Green manures for maize–bean systems in eastern Uganda: Agronomic performance and farmers’ perceptions

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Abstract. Researchers worked with farmers in eastern Uganda to develop alternatives for soil management using crotalaria (Crotalaria ochroleuca), mucuna (Mucuna pruriens var. utilis), lablab (Dolichos lablab), and canavalia (Canavalia ensiformis) as green manures in short-term fallows. The participatory research was part of a community-based approach for systems improvement. Grain yields of maize (Zea mays) and bean (Phaseolus vulgaris) following one season of crotalaria fallow were 41% and 43%, respectively, more than following a two-season weedy fallow. Grain yields of maize following a one-season fallow with mucuna and lablab were 60% and 50% higher, respectively, as compared with maize following maize. Maize and bean yield were more, although effects were small, during the second and third subsequent seasons, indicating probable residual effects of the green manures. Mucuna and lablab were successfully produced by intersowing into maize at three weeks after sowing maize, although the yields of the associated maize crop were reduced by 24% to 28%. Farmers estimated the labor requirements for mucuna and lablab to be less than for crotalaria. Farmers independently experimented on how these species can be integrated into banana (Musa spp.), coffee (Coffea robusta), sweet potato (Ipomoea batatas), and cassava (Manihot esculenta) production systems. Farmers reported that the beneficial effects of the green manures included higher food-crop yields; weed suppression; improved soil fertility, soil moisture, and soil tilth; and erosion control. Mucuna and lablab were preferred because of reduced labor requirements and increased net benefits compared with continuous cropping. Farmer participation in the green manure research resulted in efficient generation and adaptation of green manure technology now being promoted in eastern and central Uganda.

Introduction

Better integration of legumes into low-input cropping systems is often a means to improved sustainability and productivity (Becker et al., 1995; Giller and Cadisch, 1995; Peoples et al., 1995). The potential of green manure crops to increase crop productivity in sub-Saharan Africa has been repeatedly demonstrated (Balasubramanian and Blaise, 1993; Tian et al., 1993; Wortmann et al., 1994), but with increasing interest of surface application of the plant materials rather than incorporation (Schroth et al., 1992; Wortmann et al., 1994). Farmer adoption of green manure technology derived from on-station research has been limited (Wortmann, 1992; Giller et al., 1994; Becker et al. 1995). Factors limiting adoption include variability in the performance and...
effects of green manure crops in highly variable environments, increased
demands on production factors (labor, land, and capital), lack of seeds of green
manure crops, lack of short-term economic benefits, and insufficient support
by extension.

Farmer participatory research (FPR) offers alternative methods for develop-
ing or adapting technical options. FPR is most applicable for low-input,
diverse, and risk-prone production systems where improved productivity might
best be achieved through better management of available resources
(Wortmann, 1992). FPR has stimulated much publication, but few of the
papers provide evidence of successful use of participatory approaches in
solving farmers’ problems (Bentley, 1994). There are, however, some cases
where technical options were successfully generated and adopted through
involving farmers in the research process (Fernandez, 1991; Fujisaka, 1989;
Versteeg and Koudokpon, 1993).

Researchers worked with farmers in eastern Uganda as collaborators and
colleagues in a community-based research approach to systems improvement
(Fischler et al., 1996). The objectives were to (1) develop alternative soil
management options using green manure crops as short-term fallows, (2)
evaluate the agronomic performance and farmers’ perceptions of green
manures for maize–bean systems, and (3) develop an appropriate research
approach for long-term, farmer-driven, community-based experimentation in
collaboration with researchers.

Materials and methods

The participatory research process

Farmer participatory research for systems improvement was initiated in 1992
with a community in Iganga District of eastern Uganda (0°26′ N, 33°28′ E;
altitude 1160 m). The soils were reddish brown sandy loams and sandy clay
loams, mostly low in organic matter and deficient in N and P. Mean annual
rainfall is 1350 mm with bimodal distribution resulting in two cropping
periods per year with similar amounts of precipitation. The first rainy season
lasts from March through June, the second from August to December.

The FPR started with an informal survey of farmers’ perceptions of soils,
soil uses, and management practices, followed by various participatory diag-
nostic appraisal exercises. Farmers then fully participated in all steps of the
research planning process including identifying problems and setting priorities
on them, selecting possible solutions, and designing and implementing
trials (Fischler et al., 1996). Experimentation included trials designed and
evaluated jointly by researchers and farmers, as well as many trials designed
and implemented solely by individual farmers but evaluated jointly by farmers
and researchers. Yield data were collected by extension staff.