A Report on Strengthening Farmer Capacity for Growing a Healthy Potato Crop in Nepal

O.A. Hidalgo[1], D.M. Campilan[2], and T.L. Lama[3]

Low potato productivity in Nepal is largely a result of seed-borne diseases. A collaborative project between CIP and Nepal's extension and research agencies sought to use the farmer field school (FFS) approach to promote integrated disease management (IDM) for potato production and help farmers strengthen their capacity for growing a healthy potato crop. During the 1999 and 2000 growing seasons, the project conducted nine FFSs across the country for 253 participants. Farmers' knowledge improved, and yields increased on the plots where IDM practices were applied. However, it became clear that the FFS approach, which was originally designed for rice-pest problems, needs major adaptations when used to address potato IDM, and that in order for the FFS to serve as an effective vehicle for local multiplication and maintenance of healthy tuber seed, group learning processes need to be combined with appropriate social and institutional arrangements among farmer participants.

Potato Production in Nepal

Potato is an important staple food crop in Nepal, with per capita consumption of 30 kg/year, one of the highest national rates in southwest Asia. Area under potato in Nepal in 1998 was 118,043 ha (MA/ASD, 1999); the crop is grown across the country in three agroecological zones, from the southern *terai* (below 1000 m altitude) to the northern high hills and mountains (up to 4000 m). Half (50.3%) of the potato farms are found in mid-altitude areas (1500–2000 m) At elevations of 2000 m and above, farmers traditionally grow seed potato tubers that meet the requirements of farmers in the mid-hills and plains during the planting season (Bhomi, 1997). Although potato productivity has increased rapidly (by 70%) over the past 30 years, it is still among the lowest in the world. Poor seed (quality and quantity) and seed-borne diseases are a major cause of this low productivity.

Seed and diseases: Key limiting factors for increasing potato productivity

Nepal's potato growers need about 150,000 t of tuber seed per year, but government and private commercial-sector seed producers can supply only 10–15% of this amount (Lama, 1998). Tuber-seed produced by community-based Seed Producer Groups is gaining space very rapidly in Nepal's potato cultivation (Ojha et al., 2001). There are several traditional seed pockets in the mid- and high-hills of Nepal still producing seed potatoes for their surroundings and for transport to lower altitudes. However, high transport and storage costs add to the problem of

[1] CIP, Islamabad, Pakistan.
[2] CIP-UPWARD, Los Banos, Philippines.
[3] DoA-PDS, Kathmandu, Nepal.

seed supply. So the seed used by most potato farmers usually consists of tubers saved from the previous season or obtained from the local agricultural market.

The seed supply problem is further aggravated by the prevalence of various diseases. Late blight (*Phytophthora infestans)* and bacterial wilt (*Ralstonia solanacearum*) are the most devastating (Hidalgo, 1998). Late blight is a recurring feature in all regions of the country, and most of the popular potato varieties are highly susceptible; in some years, crop losses are as high as 95%. Chemical control, even if not too expensive by local standards, must be used in a preventive and precise manner, which is sometimes not possible when the disease appears in epidemic proportions. The incidence of bacterial wilt has ranged from 10% to 100% in the past 15 years. Its occurrence is mainly associated with the use of infected seed, planting on contaminated soil, and poor crop management practices. Yield losses in the western hills have reached 95% in the field and 100% in storage (Pradhanang et al., 1987, 1993; Pradhang and Elphinstone, 1997). Other important diseases include wart (*Synchytrium endobioticum*), black scurf (*Rhizoctonia solani*), common scab (*Streptomyces scabies*), and diseases caused by viruses (Hidalgo, 1998). All these diseases not only reduce yields, but also make it difficult for farmers to produce enough seed for subsequent planting seasons.

