	0	140	2,660	80	33.00	2,640	5,300	1,378	3,922	57.7

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Sree Horipad Roy	92	Sourav	240	10	210	3,990	20	33.00	660	4,650	1,388	3,262	48.0
Md. Jamshed	93	Shatadi	180	10	80	1,520	90	33.00	2,970	4,490	1,220	3,270	48.1
Sree Bhupen Chandra Roy	95	Sourav	140	80	0	0.00	60	33.00	1,980	1,980	1,348	632	9.3
Subsistence farmers													
Sree Jogesh Chandra	102	Shatabdi	300	0	150	2,850	150	33.00	4,950	7,800	1,353	6,447	94.8
Sree Jagoids Chandra Roy	103	Shatabdi	290	0	190	3,610	100	33.00	3,300	6,910	1,428	5,482	80.6
Sree Onil Chandra Ray	103	Shatabdi	180	30	30	570	120	33.00	3,960	4,530	1,220	3,310	48.7
Jitel Chandra Roy	103	Sourav	250	20	150	2,850	80	33.00	2,640	5,490	1,398	4,092	60.2
Sree Rabindranath Ray	105	Sourav	280	0	180	3,420	100	33.00	3,300	6,720	1,408	5,312	78.1
Sree Poresh Chandra Roy	113	Sourav	210	0	100	1,900	110	33.00	3,630	5,530	1,348	4,182	61.5
Omnad Chandra Roy	113	Sourav	220	0	110	2,090	110	33.00	3,630	5,720	1,348	4,372	64.3
Md. Abul Hossain	115	Shatabdi	280	0	180	3,420	100	33.00	3,300	6,720	1,418	5,302	78.0
Abdul Latif	115	Shatabdi	250	0	170	3,230	80	33.00	2,640	5,870	1,428	4,442	65.3
Mesoara	118	Shatadi	240	0	120	2,280	120	33.00	3,960	6,240	1,368	4,872	71.6
Bikash Chandra Ray	120	Sourav	225	0	135	2,565	90	33.00	2,970	5,535	1,356	4,179	61.5
Suresh Chandra Ray	129	Shatabdi	200	0	140	2,660	60	33.00	1,980	4,640	1,243	3,397	50.0
Sree Kamol Chandra Roy	144	Sourav	230	20	130	2,470	80	33.00	2,640	5,110	1,393	3,717	54.7
Md. Shahir uddin	145	Shatabdi	320	0	220	4,180	100	33.00	3,300	7,480	1,520	5,960	87.6
Sree Binoy Chandra Roy	162	Shatabdi	80	20	40	760	20	33.00	660	1,420	1,050	370	5.4
Means			235	6	135	2,565	95	34.4	3,249	5,813	1,345	4,468	65.7

Table E: Protashha - Profitability of wheat seed production in Dinajpur district.

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Invome Tk			Taka /0.08ha	USD /0.08ha
Md Nazrul Islam	33	Bijoy	200	0	110	2,090	90	40.00	3,600	5,690	1,162	4,528	66.6
Md Atikur Rahan	40	Bijoy	160	10	100	1,900	50	40.00	2,000	3,900	1,161	2,739	40.3
Md. Saidur Rahman	40	Prodip	256	16	120	2,280	120	50.00	6,000	8,280	1,356	6,924	101.8
Md Shahidul Islam	43	Bijoy	190	0	90	1,710	100	40.00	4,000	5,710	1,163	4,547	66.9
Md. Rezaul Islam	50	Prodip	250	0	150	2,850	100	50.00	5,000	7,850	1,352	6,498	95.6
Md. Sohidul Islam	53	Prodip	224	14	100	1,900	110	50.00	5,500	7,400	1,358	6,042	88.9
Md. Kamal	57	Bijoy	200	20	90	1,710	90	40.00	3,600	5,310	1,358	3,952	58.1
Md. Mojaffar Hossain	57	Prodip	240	0	140	2,660	100	50.00	5,000	7,660	1,356	6,304	92.7
Md. Abul Hossain	61	Prodip	290	15	175	3,325	100	50.00	5,000	8,325	1,354	6,971	102.5
Md. Sadequl Haque	91	Prodip	210	10	20	380	180	50.00	9,000	9,380	1,350	8,030	118.1
Md Abdul Wahed	110	Bijoy	180	0	120	2,280	60	40.00	2,400	4,680	1,164	3,516	51.7
Md. Abdus Jabbar	113	Prodip	280	20	170	3,230	90	50.00	4,500	7,730	1,356	6,374	93.7
Md. Nizam	132	Bijoy	160	0	85	1,615	75	40.00	3,000	4,615	1,161	3,454	50.8
Md Abdul Mannan	136	Bijoy	190	0	100	1,900	90	40.00	3,600	5,500	1,165	4,335	63.8
Md. Latif	143	Bijoy	180	30	70	1,330	80	40.00	3,200	4,530	1,160	3,370	49.6
Md. Khoka Miah	149	Bijoy	170	10	110	2,090	50	40.00	2,000	4,090	1,163	2,927	43.0
Md. Ashraf Ali	172	Prodip	200	0	80	1,520	120	50.00	6,000	7,520	1,352	6,168	90.7
Md. Rezaul Hoque	177	Bijoy	160	0	110	2,090	50	40.00	2,000	4,090	1,162	2,928	43.1
Md. Anisul Haque	179	Prodip	260	20	180	3,420	60	50.00	3,000	6,420	1,352	5,068	74.5
Salim Miah	245	Prodip	210	10	120	2,280	80	50.00	4,000	6,280	1,350	4,930	72.5
Means			211	9	112	2,128	90	45.0	4,120	6,248	1,268	4,980	73.2

