MUCUNA (VELVETBEAN) COVER CROPPING IN BENIN

Location: Mono Province, Southern Benin

Mucuna (velvetbean) is a regenerative plant that was introduced in Southern Benin in the late 1980s. Interplanted with corn and used as green manure, Mucuna fixes nitrogen, adds biomass to the soil, prevents erosion, and helps reduce weeds. Mucuna was successfully incorporated into farm systems in Benin through education of farmers, and rapidly resulted in higher maize yields.

CHALLENGE

Benin's farmers endure long-term struggles with land scarcity, declining soil fertility, lack of fertilizer, and weed encroachment. On the plateaus of southern Benin and Togo, soils are nearing exhaustion. Most smallholders have little access to fertilizer, but even those who do report minimal benefits due to a consistently degrading soil resource base. Further exacerbating this situation are reduced fallow periods, which facilitate the spread of aggressive weeds that are difficult to eliminate by hand. High population density has also resulted in considerable land pressure. Farmers have thus sought new technologies for weed suppression and soil revitalization.

RESPONSE

In the late 1980s, *Mucuna* cover cropping was introduced in Southern Benin's Mono Province. This was the result of a collective initiative by Recherche Appliquée en Milieu Réel (Applied Research in Practice), a development-oriented research project of the Ministry of Rural Development (MRD) of Benin, the International Institute of Tropical Agriculture (IITA), and the Royal Tropical Institute of the Netherlands.

Mucuna, an edible and extremely vigorous vine that grows well in moderately poor soil, is drought resistant and has bacteria rich roots, which store nitrogen in tiny nodules. Interplanted with corn as a green manure, it covers the entire field after corn maturation and smothers vigorous weeds such as spear grass (*Imperata cylindric*). This allows full ground-cover development for biomass accumulation and nitrogen fixation. *Mucuna* is cut back and left in place just before corn planting time. This process kills the vine but leaves it on the field where it prevents soil erosion, retains moisture and eventually turns into compost.

A small number of demonstration plots were established, often on local school grounds, which farmers were encouraged to visit. In 1988, the project tested *Mucuna* fallow, fertilizer-N, pigeon-pea hedgerows, and alley cropping with 20 farmers. Fourteen farmers obtained a dense stand and *Mucuna* cover and observed reduced *Imperata* infestation. Collaborators identified a reduced need for manual weeding or herbicide use in the subsequent maize crop as an unexpected benefit resulting in some spontaneous adoption. Farmers also discovered that *Mucuna* made good livestock fodder. In 1989, the research team observed that 103 farmers in nearby villages had planted *Mucuna* after they saw project demonstrations and other farmers' fields. The government extension services, which included each Regional Action Centre for Rural Development (RACRD) of MRD, noted this and subsequently began testing the system with farmers.

Two management systems were developed and recommended to integrate *Mucuna* into cropping systems. One was a sole-cover-crop fallow for severely degraded fields.[1] The other was a maize-*Mucuna* relay crop for fields requiring less rehabilitation.[2] Other possible management systems can also be used depending on the duration of the growing season and desired benefits. For example, farmers in the bimodal-rainfall zone can grow sole food crops during the first season and a sole *Mucuna* crop during the second season.[3]

RESULTS[4]

