

This paper synthesises five years of field research on the bean seed sector within the Great Lakes region of Africa (Rwanda, Burundi and Eastern Zaire). The work, conducted jointly by farmers, three national programmes, the International Center for Tropical Agriculture (CIAT), NGOs, shopkeepers, prisons, nutritional centres, and others suggests more effective ways for tailoring seed systems towards specific agro-ecological and socio-economic environments. While some of the recommendations are specific to the bean crop and the region, most can be applied more broadly.

The paper is divided into five main parts: observations on the formal seed system, diagnosis of the informal channels, and reflections in three areas - seed distribution, genetic management, and seed production - where Great Lakes research has built on existing farmer knowledge and farming systems to foster an improved bean seed sector. A final section suggests a framework for choosing among the multiple strategies to strengthen seed systems for small farmers.

Analyses show that the formal seed service, a government parastatal, is not necessarily meeting small farmer needs. There is a bias towards larger grain bean seed, suitable for more fertile soils (and hence better off farmers) and key, farmer-desired varieties, are dropped by the wayside. Nor are the channels through which the service diffuses operating as expected: development projects, used as intermediate producers, often show negative rates of multiplication, and farmer-to-farmer diffusion is unexpectedly slow, especially in stress environments. Despite hidden subsidies, the formal system reaches only one in 600 farmers.

Farmers' own systems consist of at least 11 potential bean seed channels. About three-fifths of Great Lakes farmers obtain at least some of their seed from their own production, with various markets being the other, very significant source. The Burundian data give an idea of the surprising importance of the market among these subsistence farmers: on average each farmer purchases 5.4 kg of bean seed in the first planting season each year and 15 kg in the second. The reliance of the poor on market seed is qualitatively and quantitatively different from the better-off: the richer use markets to find select genetic material, whereas the poor seek seed to top off or fill in for woefully inadequate stocks. Many of the Great Lake poor buy all of their seed from the market, that is, none is saved from their own production or obtained through exchange. Such insights turn upside down the stereotype about market-orientation: the poorer the farmer, the larger is the proportion of his/her seed bought.

The diagnoses of informal channels helped identify principles for distributing new varieties. Building on local channels rather than creating new ones, can help keep down costs and assure timely delivery of seed. As different clients use different channels (e.g. some prefer the open markets for the variability on offer while others rely on neighbourhood stores for their convenience and credit possibilities), a diversity of channels should be supported. Further, having many points of distribution, on a recurrent basis, can help farmers, particularly those who regularly eat their full harvest, restock novel varieties.

Subsequent field trials or 'distribution experiments' in five countries diffused 'test packets' of varieties through large open markets and neighbourhood stores. Small quantities allow farmers to explore a new product with limited risk and expense, but also help seed services, with limited volume capacity, stretch access to their products. The experiments show that farmers are willing to pay for new varieties at two times the going market price for local seed, and merchants, particularly country shopkeepers, find profit in handling the sales. Diffusion of new varieties has also been tested through non-seed outlets: charitable organisations, agricultural training schools and nutritional centres. The last locale reached the very malnourished, who showed unusual enthusiasm for the new varieties. In the longer-term, such sales can be easily coordinated by development projects and NGOs.

The beauty of the small seed packet technique is at once its simplicity and impressive potential for impact. In Rwanda, calculations show that with a mere 5 tons of seed, 100,000 farmers can be reached, or just under 10% of the population.

Studies of farmers' variety management also shaped researchers' understanding of the role of new varieties in an overall programme to improve the seed sector for small farmers. Great Lakes farmers use varietal mixtures (of up to 30 components) and target them to different soils, seasons, and crop associations; in Rwanda, over 550 bean varieties are found countrywide. In terms of key principles, diversity had to be coupled with production gains through: regionalising varieties on offer; assuring a

spectrum of choice at one point in time; allowing both local and new cultivars to be screened; and encouraging a dynamic introduction process.

Field trials or 'participatory varietal experiments' focused on the possible benefits of giving farmers more influence in the selection process itself. For a five-year period, farmer experts were brought on to station to screen various breeder controlled trials. On-farm results demonstrated farmers' considerable ability to target cultivars from station fields to their own home plots; they attained production increases of up to 38%. The diversity of cultivars selected by farmers was also considerably greater than that normally on offer: the number adopted over the first two-year experimental period, 21, matched the total number of varieties released by the national programme in the previous 25 years. While the Great Lakes may be an extreme case in terms of existing bean diversity and farmer expertise, the general principles for coupling diversity with production gains apply more widely and are particularly relevant for broadening diversity in areas where it is now dangerously restricted.

In terms of seed production, Great Lakes' research focused principally on seed quality as production alternatives hinge on whether seed produced under normal farmer management is 'inferior'. Field trials and laboratory analyses compared the phytopathological quality, germination and vigour of: (a) seed produced under formal versus informal settings; and (b) seed produced by known farmer seed experts versus that of the general rural population. Results showed no significant differences between normal farmer-produced seed and other seed, and indeed, the quality of all was a good deal better than commonly alleged. Action-oriented experiments which tried to further upgrade the quality of farmer-produced seed by 'accessible' measures (such as stricter elimination of blemished seed), proved too labour intensive to be of interest to farmers.

The Great Lakes data suggests that the advantages of seed certification for small farmers should be subject to greater scrutiny (does it give yield gains, over what period, and at what cost). The possibilities for producing seed of various quality levels, so as to deliver a good (not great) product, at affordable prices should also be explored. As a general rule, seed produced under any scheme of external intervention (whether formal or informal) should never have higher levels of disease infection than the seed farmers presently use. The best way to ensure this is to have it produced by farmers themselves, in a way as close as possible to their normal methods and to environments routinely used.

The findings, overall, show the need for quality field data on small farmer seed systems as the work challenges a number of the long-held myths. We show that:

- Even for a subsistence crop, many farmers do not rely on farmer-saved seed.
- The quality of farmer seed compares relatively well with that produced under more formal regimes.
- Some of the poorest farmers in the world are willing to try and pay for new varieties.
- Farmers can select varieties from station research trials to fit production micro-niches.

All subsequent practical recommendations are based on extensive field trials. Here we signal one: providing small quantities of seed of many varieties through markets is a good way of targeting poorer farmers.