Table F: DAE - Profitability of wheat seed production in Dinajpur, Punchagaor, Thakurgaon, Rangpur, Nilphamari & Lalmonirhat districts.

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Landless farmers													
Md Luthfar	0	Shatabdi	210	0	160	3,040	50	33.00	1,650	4,690	1,344	3,346	49.2
Mises Ajura Khatun	0	Sourav	220	0	170	3,230	50	33.00	1,650	4,880	1,352	3,528	51.9
Md Akkas Ali	0	Sourav	280	15	25	475	140	33.00	4,620	5,095	1,340	3,755	55.2
Md Noya Mia	0	Sourav	233	13	140	2,660	80	33.00	2,640	5,300	1,355	3,945	58.0
Md Alam	0	Sourav	238	8	150	2,850	80	33.00	2,640	5,490	1,362	4,128	60.7
Md Mukta Mia	0	Sourav	241	11	150	2,850	80	33.00	2,640	5,490	1,332	4,158	61.1
Md Anisur Rahman	0	Sourav	270	20	190	3,610	60	33.00	1,980	5,590	1,354	4,236	62.3
Jakir Hosen	0	Sourav	251	11	160	3,040	80	33.00	2,640	5,680	1,365	4,315	63.5
Md Aizuddin	0	Sourav	240	0	160	3,040	80	33.00	2,640	5,680	1,340	4,340	63.8
Md Raza Mia	0	Sourav	245	0	165	3,135	80	33.00	2,640	5,775	1,345	4,430	65.1
Md Sarifuddin	0	Shatabdi	200	0	50	950	150	33.00	4,950	5,900	1,332	4,568	67.2
Md Nezamuddin	0	Sourav	264	4	140	2,660	120	33.00	3,960	6,620	1,350	5,270	77.5
Md Jahangir Alam	0	Shatabdi	250	0	0	0	250	33.00	8,250	8,250	1,326	6,924	101.8
Md Shariful	0	Prodip	250	0	50	950	200	50.00	10,000	10,950	1,378	9,572	140.8
Marginal farmers													
Md Abdus Subhan	11	Sourav	290	0	140	2,660	150	33.00	4,950	7,610	1,474	6,136	90.2
Md Moslem Uddin	11	Shatabdi	210	10	100	1,900	100	33.00	3,300	5,200	1,376	3,824	56.2
Md Jakaria	14	Shatabdi	230	0	0	-	230	33.00	7,590	7,590	1,324	6,266	92.1
Edu	14	Shatabdi	192	0	92	1,748	100	33.00	3,300	5,048	1,320	3,728	54.8
Md Dulal	18	Shatabdi	184	14	120	2,280	50	33.00	1,650	3,930	1,320	2,610	38.4
Md Jiabul	21	Shatabdi	187	7	80	1,520	100	33.00	3,300	4,820	1,320	3,500	51.5
Md Jahangir Alam	22	Sourav	280	40	160	3,040	80	33.00	2,640	5,680	1,330	4,350	64.0
Sree Godo Hemram	23	Shatabdi	240	0	40	760	200	33.00	6,600	7,360	1,380	5,980	87.9
Md Soyod Ali	25	Sourav	240	0	90	1,710	150	33.00	4,950	6,660	1,345	5,315	78.2