Developing local capacity for potato IDM

Since 1999, CIP has been working with Nepal's agricultural extension and research agencies on a project aimed at promoting integrated disease management (IDM) by developing and piloting participatory farmer learning approaches. The project, supported by the Swiss Agency for Development and Cooperation (SDC) and the Users' Perspectives With Agricultural Research and Development (UPWARD), trained a team of extensionists and researchers working to strengthen the capacity of potato farmers to multiply and maintain their own supply of healthy tuber seed. The farmer field school (FFS) approach was selected as the main vehicle through which extensionists and researchers could facilitate farmer learning on IDM. The project's underlying goal was to assess the potential of applying FFS for this purpose on a wider scale in Nepal.

In the 1999 and 2000 crop seasons, the CIP-SDC Project and UPWARD, in partnership with the Nepal Department of Agriculture (DoA) and the Nepal Agricultural Research Council (NARC), conducted nine FFSs and trained 253 participants. This was the first time that FFSs had been used in supporting potato production in Nepal, so the project sought to develop an eclectic approach that drew on relevant past experience in potato and sweetpotato from UPWARD and other CIP projects, and in rice from the Food and Agriculture Organization of the United Nations (FAO) Community Integrated Pest Management (IPM) Program in Nepal.

The lack of previous experience in potato FFS was a major drawback, but the project benefited from the FAO program's earlier efforts to train district-level agricultural technicians as FFS facilitators. Of the 32 facilitators for the potato FFS, one third had prior experience in running a similar activity on rice IPM (the FFS approach was developed for IPM in rice). In a project workshop after the first year of project implementation, these facilitators indicated that their facilitation skills acquired through FAO were an asset, but they noted that major adaptations had to be made for the FFS approach to be applied to potato seed and disease problems (Table 1).

Potato ICM required that the FFS be conducted over several seasons, the learning plots be used also for seed multiplication, and the field observations be done to anticipate the onset of late blight.

Table 1. Comparison of original rice Farmer Field School (FFS) and the emerging potato integrated disease management (IDM) approach in Nepal.

Aspect	Rice FFS	Potato IDM	Remarks
Time frame	Season-long	Multi-season	IDM requires a longer time frame since its success is determined by doing a follow-up by replanting produced seeds in next seasons.
Learning plots	Experimentation	Experimentation, seed multiplication/ maintenance	Seed is an important component of IDM. Learning plot is also used to multiply/ maintain good-quality seed.
Frequency of sessions	Weekly	Weekly, but with more frequent inspection for late blight detection.	Depends on appearance of disease symptoms, especially for late blight. Sessions need not be weekly early in the season, however, they need to be more frequent (2–3 per week) when late blight/ bacterial wilt symptoms begin to appear.
AESA[1]	Basic method for learning by 'discovery' by farmers	AESA needs to be complemented by other 'discovery' methods	To be used more selectively since weekly AESA produces data which may not be directly useful/relevant for potato IDM.
Making things visible	Directly through AESA	Directly and indirectly	Unlike insects, pathogens are often not visible. Experiments to show the 'effects' needs to be done.
Evaluation	Impact after FFS season	Impact after several seasons	Disease management takes several seasons to complete. Impact assessment needs to be done only after several seasons.
Scope	Single constraint - crop	Multiple constraints - cropping system	Disease and seed management are closely interrelated. FFS needs to deal with the interaction among disease and seed factors, as well as dynamics between potato and other crops.

[1] AESA = agro-ecosystem analysis.

Most importantly, project collaborators suggested that agro-ecosystem analysis (AESA), as designed in rice FFS, had to be used more selectively because, unlike in rice FFS:

- weekly AESA early in the season often does not yield sufficiently different or new observations about the potato crop.
- the detailed data (e.g., number of leaves) gathered in rice AESA are not directly relevant to the learning content in potato AESA, and
- AESA needs to be combined with other observation methods and exercises to facilitate farmers' discovery/learning more about potato diseases (e.g., trials).

Increasing farmers' knowledge through field schools

Because there were differences in the potato systems and constraints at the nine FFS sites, each group of facilitators and farmers developed its own locally relevant training curriculum (Table 2). Thus, they had a common focus on seed health and late blight, but each FFS took the decision of including bacterial wilt, true potato seed, and/or crop management.

