"The Magic Bean" (*Mucuna pruriens* ~ the velvetbean)

Briefing Notes to accompany BBC2 Correspondent Programme (June 10th) directed and produced by Suzanne Campbell-Jones

Compiled by Professor Jules Pretty, University of Essex (jpretty@essex.ac.uk)
(with input from Bob Carsky, Victor Manyong and Roland Bunch)

History of Mucuna

One of the most comprehensive books on *Mucuna* is by Buckles and colleagues, and the following section is drawn from their 1998 book "*Cover Crops in Hillside Agriculture: Farmer Innovation with Mucuna*" (by Daniel Buckles, Bernard Triomphe, and Gustavo Sain; IDRC / CIMMYT 1998). This book is on line at http://www.idrc.ca/acb/showdetl.cfm?&DID=6&Product_ID=486&CATID=15

"With the fertilizer bean, cowardly land becomes brave."
— Teodoro Reyes, La Danta, Honduras

Velvetbean, a vigorous annual climbing legume, originally came from southern China and eastern India, where it was at one time widely cultivated as a green vegetable crop (CSIR 1962; Burkill 1966; Duke 1981; Wilmot-Dear 1984). The genus *Mucuna* (Adans), belonging to the Fabaceae family, covers perhaps 100 species of annual and perennial legumes, including the annual velvetbean. The genus *Stizolobium* was used by Bort (1909) to distinguish velvetbean from perennial *Mucuna* spp., but this distinction was not maintained by Burkill (1966) or Bailey (1947).

Mucuna is self-pollinating; hence, natural out-crossing is rare (Duke 1981). The dozen or so cultivated *Mucuna* spp. found in the tropics probably represent a fragmentation from the Asian cultigen, and there are numerous crosses and hybrids (Piper and Tracy 1910; Bailey 1947; Burkill 1966; Bailey and Bailey 1976). The most commonly cited species include *M. deeringiana* Merrill, *M. utilis* Wallich (Bengal velvetbean), *M. pruriens* (L.) DC., *M. nivea*, *M. Hassjoo* (Yokohama velvetbean), *M. aterrima* Holland (Mauritius and Bourbon velvetbean), *M. capitata*, and *M. diabolica* (IIA 1936; Burkill 1966; Tanaka 1976; Duke 1981). However, the taxonomy of these species is confused, and some designations may be synonymous. For example, Burkill (1966) recorded *M. nivea* as being synonymous with *M. cochichinensis* and *M. lyonii* (Lyon velvetbean) (Awang et al. 1997).

The main differences among cultivated species are in the character of the pubescence on the pod, the seed colour, and the number of days to harvest of the pod. "Cowitch" and "cowhage" are the common English names of *Mucuna* types with abundant, long stinging hairs on the pod. Human contact results in an intensely itchy dermatitis, caused by *mucunain* (Infante et al. 1990). The nonstinging types, known by the common English name "velvetbean," have appressed, silky hairs. Cowitch may be the original type of the genus (Bailey 1947). Seed colours include shiny black, creamy white, gray, beige, and mottled. Life cycles range from 100 to 300 d to harvest of the pod (Tracy and Coe 1918; Bailey 1947). A nonvining variety, with low forage yields, is also reported under the name "bunch velvetbean" (Watson 1922; Duke 1981).

The velvetbean grown in northern Honduras is probably *M. pruriens*, which is the most widespread of the cultivated species. The mottled-seed type is the most common in northern Honduras, although shiny-black and creamy-white seeds are also present. Farmers note that the black-seeded velvetbean is slightly more precocious than the others, but all velvetbean types are harvested in bulk, irrespective of their type, and replanted together. All velvetbean fields observed in northern Honduras begin flowering in early to mid-October, regardless of the planting date. This suggests that the life cycle of

the crop responds to shorter day lengths (photoperiodic). Flowering may also be stimulated by cooler night temperatures (21°C) (Duke 1981). Velvetbean dies naturally after producing seed, about 45–60 d after flowering.