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Sree Mohos Chandra	25	Prodip	290	0	140	2,660	150	50.00	7,500	10,160	1,320	8,840	130.0
Md Ansar Ali	27	Shatabdi	190	0	90	1,710	100	33.00	3,300	5,010	1,324	3,686	54.2
Sree Mohendro	29	Shatabdi	150	30	0	-	120	33.00	3,960	3,960	1,320	2,640	38.8
Md Hamidul Islam	29	Shatabdi	250	0	230	4,370	20	33.00	660	5,030	1,320	3,710	54.6
Md Nazrul Islam	31	Shatabdi	344	44	0	-	300	33.00	9,900	9,900	1,495	8,405	123.6
Sree Mukul Chandro Ray	32	Prodip	185	0	65	1,235	120	45.00	5,400	6,635	1,245	5,390	79.3
Poiz	34	Shatabdi	190	0	90	1,710	100	33.00	3,300	5,010	1,320	3,690	54.3
Md Amirot Ali	34	Prodip	180	0	90	1,710	90	45.00	4,050	5,760	1,237	4,523	66.5
Sree Kamona Ray	36	Shatabdi	160	0	30	570	130	33.00	4,290	4,860	1,320	3,540	52.1
Md Enamul	36	Shatabdi	270	0	70	1,330	200	33.00	6,600	7,930	1,322	6,608	97.2
Md. Robiul Islam	38	Shatabdi	260	0	60	1,140	200	33.00	6,600	7,740	1,328	6,412	94.3
Sree Onil Chandro	39	Shatabdi	178	0	100	1,900	78	33.00	2,574	4,474	1,244	3,230	47.5
Md Moslem Uddin	40	Shatabdi	240	0	40	760	200	33.00	6,600	7,360	1,355	6,005	88.3
Md. Fajlar Rahman	40	Shatabdi	256	6	0	-	250	33.00	8,250	8,250	1,323	6,927	101.9
Md Khatib Uddin	40	Prodip	180	0	70	1,330	110	45.00	4,950	6,280	1,241	5,039	74.1
Md Jahir Uddin	40	Shatabdi	256	16	40	760	200	33.00	6,600	7,360	1,485	5,875	86.4
Md. Sohidul Islam	41	Shatabdi	224	24	0	-	200	33.00	6,600	6,600	1,320	5,280	77.6
Md Motahar Hosen	42	Prodip	190	0	30	570	160	45.00	7,200	7,770	1,247	6,523	95.9
Sree Mohadebmohonto	43	Shatabdi	199	0	100	1,900	99	33.00	3,267	5,167	1,320	3,847	56.6
Md Sekender Ali	44	Sourav	300	0	100	1,900	200	33.00	6,600	8,500	1,555	6,945	102.1
Md Rabiul Islam	44	Shatabdi	250	0	50	950	200	33.00	6,600	7,550	1,328	6,222	91.5
Md Motiar Rahman	44	Sourav	280	15	25	475	240	33.00	7,920	8,395	1,328	7,067	103.9
Sree Farul Chandra	45	Shatabdi	240	0	0	-	240	33.00	7,920	7,920	1,320	6,600	97.1
Sunasuddin	46	Shatabdi	192	0	92	1,748	100	33.00	3,300	5,048	1,320	3,728	54.8
Md Moinuddin	47	Shatabdi	260	5	230	4,370	25	33.00	825	5,195	1,365	3,830	56.3
Md Alal	47	Sourav	320	0	220	4,180	100	33.00	3,300	7,480	1,545	5,935	87.3
Md Nur Islam	47	Shatabdi	250	0	30	570	220	33.00	7,260	7,830	1,324	6,506	95.7