The project demonstrated that it is not only male, literate farmers from the dominant ethnic group who are able to participate meaningfully in agricultural research and extension. Of those who successfully

Table 2. Comparison of FFS curricula among different sites.

FFS Sites	Main learning content for potato IDM in FFSs				
	Seed health	Late blight	Bacterial wilt	True potato seed	Crop management
Sarlahi	X	X			X
Rupandelhi	X	X			
Sunsari	X	X		X	
Nigaley	X	X	X		
Danushi	X	X		X	
Surkhet	X	X			
Kathmandu	X	X			X
Kavre	X	X	X		
Kapilbastu	X	X		X	

completed the FFS, 26% were illiterate and 36% were female. In addition, participants at seven of the FFSs came from multiple ethnic groups. Average knowledge gain (based on a comparison of the results of pre- and post-FFS tests) on potato seed and disease management was 84% (Table 3).

FFS plots for learning and seed multiplication

In an FFS, group learning centers around the learning plots. In the Nepal project, the learning plots were used to compare recommended IDM practices (such as use of healthy seed, resistant varieties, field sanitation, and regular monitoring) with farmers' seed and associated practices.

At all FFS sites (except Kathmandu, for which data are not available), the average yields from the IDM plots were higher than those from the plots with farmers' seed and practices (FSP); average yield increase across the eight sites was 14.2 t/ha (Table 4). No data are available on the yields achieved by the farmers in their own fields; participants at future FFS should be asked to provide such information.

The FFS learning plots were also intended to be used for multiplying healthy tuber seed that could be shared among participating farmers at the end of the FFS. In the majority of the FFS sites, however, this goal was not achieved because the farmers did not discuss in advance how the tubers harvested from the learning plots would be divided among them. The informal agreement was for the harvested tubers to be given as incentive to landowners whose fields were used as learning plots. But the landowners wanted immediate cash benefits, so they sold the tubers,

Table 3. Profile of FFS participants and their change in knowledge on potato IDM.

FFS Sites	Farmers gender (M/F)	Change in knowledge				
		Literacy (%)	Pre-test score (%)	Post-test score (%)	Net increase (%)	Difference (%)[1]
Sarlahi	18 (18/0)	83	39	70	31	79.5
Rupandelhi	34 (31/3)	40	27	84	57	211.1
Sunsari	34(21/13)	82	38	78	40	105.3
Nigaley	24 (8/16)	50	35	73	38	108.6
Danushi	25 (17/8)	60	-	-	-	-
Surkhet	39 (3/36)	60	38	98	60	157.9
Kathmandu	21 (18/3)	100	55	73	18	32.7
Kavre	25 (21/4)	90	53	85	32	60.4
Kapilbastu	17 (14/3)	100	65	85	20	30.8
Total average	**237/26 (17/9)**	**74**	**43.8**	**80.8**	**37**	**84.5**

[1] Compares changes in knowledge between pre- and post-tests.

Table 4. Yield comparison between IDM and FSP plots.

FFS sites[1]	Farmers' seed and practices (t/ha)	IDM (t/ha)	Yield increase (t/ha)	Difference (%)[2]
Nigaley	12.5	40.0	27.5	220.0
Kapilbastu	12.0	26.0	14.0	116.7
Rupandelhi	20.0	35.0	15.0	75.0
Danushi	8.0	13.8	5.8	72.5
Sunsari	36.0	58.0	22.0	61.1
Sarlahi	17.0	25.0	8.0	47.1
Kavre	25.0	35.0	10.0	40.0
Surkhet	27.1	29.6	2.5	9.2
Average	**19.7**	**32.8**	**14.2**	80.2

[1] Data not available in one FFS site (Kathmandu).

[2] Percent of difference compares yield in FSP plots and increase in yield obtained in IDM plots.

either in the market as ware potatoes, or to their fellow farmers as seed for the next season. Consequently, the underlying purpose of providing FFS farmers with direct access to quality seed was not fully achieved.