Most *Mucuna* spp. exhibit reasonable tolerance to a number of abiotic stresses, including drought, low soil fertility, and high soil acidity, although they are sensitive to frost and grow poorly in cold, wet soils (Duke 1981; Hairiah 1992; Lobo Burle et al. 1992). The genus thrives best under warm, moist conditions, below 1500 m above sea level (asl), and in areas with plentiful rainfall. In such environments, velvetbean vines can grow to 10 m and the canopy may stand as high as 1 m above the soil surface. Velvetbean sheds significant quantities of leaves before reaching maturity, and these decay gradually in a litter layer below the actively growing velvetbean. Only a few roots tapping deep horizons can be found per square metre sampled, but surface roots are abundant (Tracy and Coe 1918; Hairiah 1992). Levels of aboveground biomass range from 5 to more than 12 t of dry matter (DM) ha^{-1}; below ground, more than 1 t of dried roots ha^{-1} may be produced (Duggar 1899; Ferris 1917; Camas Gómez 1991; Chávez 1993). Pod production is variable, depending on the environmental conditions, but can easily reach more than 2 t ha^{-1}, especially if the velvetbean vines have the opportunity to climb trees, stalks, or other tutors. Like most legumes, velvetbean has the potential to fix atmospheric N through a symbiotic relationship with soil microorganisms. The N is converted by the rhizobia on the roots of the plant to an available form that is stored in the leaves, vines, and seeds — making the plant an efficient source of N.

Mucuna spp. have been reported to contain the toxic compounds L-Dopa and hallucinogenic tryptamines and antinutritional factors such as phenols and tannins (CSIR 1962; Ravindran and Ravindran 1988; Awang et al. 1997). Because of the high concentrations of L-Dopa (7%), velvetbean is a commercial source of this substance, used in the treatment of Parkinson's disease. However, L-Dopa can also produce a confused state of mind and intestinal disruptions in humans.

Despite its toxic properties, various species of *Mucuna* are grown as a minor food crop. Raw velvetbean seeds contain about 27% protein and are rich in minerals (especially K, Mg, Ca, and Fe; de la Vega et al. 1981; Duke 1981; Olaboro 1993). During the 18th and 19th centuries, *Mucuna* was grown widely as a green vegetable in the foothills and lower hills of the eastern Himalayas and in Mauritius (Watt 1883; Piper and Tracy 1910; CSIR 1962). Both the green pods and the mature beans were boiled and eaten. Burkill (1966) and Watt (1883) suggested that *Mucuna* was eventually replaced as a vegetable in Asia by more palatable legumes, although it is still used as a famine food and as specialty food in northeastern India (CSIR 1962). In Guatemala and Mexico, *M. pruriens* has for at least several decades been roasted and ground to make a coffee substitute; the seed is widely known in the region as "Nescafé," in recognition of this use. The use of *Mucuna* spp. as minor food crops has also been reported in Ghana (Osei-Bonsu et al. 1995), Mozambique (Infante et al. 1990), and Nigeria (Ezueh 1977). However, an outbreak of acute psychosis in Mozambique was attributed to the inappropriate consumption of velvetbean: because of famine and drought, the water used to boil the seed was not discarded, as it normally is, and larger than normal quantities of this liquid were consumed (Infante et al. 1990).

The toxicity of unprocessed velvetbean may explain why the plant has few problems with insect pests (Scott 1910; IIA 1936; Duke 1981). Velvetbean is well known for its nematicidic effects when used in rotation with a number of commercial crops (Acosta et al. 1991; Kloepper et al. 1991; Marban-Mendoza et al. 1992), although it is not itself immune to a number of nematode species (Duke 1981). It also seems to possess a notable allelopathic activity, which may help it suppress competing plants (Gliessman et al. 1981). It can, however, harbour soil-borne pathogens, such as *Macrophomina phaseolina*, that are detrimental to maize and other food crops (Bell and Jeffers 1992; Berner et al. 1992).

Mucuna spp. have also been grown for some time as a fallow crop to improve soil fertility, a smother crop to control weeds, and a forage plant. Burkill (1966) noted that *Mucuna* was cultivated in Bali, Java, and Sumatra in the 17th century to recover worn-out ground — its first reported use as a cover crop. A survey on legume use in tropical countries, conducted by the International Institute of Agriculture (IIA) in the 1930s (IIA 1936), documented the use of *M. pruriens* in the Punjab of India to

provide a cover crop and on the island of Madagascar to provide fodder for cattle and improve the soil for sugar cane, cassava, and lemon grass. The same species was reportedly used in Zanzibar to prevent the growth of *Imperata cylindrica* and to provide a green manure for maize, cassava, and sorghum. *Mucuna aterrima* was used as a green manure for maize and tobacco in Malawi and as a cover crop in Sierra Leone. *Mucuna deeringiana* was used as a cover crop on the citrus and banana estates in Jamaica and Puerto Rico as early as 1906.