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Md Shofikul Islam	48	Shatabdi	210	10	0	0	200	33.00	6,600	6,600	1,328	5,272	77.5
Sree Dhoronikanto	48	Shatabdi	280	10	0	-	270	33.00	8,910	8,910	1,344	7,566	111.3
Md Samsul Haque	49	Shatabdi	220	20	0	-	200	33.00	6,600	6,600	1,324	5,276	77.6
Md Sobed Ali	51	Shatabdi	130	0	70	1,330	60	33.00	1,980	3,310	1,320	1,990	29.3
Sree Bimol	51	Shatabdi	224	24	100	1,900	100	33.00	3,300	5,200	1,332	3,868	56.9
Md Easin Ali	52	Shatabdi	200	0	0	-	200	33.00	6,600	6,600	1,329	5,271	77.5
Sree Bishonath Mohonto	54	Shatabdi	194	10	90	1,710	94	33.00	3,102	4,812	1,324	3,488	51.3
Md Sadekul Islam	54	Shatabdi	195	5	140	2,660	50	33.00	1,650	4,310	1,320	2,990	44.0
Md Polash Mia	55	Sourav	250	0	190	3,610	60	33.00	1,980	5,590	1,342	4,248	62.5
Md Merajul Islam	55	Prodip	175	0	90	1,710	85	45.00	3,825	5,535	1,239	4,296	63.2
Md Nazmul	55	Prodip	260	10	0	-	250	50.00	12,500	12,500	1,400	11,100	163.2
Md. Mojaffar Hossain	57	Shatabdi	240	0	40	760	200	33.00	6,600	7,360	1,328	6,032	88.7
Md Ainal Haque	58	Sourav	230	30	160	3,040	40	33.00	1,320	4,360	1,332	3,028	44.5
Md Nuruzzaman	59	Shatabdi	190	0	130	2,470	60	33.00	1,980	4,450	1,327	3,123	45.9
Md. Abdul Kalam	61	Shatabdi	290	0	90	1,710	200	33.00	6,600	8,310	1,473	6,837	100.5
Md Azizul Islam	61	Prodip	170	0	90	1,710	80	45.00	3,600	5,310	1,237	4,073	59.9
Md Sofiuddin	62	Shatabdi	160	0	120	2,280	40	33.00	1,320	3,600	1,324	2,276	33.5
Sree Modon Kumer Ray	63	Shatabdi	256	6	0	-	250	33.00	8,250	8,250	1,342	6,908	101.6
Sree Dhananjoy	66	Shatabdi	190	0	150	2,850	40	33.00	1,320	4,170	1,320	2,850	41.9
Md Khademul Islam	67	Shatabdi	200	0	100	1,900	100	33.00	3,300	5,200	1,327	3,873	57.0
Md Ismail Hosen	67	Shatabdi	240	0	20	380	220	33.00	7,260	7,640	1,322	6,318	92.9
Sree Nony Gopal	68	Shatabdi	220	20	160	3,040	40	33.00	1,320	4,360	1,332	3,028	44.5
Sree Norendronath	68	Shatabdi	213	13	120	2,280	80	33.00	2,640	4,920	1,329	3,591	52.8
Sree Amal Chandra Ray	68	Shatabdi	300	0	50	950	250	33.00	8,250	9,200	1,505	7,695	113.2
Md Moktar	68	Shatabdi	190	0	140	2,660	50	33.00	1,650	4,310	1,320	2,990	44.0
Sree Ranzan Bosak	68	Shatabdi	200	0	0	-	200	33.00	6,600	6,600	1,332	5,268	77.5
Md Joynal Mia	70	Sourav	250	0	200	3,800	50	33.00	1,650	5,450	1,338	4,112	60.5