- Following the initial success, Mono province's RACRD tested the system with 180 farmers in 12 more villages in 1990. Efforts were extended to other southern provinces in 1991. Some NGOs, such as Sasakawa Global 2000, became involved in plant diffusion. By 1993 an estimated 3,000 farmers had tested *Mucuna*; in 1996, this number neared 10,000 across Benin.
- Farmers who adopted *Mucuna* cover cropping benefited from higher maize yields as early as the second planting season. Yields were even higher with nitrogen application. Similar 2004 research in neighboring Togo showed a 40 percent increase in maize yields following *Mucuna* intercropping.[5]
- In 1998, there were reported increases in maize grain yield of approximately 500 kg per hectare for a local maize variety and 800 kg per hectare for an improved variety, following a one-year fallow with *Mucuna*. Many of the early adopters earned additional revenue by selling *Mucuna* seed as the technology spread.[6]
- Nitrogen benefits to soil have also been repeatedly observed in *Mucuna* planting.[7] Used as either an intercrop or sole crop, it provides more than 100 kg nitrogen per hectare for the next maize planting.[8] In 2002, experts estimated that *Mucuna* adoption in Mono province would result in savings of about 6,500 tons of nitrogen or about $1.85 million per year.[9]
- An economic analysis of the data mentioned above indicated that high returns are achieved at both farmer and regional levels three years after *Mucuna* adoption. If the seed can be sold, then the system is economically beneficial from the first year of introduction. An *ex-ante* cost-benefit analysis over eight years indicated a ratio of 1.24 when *Mucuna* was included in the system, compared with 0.62 for the system without it. The ratio was as high as 3.56 if *Mucuna* seeds were sold.
- *Mucuna* fallowing produces additional benefits, including erosion control and maintenance or improvement of soil physical, chemical, and biological properties. For example, studies of soil after mechanical land clearing at the IITA station in Ibadan demonstrated increased infiltration rates and porosity and decreased penetrometer resistance with the amount of *Mucuna* biomass produced.

Mucuna Pruriens inflorescence. © Wikipedia

Farmers who adopted *Mucuna* cover cropping benefited from higher maize yields as early as the second planting season.

Wild varieties of the *Pueraria* family can also be used for cover cropping. © Patrice Awanou

- *Mucuna* cover cropping also resulted in less labor required for weeding. In Mono province, a one-year fallow with *Mucuna* reduced *Imperata* weed density from 270 shoots per square meter, to just 32 shoots. Fields that needed an estimated 60–80 person days per hectare to remove the weed now required a fraction of the labor.[10]

FOR MORE INFORMATION

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ENDNOTES

1 The plot is slashed before seeding *Mucuna* and a second slashing may be necessary to allow the Mucuna seedlings to overcome the fast-growing *Imperata*.

2 Maize is planted at a normal spacing, followed by *Mucuna* seeding either between or within the rows 40 to 45 days after planting the maize and just after the second weeding.

3 Vissoh, P. "Experiences with Mucuna in West Africa." in *Cover Crops in West Africa, Contributing to Sustainable Agriculture.* International Development Research Center and International Institute of Tropical Agriculture, 1998. https://idl-bnc.idrc.ca/dspace/bitstream/10625/24596/1/108242_p1-32.pdf (accessed July 14, 2014).

4 Unless otherwise indicated all sources for this section are from Avav, T., Shave, P.A. and P.H. Hilakaan. "Growth of *Mucuna* Accessions Under Fallow and their Influence on Soil and Weeds in a Sub-Humid Savanna Environment." *Journal of Applied Biosciences* 10.1 (2008): 442-448.

5 Fofana, B. "Using *Mucuna* and P fertilizer to increase maize grain yield and N fertilizer use efficiency in the coastal savanna of Togo." *Nutrient Cycling in Agroecosystems* 68.3 (2004): 213-222

6 Galiba, M *et al*. «Réactions et craintes des paysans à la vulgarisation du pois mascate (*Mucuna* pruriens var. utilis).» in D. Buckles *et al* (eds). *Cover Crops in West Africa, Contributing to Sustainable Agriculture*. Ottawa: IDRC, 1998.

7 Fofana, B. "Nitrogen use efficiency by maize as affected by a *Mucuna* short fallow and P application in the coastal savanna of West Africa." *Nutrient Cycling in Agroecosystems* 71.3 (2005): 227-237.

8 Carsky, Robert. "Land and soil quality improvements." FAO Corporate Document Repository, (undated). http://www.fao.org/docrep/006/y3951e/y3951e05.htm (accessed July, 14 2014).

9 *Ibid.*

10 Versteeg, M.N. and V. Koudokpon. "Participative farmer testing of four low external input technologies to address soil fertility decline in Mono département (Benin)." *Agricultural Systems* 42.3 (1993): 265-276.

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Mucuna Pods. © Jules Pretty