In the 1920s, several experiment stations in Nigeria grew *Mucuna* spp. as an improved fallow and as a relay crop (with maize and cassava), with a view to intensifying small-scale, shifting-agricultural systems (IIA 1936); however, adoption of the practice was never reported. The authors of the IIA study argued that there was no pressing need for green manuring in West Africa, as forest land was abundant and traditional shifting-cultivation practices required less labour for clearing land than permanent cultivation did. In West Africa, during the 1920s, fallowing and slash-and-burn techniques effectively controlled weeds and provided optimum land preparation for planting. Under these conditions, farmers seemed unwilling to invest additional labour to establish green-manure cover crops. As noted below, however, changing circumstances may be opening up new opportunities for cover crops in this region.

Enthusiasm for velvetbean in the United States stimulated diffusion of seed to many countries in the tropics for experimentation during the early part of this century. Initially, velvetbean seed was sold by seed companies in the United States under the name "banana field bean" (Duggar 1899; Bort 1909, p. 26) and was later distributed as velvetbean throughout the tropics by the USDA (Piper and Tracy 1910). Velvetbean and knowledge of its uses in Mesoamerica can be linked to management practices developed by farmers in the southern United States. The plant was probably introduced as a forage crop in Mesoamerica in the 1920s by the United Fruit Company, a banana producer with extensive tracts of land along the Atlantic coast of Central America. Elderly banana-plantation workers in Morales and Puerto Barrios, Guatemala, reported that velvetbean was grown in maize by plantation workers on company land and grazed by mules used to transport bananas from the plantations to the railway depots (Buckles 1995).

The use of velvetbean as a forage crop by the banana companies faded as mules were replaced by tractors during the 1930s, but the plant retained the name "mule bean," or *quenk mula*, among the Ketchi natives of Guatemala. The Ketchi, originally from the densely populated highland area of Verapaz, were employed on banana plantations in Guatemala and may have become familiar with velvetbean on these estates. Carter (1969) reported that the Ketchi migrating to the lowland valley of Polochic, in the department of Izabel, Guatemala, had been planting velvetbean in rotation with maize since their arrival in the 1950s. Commercial farmers, also settling in the valley during the 1950s, used velvetbean for a dual purpose: as a soil improver for maize and as a forage crop for cattle. According to elderly residents interviewed by DB, the crop was first introduced in the valley during the 1930s by a Jamaican banana-plantation owner financed by the United Fruit Company (see also Carter 1969).

The velvetbean-management strategy used by commercial farmers and Ketchi in the Polochic Valley differed from that used by US farmers. Whereas velvetbean was intercropped in summer maize in the United States, in Guatemala a rotation strategy with second-season maize was developed. As in northern Honduras, the mature velvetbean crop was slashed with a machete in November, and then maize was stick planted into the layer of decomposing velvetbean leaves and vines. After the maize harvest, the velvetbean crop reestablished itself through natural reseeding or was replanted by the farmer, thereby continuing the rotation indefinitely. These farmers also grew maize during the wet season on a different field, using traditional techniques of slash-and-burn cultivation (Carter 1969).

The use of velvetbean by commercial farmers in the Polochic Valley declined sharply during the 1970s, when much of the land used for maize production was diverted to pasture for cattle (Buckles 1995). The increased area of pasture in turn reduced requirements for velvetbean as a forage crop. These changes occurred before commercial fertilizers became widely available in the valley. In fact, the few remaining large-scale maize producers in the valley continue to grow second-season maize in

rotation with velvetbean, reportedly with better yields and higher net returns than those gained from maize-production practices based on commercial fertilizers (Chávez 1993; Buckles 1995). This account suggests that broad changes in land-use patterns may have more of an effect on the use of velvetbean in Mesoamerica than alternative maize-production techniques — an issue that emerges again in northern Honduras.