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Md Masum Sarker	71	Sourav	360	0	80	1,520	280	33.00	9,240	10,760	1,487	9,273	136.4
Md Rokonuzzaman	72	Sourav	240	0	160	3,040	80	33.00	2,640	5,680	1,335	4,345	63.9
Md Mohidul Islam	73	Shatabdi	148	8	40	760	100	33.00	3,300	4,060	1,320	2,740	40.3
Md Ershad Ali	73	Sourav	350	0	50	950	300	33.00	9,900	10,850	1,473	9,377	137.9
Md Zahangir	73	Sourav	226	6	40	760	180	33.00	5,940	6,700	1,332	5,368	78.9
Md Afjal Hosen	73	Shatabdi	170	0	90	1,710	80	33.00	2,640	4,350	1,241	3,109	45.7
Sree Nobin Chandro	73	Prodip	240	0	0	-	240	50.00	12,000	12,000	1,320	10,680	157.1
Md Shofikul Islam	74	Shatabdi	240	20	140	2,660	80	33.00	2,640	5,300	1,328	3,972	58.4
Obinashchandro sen	75	Shatabdi	223	23	110	2,090	90	33.00	2,970	5,060	1,328	3,732	54.9
Md. Abdus Sattar	75	Shatabdi	300	0	50	950	250	33.00	8,250	9,200	1,472	7,728	113.6
Md Ansar Ali	76	Sourav	280	0	180	3,420	100	33.00	3,300	6,720	1,465	5,255	77.3
Md Mozahar Ali	77	Shatabdi	240	0	160	3,040	80	33.00	2,640	5,680	1,330	4,350	64.0
Sree Prem Horri	78	Prodip	280	0	130	2,470	150	50.00	7,500	9,970	1,320	8,650	127.2
Md Mofizuddin	79	Shatabdi	200	0	130	2,470	70	33.00	2,310	4,780	1,360	3,420	50.3
Md Habibur Rahman	79	Shatabdi	240	0	40	760	200	33.00	6,600	7,360	1,378	5,982	88.0
Sree Jiten	80	Shatabdi	190	0	110	2,090	80	33.00	2,640	4,730	1,320	3,410	50.1
Md Emaruddin	81	Shatabdi	250	0	100	1,900	150	33.00	4,950	6,850	1,320	5,530	81.3
Md Rafikul Islam	82	Shatabdi	195	5	100	1,900	90	33.00	2,970	4,870	1,324	3,546	52.1
Md Afjal Hosen	83	Shatabdi	220	20	0	-	200	33.00	6,600	6,600	1,324	5,276	77.6
Md Afsar Ali	83	Shatabdi	270	10	200	3,800	60	33.00	1,980	5,780	1,360	4,420	65.0
Md Saheb Mia	84	Sourav	290	0	240	4,560	50	33.00	1,650	6,210	1,334	4,876	71.7
Md Emdadul Haque	85	Shatabdi	275	0	255	4,845	20	33.00	660	5,505	1,342	4,163	61.2
Md Harunur Rashid	85	Shatabdi	180	0	30	570	150	33.00	4,950	5,520	1,320	4,200	61.8
Sree Dhoneshor Chandro	86	Shatabdi	256	6	30	570	220	33.00	7,260	7,830	1,344	6,486	95.4
Sree Ojit Kumar Ray	87	Shatabdi	187	7	80	1,520	100	33.00	3,300	4,820	1,320	3,500	51.5
Md Sahojahan Ali	89	Shatabdi	285	5	250	4,750	30	33.00	990	5,740	1,320	4,420	65.0
Md Abdul Mannan	89	Shatabdi	250	20	190	3,610	40	33.00	1,320	4,930	1,324	3,606	53.0

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Md Abdus Salam	90	Shatabdi	240	0	160	3,040	80	33.00	2,640	5,680	1,328	4,352	64.0
Md Amzad Hosen	90	Sourav	200	0	140	2,660	60	33.00	1,980	4,640	1,332	3,308	48.6
Md Makbul Hosen	91	Prodip	180	0	60	1,140	120	45.00	5,400	6,540	1,237	5,303	78.0
Md. Emdadul Haque	91	Shatabdi	255	5	0	-	250	33.00	8,250	8,250	1,327	6,923	101.8
Md Khalilur Rahman	91	Prodip	190	0	70	1,330	120	45.00	5,400	6,730	1,235	5,495	80.8
Sree Jamineekanto	91	Shatabdi	229	9	120	2,280	100	33.00	3,300	5,580	1,322	4,258	62.6
Md Shahidul Islam	95	Shatabdi	260	0	70	1,330	190	33.00	6,270	7,600	1,343	6,257	92.0
Md Abdul Mozid	96	Shatabdi	240	0	100	1,900	140	33.00	4,620	6,520	1,342	5,178	76.1
Md Shofiar Rahman	96	Sourav	280	0	230	4,370	50	33.00	1,650	6,020	1,350	4,670	68.7
Md Shajad Hosen	98	Sourav	300	0	200	3,800	100	33.00	3,300	7,100	1,485	5,615	82.6
Mo. Somsar Uddin	99	Shatabdi	290	0	260	4,940	30	33.00	990	5,930	1,365	4,565	67.1
Sree Vobesh Chandra	99	Shatabdi	320	0	0	-	320	33.00	10,560	10,560	1,465	9,095	133.8
Subsistence farmers													
Md Abdul Mannan	100	Shatabdi	198	8	120	2,280	70	33.00	2,310	4,590	1,328	3,262	48.0
Sree Monoronjon Ray	100	Shatabdi	288	8	30	570	250	33.00	8,250	8,820	1,332	7,488	110.1
Md Koisar Ali	101	Shatabdi	186	0	86	1,634	100	33.00	3,300	4,934	1,326	3,608	53.1
Sree Susil Chandra Ray	103	Shatabdi	340	40	0	-	300	33.00	9,900	9,900	1,473	8,427	123.9
Sree Atul Chandro	104	Shatabdi	256	6	20	380	230	33.00	7,590	7,970	1,348	6,622	97.4
Md Hamidul Islam	105	Shatabdi	180	0	30	570	150	33.00	4,950	5,520	1,320	4,200	61.8
Md Efikul	106	Shatabdi	220	0	70	1,330	150	33.00	4,950	6,280	1,360	4,920	72.4
Sree Prionath	108	Shatabdi	180	0	30	570	150	33.00	4,950	5,520	1,320	4,200	61.8
Md Ainal Haque	109	Shatabdi	260	0	180	3,420	80	33.00	2,640	6,060	1,325	4,735	69.6
Abdul Motaleb	110	Shatabdi	250	0	200	3,800	50	33.00	1,650	5,450	1,326	4,124	60.6
Sree Dipcharan	110	Shatabdi	200	0	160	3,040	40	33.00	1,320	4,360	1,320	3,040	44.7
Md Abdul Kader	114	Prodip	90	0	20	380	70	45.00	3,150	3,530	1,243	2,287	33.6
Md Younis Ali	114	Shatabdi	280	0	230	4,370	50	33.00	1,650	6,020	1,320	4,700	69.1
Ozit Chandra Ray	114	Shatabdi	200	0	0	-	200	33.00	6,600	6,600	1,324	5,276	77.6

