Highlights
CIAT in Africa

Impact of improved bean varieties in western Kenya

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Common bean (*Phaseolus vulgaris L.*) is the most important pulse crop in western Kenya, second only to maize as a food crop. The farming system is characteristically subsistence with a mixture of crops, livestock and trees. Low yields and small farm sizes mean that farmers in this region are not self-sufficient in food and also rely on off-farm employment, remittances, and the export of male labour. Hence, many households are female-headed.

In the late 1980s and early 1990s, the western Kenya districts of Kakamega and Vihiga experienced an increase in incidence and severity of bean root rot disease resulting in recurrent crop failures. As a result many of the farmers stopped growing beans. The outbreak was caused primarily by a complex of fungal pathogens whose increasing damage of beans was associated with the evolution of farming systems under high human population pressure. Reducing household land area led to intensified land use, continuous cropping, low use of agricultural inputs, declining soil fertility and a build-up of the soil-borne pathogens. In response to the root rot crisis, the Kenya Agricultural Research Institute (KARI) at Kakamega, the Centro Internacional de Agricultura Tropical (CIAT), and the Extension Department of the Ministry of Agriculture collaborated on an accelerated programme to identify suitable root rot-resistant bean varieties.

Using farmer participatory evaluation approaches five bush bean varieties (KK8, KK14, KK15, KK20, and KK22) and five climbing bean varieties (Umubano, Gisenyi 2-Bis, Flora, Puebla, and Ngwinurare) were selected from germplasm introduced from Rwanda. The climbing beans were introduced as a new technology to intensify bean production, together with complementary soil management options (such using organic and inorganic inputs for integrated root rot control). The 10 varieties were multiplied and their seed disseminated through farmers, especially women groups with the facilitation of Organic Matter Management Network (an NGO), KARI and the extension services of the Ministry of Agriculture. Growing of the root rot resistant varieties subsequently achieved widespread adoption.

Assessing the adoption of introduced varieties

The main objective was to conduct people-focused impact assessments that would show how introducing root-rot-resistant bean varieties improved poor people's well-being in a sustainable way. Information was collected on the rate and extent of the adoption and the effects of these improved varieties on farmers' livelihoods.

A formal survey of 225 households was carried out in 2001 and data was collected by several methods, including participatory rural appraisal (PRA), formal surveys of farm households and bean traders, group discussions, impact diagramming (a farmer participatory tool) and a structured questionnaire. Descriptive statistics were used to assess proportions and

magnitudes of socio-economic variables, while partial budget analysis provided a relative indication of profitability and the contribution of the new bean varieties to farm incomes. At the aggregate level, the economic surplus model was adapted to assess *ex post* net economic benefits accruing from the adoption of the improved bean varieties. The intensity of adoption was used to provide insights on the factors affecting technology adoption and the resulting impact. A stakeholder feedback meeting was held in 2004 to validate the study's results.

Lessons learned

Of the 10 varieties, three bush bean varieties (KK22, KK15, and KK8) were adopted by 35%–80% of the farmers. Only 8%–18% of farmers adopted climbing beans, because they were considered too labour-intensive, requiring staggered harvesting and staking. Other factors that discouraged the adoption of climbing beans were a shortage of stakes, bird damage, and difficulties in intercropping with maize.

No one bean variety, whether introduced or local, had all the attributes farmers preferred. Hence, to compensate, most farmers grew more than one variety. The study also showed that when farmer participatory approaches were used to evaluate and disseminate the improved bean varieties, their adoption and the proportion of area planted to them were enhanced. Farmers use a complex set of criteria to select the bean varieties they grow so they should also be more closely involved in variety development. Examples of criteria used are maturity, yield, labour intensity, suitability for intercropping with maize, culinary qualities and taste, shelf life, market demand and prices, as well as disease resistance.

Farmer characteristics also influenced the adoption and intensity of adoption of improved bean varieties. For example, most (76%) households that had adopted the new varieties were male-headed (probably because men are better able to obtain information and access the inputs needed to adopt the technology). Likewise, poorer households tended to adopt the technology, because it was simple and could be tailored to available resources, with results observable within a short period of time.

Impact of new bean varieties

The new bean varieties had impact on five areas: food security, household income, varietal diversity, firewood use and commercialisation. For example, the varieties improved food security in both districts for almost all the surveyed farmers, that is, one third of the farmers in both districts had more beans to eat throughout the year and, consequently, their health and income improved.

While local varieties are expected to continue being displaced by the introduced ones, many of the surveyed farmers plan to continue planting local root rot-susceptible varieties. So, far from eroding varietal diversity, the introduction of root rot-resistant bean varieties appear to have increased varietal diversity, giving farmers the option of growing a combination of new and local varieties to meet their farming constraints and objectives.

Returns to society

Economic models tend to emphasise only those benefits that can be valued in monetary terms, ignoring such major non-financial gains as reduced labour in searching for food, firewood savings, health benefits and advancements in farmer knowledge. These gains cannot usually be traded in the market and thus, cannot be easily captured by an economic surplus model.

Changing from sole maize cropping to maize-bean intercropping, using the most preferred local bean variety (Alulu) resulted in a marginal rate of return (MRR) of 370%. For the most widely adopted improved bean variety (KK 22), MRR was 697%. These results confirmed that growing maize in association with improved beans is overwhelmingly advantageous, compared with planting maize as a sole crop. The survey of local markets showed that the farmers were commercialising the farming of introduced bean varieties, using the extra income for short-term consumption and investments such as food, household items and school-related expenses.

For 10 years, research and development agencies (AHI, CIAT, ECABREN, FARMESA and the government of Kenya) had invested KSh26 million (US$325,000) to identify and disseminate root-rot-resistant bean varieties suitable for western Kenya. The total benefits from the improved varieties to society will amount to about KSh 4400 million(US$55 million) projected over 20 years from dissemination in 1993. The average annual return to society for the investment is thus KSh 69 to every shilling invested in R&D, with an internal rate of return of 113%!

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