Velvetbean is still used by the Ketchi in the Polochic Valley, the northern coastal mountains near Livingstone, the Petén, and border areas in Belize. The crop has also been used since at least the 1950s by indigenous farmers in the Mexican states of Chiapas, Oaxaca, Tabasco, and Veracruz. The Mames of southwestern Chiapas (Tsuzuki, personal communication, 1993) and the Nahua of Mecayapan in southern Veracruz (Buckles & Perales 1995) manage velvetbean on hillside land as a rotation crop, with winter maize, using practices similar to those of the Ketchi. The Popoluca of San Pedro Soteapan, also in southern Veracruz, broadcast velvetbean over maize fields they intend to fallow, giving rise to a practice they refer to as making a fallow field (*hacer acaual*). According to experienced farmers, maize yields on land improved using velvetbean for 2 years rival yields on land fallowed for 5 years with native trees and shrubs, a significant intensification of the traditional cropping cycle (Buckles & Perales 1995).

The Mixe and Chinantecos of southeastern Oaxaca have also used velvetbean for several decades in rotation with winter maize (Arévalo Ramírez and Jiménez Osornio 1988). However, the land type dedicated to the rotation differs from the hillside land used by the Ketchi, Nahua, and Popoluca. In southeastern Oaxaca, velvetbean is established on riverbanks subject to occasional flooding. This land is often very fertile because of the periodic deposition of new soil through floodwaters, but it is unsuitable for most wet-season crops because of the risk of flood damage. Furthermore, the riverbanks are heavily infested with weeds brought in with the sediment, and this increases the cost of cultivation. These features make riverbanks ideally suited, however, to the production of winter maize with velvetbean; the aggressive cover crop chokes out weeds, and when it is cut down, it forms a mulch that conserves the residual moisture from the wet season, which is needed to produce maize during the relatively dry period of the year (Narváez 1996.

The varied land types and traditional farming practices of the Chontales of Tabasco have given rise to yet another variation on the management of velvetbean with winter maize. These farmers use hummocks in the marshlands of their territory to grow winter maize in a velvetbean mulch, into which they also interplant squash (*Cucurbita pepo* L.) — an adaptation of the maize–bean–squash triad characteristic of indigenous intercropping systems in Mesoamerica (Miranda Medrano 1985; Granado Alvarez 1989). The diversified system controls soil pests that would otherwise significantly affect maize yields (Quiroga Madrigal et al. 1991).

Velvetbean was introduced in northern Honduras during the early 1970s, possibly by two Guatemalan brothers who settled in Planes de Hicaque near Tela. A Honduran brother-in-law of theirs is credited with introducing the seed into San Francisco de Saco, also one of the earliest sites of velvetbean use in northern Honduras. It grew wild there, unnoticed, for a number of years. A few farmers in the community observed the plant's ability to control weeds and improve maize yields in fields where it dominated, thereby rediscovering the rotation practice of the Ketchi and others. In northern Honduras, a field of velvetbean became known as an *abonera*, or "fertilized field." The velvetbean seed became known as *frijol de abono*, "the fertilizer bean," in recognition of one of its main benefits.

Legumes and Green Manures

The impact of legumes grown together with or before a cereal crop can reduce, and sometimes eliminate, the need for nitrogen fertilizers. Symbiotic bacteria present in specialised nodules that develop on the roots of legumes can fix nitrogen directly from the atmosphere. The cultivation of cereals and legumes crops together can improve both total yields and stability of production. Bushes and trees with nitrogen-fixing capacity also have beneficial effects on plants growing with or after them.

In the Americas, the interplanting of maize, beans and squash, often the seeds being placed in the same planting hole, is a practice of great antiquity, probably dating to soon after agriculture began in the valleys of Mexico. In such situations, with soils of low inherent fertility, the cultivation of cereals and legumes crops together can improve both total yields and stability of production. Cowpea and lablab are particularly useful legumes for inter-cropping with cereals, the former because it is adapted to acid, infertile soils, and the latter because it is drought-tolerant, produces good fodder and can regrow well after clipping. Here, legumes contribute not only through nitrogen fixation, but also because the green matter can be used as a mulch or green manure.