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Md Ibrahim	117	Shatabdi	200	0	50	950	150	33.00	4,950	5,900	1,332	4,568	67.2
Sree Ramchandra	118	Shatabdi	220	0	120	2,280	100	33.00	3,300	5,580	1,340	4,240	62.4
Md Mizanur Rahman	123	Sourav	244	4	40	760	200	33.00	6,600	7,360	1,320	6,040	88.8
Sree Rathindranath	126	Shatabdi	310	0	30	570	280	33.00	9,240	9,810	1,487	8,323	122.4
Jotish Chandra Ray	126	Shatabdi	240	20	0	-	220	33.00	7,260	7,260	1,328	5,932	87.2
Md Farhad Hosen	128	Prodip	290	0	40	760	250	50.00	12,500	13,260	1,398	11,862	174.4
Sree Prothom Odhikari	128	Prodip	320	0	100	1,900	220	50.00	11,000	12,900	1,410	11,490	169.0
Md Jillur	130	Shatabdi	195	0	95	1,805	100	33.00	3,300	5,105	1,320	3,785	55.7
Sree Poresh Chandra Ray	130	Shatabdi	310	10	0	-	300	33.00	9,900	9,900	1,473	8,427	123.9
Ukil Chandra Roy	131	Shatabdi	240	0	0	-	220	33.00	7,260	7,260	1,326	5,934	87.3
Md Asadul Islam	131	Shatabdi	180	0	130	2,470	50	33.00	1,650	4,120	1,328	2,792	41.1
Jogodish Mohonto	131	Shatabdi	228	8	120	2,280	100	33.00	3,300	5,580	1,326	4,254	62.6
Sree Sukumar Ray	135	Shatabdi	290	0	0	-	290	33.00	9,570	9,570	1,477	8,093	119.0
Sree Krisna Chandra Roy	136	Shatabdi	260	0	60	1,140	200	33.00	6,600	7,740	1,322	6,418	94.4
Md Asadul Habib	137	Shatabdi	260	0	180	3,420	80	33.00	2,640	6,060	1,322	4,738	69.7
Md Moinul Haque	140	Prodip	270	20	0	-	250	50.00	12,500	12,500	1,320	11,180	164.4
Md. Ashraf Ali	141	Shatabdi	273	23	0	-	250	33.00	8,250	8,250	1,328	6,922	101.8
Md Abdur Rahman	142	Shatabdi	200	0	130	2,470	70	33.00	2,310	4,780	1,342	3,438	50.6
Sree Kisorimohon	158	Shatabdi	210	0	130	2,470	80	33.00	2,640	5,110	1,334	3,776	55.5
Md. Sumon Mian	158	Shatabdi	258	8	0	-	250	33.00	8,250	8,250	1,329	6,921	101.8
Md Amir Ali	164	Shatabdi	200	0	120	2,280	80	33.00	2,640	4,920	1,324	3,596	52.9
Md Suruz Ai	168	Prodip	250	0	100	1,900	150	50.00	7,500	9,400	1,387	8,013	117.8
Md Siddikul Islam	175	Shatabdi	240	0	60	1,140	180	33.00	5,940	7,080	1,329	5,751	84.6
Md Amjad Ali	177	Shatabdi	222	22	160	3,040	40	33.00	1,320	4,360	1,332	3,028	44.5
Md Abdul Malek	177	Shatabdi	187	7	80	1,520	100	33.00	3,300	4,820	1,320	3,500	51.5
Md Tomijuddin	179	Shatabdi	212	12	150	2,850	50	33.00	1,650	4,500	1,334	3,166	46.6
Md. Anisul Haque	179	Shatabdi	264	14	0	-	250	33.00	8,250	8,250	1,324	6,926	101.9