A major lesson from this experience is that learning processes, such as through the FFS, are possible and the technology available can fulfill the farmers' needs on the use of healthy seed and IDM in general. The learning/seed plot approach, however, was not successful in promoting the multiplication and maintenance of healthy seeds among farmers. Equally important is setting up social and institutional arrangements for ensuring a more equitable access and sharing of good-quality seed produced through the FFS. Both FFS facilitators and farmers recognized this to be a key negotiation point that has to be made during the preparatory meeting in the next season's FFS. It is one thing to produce good-quality seed, but it is another thing to share it.

Improving the FFS approach

The positive results of farmers' experiments and of the FFS in general were encouraging, but agricultural technicians and farmers agreed that the participatory training approach could be further improved. The following are some of their suggestions.

Simplifying trials. In addition to the learning plots, FFS farmers also set up observation plots where they conducted various experiments on potato IDM. However, farmers tended to test several variables simultaneously in one trial, so it was difficult to analyze data and derive conclusions. Experiments should be simpler, with only one variable in each trial.

Limiting number of trials. In order to maintain a clear learning focus, there should be no more than five trials in each FFS. Other research questions or experiments suggested by farmers can be addressed in subsequent FFS. It was agreed that the basic trials for potato FFS in Nepal should include varietal selection and TPS evaluation.

Comparing performance. It would be instructive to monitor and compare crop/field performance on the learning plot in the FFS with that on the FFS farmers' own farms and on the farms of non-FFS farmers.

Documenting other processes. In addition to crop/field monitoring, the project should look into learning and social processes, such as changes in FFS farmers' knowledge and practices, diffusion of potato ICM information to other (non-FFS) farmers, perceived effectiveness of FFS methods and activities, and performance of extensionists and researchers as FFS facilitators. Subsequently, the project organized a learning workshop to develop capacity of FFS facilitators for more effective participatory monitoring and evaluation.

References

Bhomi, B.K. 1997. Potato development programme in Nepal: Past, present and future. In: Pradhanang, P.M. and J. G. Elphingstone (eds.). Integrated management of bacterial wilt of potato: Lessons from the hills of Nepal. Lumle Agricultural Research Centre, Pokhara, Nepal. p. 4–10.

Hidalgo, O. 1998. Major diseases and the control components available for their utilization in IDM programs in countries of SWA. Paper presented at the Workshop on the Implementation of Integrated Disease Management Program Utilizing the Farmer Field School Approach held 2–5 June in Kathmandu, Nepal. (unpublished.)

Lama, T.L. 1998. Potato development programme in Nepal. Paper presented at the Workshop on the Implementation of Integrated Disease Management Program Utilizing the Farmer Field School Approach held 2–5 June in Kathmandu, Nepal. (unpublished.)

MA/ASD (Ministry of Agriculture/ Agricultural Statistics Division). 1999. Statistical information on Nepalese agriculture. MA/ASD, Kathmandu, Nepal.

Ojha,D.N., O.A. Hidalgo, and T.L. Lama. 2001. A Report on informal high quality seed-potato production and marketing by Seed Producer Groups in Nepal. From the Lab to the Land, Research for the 21st Century, Program Report, International Potato Center, Lima, Peru. p. 245.

Pradhanang, P.M. and J.G. Elphingstone (eds.). 1997. Integrated Management of Bacterial Wilt of Potato: Lessons from the Hills of Nepal. Lumle Agricultural Research Centre, Pokhara, Nepal.

Pradhanang, P.M., B.K. Dhital, M. Rossi, S.L. Joshi, S.P. Chand, S.K. Shrestha, and D.B. Gurung. 1987. Potato production systems in the western hills: A combined trek report in LARC target areas. Working Paper 1/1987. Lumle Agricultural Research Centre, Pokhara, Nepal.

Pradhanang, P.M., R.R. Pandey, S.R. Ghimere, B.K. Dhital, and A. Subedi. 1993. An approach to management of bacterial wilt of potato through crop rotation and farmers' participation. Proceedings of an International Conference held 28–31 Oct 1992 in Kaoshiung, Taiwan. ACIAR, Canberra, Australia. p. 362–370.