Undersowing is a once-common practice used now by only a few farmers in industrialised countries. Cereals are sown with a legume and/or grass, and these are already established at harvest. This can help control pests and diseases, provide ground cover, and supply nitrogen. Undersowing cereals and brassica with trefoil and clover increases the number of insect predators, reduces the numbers of pests, and gives better crop yields than monocrops.

Nutrients are also supplied when vegetation is incorporated in the soil as a `green manure'. Green mnaures increase nutrient levels as well as improve the physical properties of the soil. This has long been practised; the Romans grew lupins and ploughed them in before sowing cereals more than 2000 years ago. Quick-growing legumes are valuable green manures for many low input systems, and have the potential to meet much, if not all, of the nitrogen requirements of succeeding non-legume crops. The equivalent amount of nitrogen fertilizer required to match the green manures can be 80-200 kg/ha. Many green manures can also add large amounts of organic matter, up to 30 tonnes/ha.

One of the most remarkable is the velvetbean (*Mucuna pruriens*). This has been widely promoted in central America, though its effectiveness is attested by its spontaneous spread from village to village without outside intervention. It grows rapidly, is palatable to animals and humans, fixes large amounts of nitrogen, and can annually produce 50-100 tonnes/ha of organic matter. It can grow on most soils, and its spreading habit suppresses weed growth. Incorporating such green manures into cropping systems can substantially increase yields. Honduran farmers are able to harvest some 2.5-3.2 t/ha of maize when grown after velvetbean.

There has been spectacular success with green manures and cover crops in the southern Brazilian State of Santa Catarina. The focus is on soil and water conservation at the microwatershed level using contour grass barriers, contour ploughing and green manures. Some 60 species have been tested with farmers, including both leguminous plants such as velvetbean, jackbean, lablab, cowpeas, many vetches and crotalarias, and non-legumes such as oats and turnips. For farmers, these involve no cash costs, except for the purchase of seed. These are intercropped or planted during fallow periods, and are used in cropping systems with maize, onions, cassava, wheat, grapes, tomatoes, soybeans, tobacco and orchards. Farmers use animal-drawn tools to knock over and cut up the green manure/ cover crop, leaving it on the surface. With another farmer-designed, animal-drawn instrument, they then clear a narrow furrow in the resulting mulch into which the next crop is planted. As a result, many farmers no longer plough.

There has been rapid spread of mucuna in Benin in recent years for suppression of the aggressive weed imperata (*Imperata cylindrica*). Soils on the plateaux of southern Benin and Togo are nearing exhaustion. Even if fertilizers were available, the benefit from their use is declining because of a degrading soil resource base. Researchers introduced mucuna cover cropping to alleviate the constraint of low nutrient supply to maize, the staple crop. Some 14,000 farmers now growing mucuna throughout Benin. Farmers who adopted mucuna cover cropping benefited from higher yields of maize with less labour input for weeding: maize following mucuna yields 3-4 t/ha without application of nitrogen fertilizer (similar to yields normally obtained with recommended levels of fertilization at 130 kg N/ha); whilst yields on plots previously planted with maize and cowpea was 1.3 t/ha. Mucuna as an intercrop or as a sole crop provides more than 100 kg N/ha to the following maize.

Details of Mucuna varieties and names throughout world

See International Legume Database & Information Service
http://www.biodiversity.soton.ac.uk/LegumeWeb?genus=Mucuna&species=pruriens#1

A = names approved by most authorities, *s* = approved as synonyms:

- Mucuna aterrima (Piper & Tracy) Holland -> Mucuna pruriens (L.) DC. var. utilis (Wall. ex Wight) Baker ex Burck.
- Mucuna aterrima (Piper & Tracy) Merrill -> Mucuna pruriens (L.) DC. var. utilis (Wall. ex Wight) Baker ex Burck.
- Mucuna atropurpurea sensu auct.
- Mucuna cochinchinensis (Lour.) A. Chev.
- Mucuna cochinchinensis (Lour.) Merr.
- Mucuna cyanosperma Schumann
- Mucuna deeringiana (Bort) Merr. -> Mucuna pruriens (L.) DC. var. utilis (Wall. ex Wight) Baker ex Burck.
- Mucuna esquirolii A. Léveillé -> Mucuna pruriens (L.) DC.
- Mucuna nivea (Roxb.) DC.
- Mucuna prurita (L.) Hook. -> Mucuna pruriens (L.) DC.
- Mucuna pruriens (L.) DC. *A*
- Mucuna pruriens (L.) DC. var. pruriens
- Mucuna utilis Wall. ex Wight -> Mucuna pruriens (L.) DC. var. utilis (Wall. ex Wight) Baker ex Burck.