Farmer's name	RSSI %	Wheat variety	Wheat yield kg/0.08ha	Grain			Seed			Total income Grain+Seed	Input cost Tk/.08ha	Profit	
				Eaten kg	Sold kg	Income Tk	Saved kg	Price Tk/kg	Income Tk			Taka /0.08ha	USD /0.08ha
Md Aiub Ali	180	Shatabdi	240	0	40	760	200	33.00	6,600	7,360	1,320	6,040	88.8
Md Motaleb	182	Prodip	195	0	35	665	160	45.00	7,200	7,865	1,247	6,618	97.3
Md Fazlur Rahman	192	Shatabdi	190	0	10	190	180	33.00	5,940	6,130	1,320	4,810	70.7
Sree Kalishek	192	Prodip	240	0	200	3,800	40	50.00	2,000	5,800	1,410	4,390	64.6
Md Luthfar	197	Shatabdi	192	0	92	1,748	100	33.00	3,300	5,048	1,320	3,728	54.8
Md Babul Haque	197	Shatabdi	260	0	90	1,710	170	33.00	5,610	7,320	1,328	5,992	88.1
Md Sadekul Islam	197	Shatabdi	250	5	50	950	195	33.00	6,435	7,385	1,324	6,061	89.1
Food surplus farmers													
Md Torikul Islam	208	Shatabdi	280	0	70	1,330	210	33.00	6,930	8,260	1,328	6,932	101.9
Md Shahajul Islam	212	Shatabdi	240	20	0	0	220	33.00	7,260	7,260	1,350	5,910	86.9
Upendranath Roy	214	Shatabdi	220	20	0	-	200	33.00	6,600	6,600	1,322	5,278	77.6
Md Tarek Rahman	276	Sourav	241	11	150	2,850	80	33.00	2,640	5,490	1,344	4,146	61.0
Md Rafikul Islam	342	Shatabdi	256	6	50	950	200	33.00	6,600	7,550	1,326	6,224	91.5
Md Salim Ahmed	356	Shatabdi	245	5	50	950	190	33.00	6,270	7,220	1,320	5,900	86.8
Means			235	5	89	1,685	140	34.7	4,900	6,585	1,343	5,242	77.1