Mucuna pruriens (L.) DC.
SYNONYM(S) : Dolichos pruriens L., Mucuna prurita (L.) Hook., Mucuna esquirolii A. Léveillé
Common names as for var pruriens.

Mucuna pruriens (L.) DC. var. pruriens
ENGLISH : Cowitch, Cow itch, Itchy bean, Wild itchy bean.
FRENCH : Pois pouilleux, Poil à gratter.
GERMAN: Juckbohne.
MALAY : Kacang babi, Kacang gatal, Kekara gatal, Kara-kara gatal, Kramé.
SPANISH : Picapica, Chiporro.
VIETNAMESE : (e of meo should be è).

Mucuna pruriens (L.) DC. var. utilis (Wall ex Wight) Baker ex Burck.
SYNONYM(S) : Mucuna deeringiana (Bort) Merr., Mucuna utilis Wall. ex Wight, Mucuna aterrima (Piper & Tracy) Holland, Stizolobium deeringianum Bort, Stizolobium pruriens (L.) Medik., Stizolobium hassjoo Piper & Tracy
CHINESE : Ci mao li dou, Ci mao li dou (medicinal name), Mao dou, Gou zhua dou.
DANISH : Fløjlsbønne, Floejlsboenne.
DUTCH : Fluweelboon.
ENGLISH : Velvet bean, Bengal bean, Buffalo bean, Florida velvet bean (USA), Lyon's bean.
ESTONIAN : Bengaali rasvauba.
FINNISH : Samettipapu.
FRENCH : Pois velu, Pois mascate.
GERMAN : Samtbohne.
ITALIAN : Fagiolo vellutato.
JAPANESE : Hasshou mame.
MALAY : Kacang babi, Kacang benguk, Kekara juleh, Kara benguk.
SPANISH : Judia aterciopelada de Florida, Haba terciopelo, Frijol terciopelo, Guisante negro.
VIETNAMESE : - (e of meo should be è).

Where can I get seeds and information?

See http://www.echonet.org/seeds/seed.htm

Central America

CIDICCO (the Cover Crop Clearinghouse in Honduras is designed precisely to provide seeds.
Contact Ing. Milton Flores,
CIDICCO,
Apartado 4443,
Tegucigalpa,
Honduras.
Telephone: (504) 239-5851, 239-5859.
Fax: (504) 232-3850.
E-mail: cidicco@sdnhon.org.hn

Florida
To get very small packets of seed for small-scale trials, these can be requested from ECHO in Florida.
ECHO's contact:
17430 Durrance Rd.,
North Fort Myers,
FL 33917-2239, USA. Tel: 1 (941) 543-3246. Fax: 1 (941) 543-5317.
E-mail: mprice@echonet.org

The Center for Cover Crops Information and Seed Exchange in Africa

The Cover Crops Information and Seed Exchange Center for Africa (CIEPCA) contributes to the sustainable management of tropical soils by assisting researchers and development specialists to develop, target, and test appropriate cover cropping systems in Africa. CIEPCA was established by the International Institute of Tropical Agriculture (IITA) with financial support from the Canadian International Development Research Center (IDRC). The CIEPCA secretariat is based at the IITA station in the Benin Republic, near Cotonou. CIEPCA is an important outreach mechanism of IITA's Institute-wide project on "Short Fallow Systems to Arrest Resource Degradation Due to Land-use Intensification" and more recently the institutue-wide project on "Protection and Enhancement of Vulnerable Cropping Systems". CIEPCA is also a founding member of the Tropical Soil Cover and Organic Resources Exchange Consortium.

http://ppathw3.cals.cornell.edu/mba_project/CIEPCA/home.html

Seed multiplication and dissemination activities by CIEPCA

- In 1997 seed of ten species/accessions from existing stock (total of approximately 150 kg) was sent to 11 beneficiaries in seven West African countries. The most requested species were *Mucuna* spp, *Canavalia* spp and *Aeschynomene histrix*.
- In 1998, seed of 11 species/accessions (total of approximately 300 kg) was sent to 15 beneficiaries in 6 West African countries.
- 2.6 tonnes of seed was given to 50 individuals or organisations in Benin Republic.