Appendix II

Table G: Food security indices for Molo farmers

Name	Village	Land holding acres	Potential maize yield kg	Household size			Ann. maize requirement kg	MSSI %
				Adults	10-18 yrs	<10yrs		
Food insecure farmers								
P Waweru	Temoyetta	0	0	2	0	1	913	0
J Kaguvi	Rwangondu	0	0	2	0	2	1,096	0
J Wamboi*	Temoyetta	0	0	3	2	3	2,192	0
J Kinyua	Temoyetta	0	0	2	0	2	1,096	0
M Nyaguthi*	Temoyetta	0.25	450	1	1	2	1,005	45
R Nguku	Temoyetta	0.5	900	2	2	1	900	62
J Wachira	Rwangondu	1	1,800	2	3	2	1,858	94
B Muthoga	Temoyetta	2	3,600	5	4	4	3,653	99
Subsistence farmers								
S Karanja	Baringo	1.5	2,700	2	4	4	2,558	106
G Njuguna	Githiringa	1	1,800	1	4	1	1,644	110
J Mjoroge	Temoyetta	2	3,600	4	3	5	3,197	113
P Nganga	Rwangondu	2	3,600	2	4	7	3,107	117
P Karomo	Rwangondu	2	3,600	2	4	7	3,107	117
J Wamahia	Mawihgu	2	3,600	4	3	4	3,014	120
G Ngugi	Temoyetta	1	1,800	2	2	1	1,461	123
P Nguku	Temoyetta	1	1,800	2	1	2	1,370	132
J Mungai	Temoyetta	2	3,600	3	3	2	2,283	158
J Macharia	Rwangondu	2	3,600	2	3	4	2,284	158
P Nderi	Temoyetta	2	3,600	2	4	2	2,192	165
S Kimani	Temoyetta	1.5	2,700	2	2	2	1,644	165
D Mburu	Temoyetta	2	3,600	2	2	5	2,193	165
J Boro	Temoyetta	2.5	4,500	2	5	3	2,649	170
P Maingi	Rwangondu	2	3,600	2	3	3	2,101	172
P Murango	Temoyetta	5	9,000	7	5	4	4,657	194
M Wangari	Baringo	1	1,800	1	2	0	913	197
J Ngure	Temoyetta	5	9,000	9	4	1	4,564	197
Food surplus farmers								
P Githinji	Temoyetta	5	9,000	10	3	0	4,472	201
P Rugame	Baringo	4	7,200	6	4	1	3,469	208
J Njongoro	Temoyetta	5	9,000	3	8	2	3,653	247
J Kiarii	Temoyetta	3	5,400	3	2	3	2,192	247
M Kimani	Temoyetta	5	9,000	5	3	4	3,379	267
J Mwangi	Temoyetta	5	9,000	5	4	2	3,287	274
D Wanjuki	Temoyetta	2	9,000	5	3	2	3,013	299
M Wanjiru	Temoyetta	5	9,000	4	3	4	3,014	300
D Ngugi	Temoyetta	2	9,000	4	3	4	3,014	300
E Waitiki	Temoyetta	3	5,400	2	3	1	1,735	312
M Nganga*	Temoyetta	5	9,000	5	3	1	2,830	318
J Kimani	Temoyetta	5	9,000	5	2	2	2,739	329
S Thuku	Temoyetta	5	9,000	6	1	0	2,464	365
L Githaiga*	Temoyetta	5	9,000	5	2	0	1,278	379
P Ndurou	Temoyetta	5	9,000	4	2	2	2,374	380
J Mwangi	Temoyetta	3.5	6,300	2	2	2	1,644	385
G Gicheha	Temoyetta	5	9,000	2	5	0	2,100	429
M Kihiuhi	Temoyetta	5	9,000	2	4	1	2,009	449
J Kihenja	Temoyetta	5	9,000	2	4	1	2,009	449
D Mungai	Temoyetta	5	9,000	2	2	4	2,010	450
P Kamau	Rwangondu	5	9,000	2	2	4	2,010	450
J Kariithi	Temoyetta	5	9,000	4	1	1	1,917	470
L. Wanjiru	Temoyetta	5	9,000	2	3	2	1,918	471
W Kinu	Temoyetta	5	9,000	2	3	2	1,918	471
J Njoroge	Temoyetta	5	9,000	2	4	0	1,826	493

Name	Village	Land holding acres	Potential maize yield kg	Household size			Ann. maize requirement kg	MSSI %
				Adults	10-18 yrs	<10yrs		
R Mwangi*	Temoyetta	5	9,000	2	2	3	1,827	495
G Gachini	Temoyetta	5	9,000	2	2	3	1,827	495
J Chege	Temoyetta	5	9,000	2	2	2	1,644	549
J Rimiru	Temoyetta	5	9,000	2	2	2	1,644	549
D Kanyord	Baringo	5	9,000	2	2	2	1,644	549
S Njoroge	Baringo	12	21,600	5	5	2	3,561	608
M Kamau	Rwangondu	8	14,400	2	4	3	2,375	609
M Njoka	Temoyetta	5	9,000	2	1	2	1,370	660
S Karuri	Ngarua	5	9,000	1	3	0	1,187	758
W Mwangi	Temoyetta	6	10,800	3	1	0	1,369	789
M Mbara	Baringo	16	28,800	7	0	6	3,653	792
P Thuku	Temoyetta	5	9,000	2	0	2	1,096	826
J Wachira	Temoyetta	5	9,000	2	0	1	913	989
J Njenga	Kentoiletty	10	18,000	3	1	1	1,552	1,162
J Barus	Baringo	12	21,600	2	0	3	1,279	1,701

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