For more on CIEPCA, contact Albert Chabi Eteka at: C.ETEKA@CGIAR.ORG

According to Dr Bob Carsky: *"CIEPCA can send out seed of mucuna. We have 12 or 13 accessions of differing seed colour and maturity class. CIEPCA sells mucuna to international organizations for $5/kg not including shipping charges."*

For CIEPCA newsletters – see http://ppathw3.cals.cornell.edu/mba_project/moist/CIEPCA1.html

Background on Mucuna Germplasm (Meeting in Alabama)

In September 21-22, 2000, two of the April 2000 workshop participants, Steve Temple and Luc St-Laurent, visited Ludovic Capo-chichi in Auburn, Alabama. S. Temple is a bean breeder-agronomist at the University of California-Davis, while L. St-Laurent and L. Capo-chichi are both knowledgeable in *Mucuna* taxonomy. The purpose of the visit was to give an opportunity for the three scientists to together assess the morphological variability in the accessions grown by them (particularly the Auburn trials of L. Capo-chichi), to discuss the research of L. Capo-chichi, and to recommend further work on issues related to *Mucuna* germplasm. The three participants have produced a final report, which is available on request from Ludovic Capo-chichi cludovic@acesag.auburn.edu.

Based on the visit, the group made the following recommendations:

- Further crosses of *Mucuna* should be made and their agronomic characteristics evaluated. Such crosses should include crosses between high and low, and between low and low L-dopa lines.
- L-dopa data should be obtained on a number of individual plants from a supposedly uniform cultivar or landrace to better estimate the range of plant-to-plant and seed-to-seed variability in L-dopa levels that one can expect.
- The taxonomy of *Mucuna* genus and *Mucuna pruriens* species needs to be clarified to allow for a correct identification of species and cultivars within species.
- Current use of cultivar names should be discontinued in formal research, and researchers should make clear in their communication that names are used only to denote the origin of the seeds and are not taxonomic descriptors.
- A centralized seed bank should be organized for *Mucuna*, to store germplasm and passport data.
- Investigation of wild germplasm of *Mucuna* should be encouraged.

The group also recommended that while the genotype by environment trial be continued in 2001, certain modifications be made, such as including a greater number of accessions, including accessions which are diverse in maturity and morphological characteristics, and involving trial sites at a wider range of latitudes.

Mucuna and Medicine

Mucuna pruriens, commonly known as velvet bean or cowitch, is a plant indigenous to India A clinical study confirmed the efficacy of the seeds in the management of Parkinson's disease by virtue of their L-Dopa content[1,5]. *Mucuna pruriens*, recognized as an aphrodisiac in Ayurveda, has been shown to increase testosterone levels[2], leading to deposition of protein in the muscles and increased muscle mass and strength[3]. The extract is also known to enhance mental alertness and improve coordination[4].

1. Manyam, B.V., et. al. (1995) *J. of Alternative and Comp. Med*., 1 (3) 249-255.
2. Amin, K.M.Y. (1996) *Fitoterapia*, 67:53-58.
3. Bhasin, S., et. al. (1996) *New England J. of Med*., 335, 1-7.
4. Singh, R.H. et al. (1989) *J. Res. Ayur. Siddha*, 1(1):1-6.
5. Bell , Nulu and Cone (1971). *Phytochem*. 10, 2191-2194

According to the MS Swaminathan Research Foundation of Chennai, traditional healthcare uses of *Mucuna pruriens (*local names: *Baidhanka* (Oriya), *Rundulu* (Rana), *Tuliarimalalaha* (Kandha)) in southern India are as follows:

i. Abdominal discomfort: Grind the root of *Mucuna pruriens* to make a paste. Take this paste orally once a day for two days.

ii. Cholera: Boil the roots of *Mucuna pruriens* with four litres of water. Filter the decoction. Take one glass of this decoction orally with honey eight times a day until cured.

iii. Diabetes: Grind together the following into powder: 50 g seeds of *Mucuna pruriens*, 50 g seeds of *Hygrophila auriculata*, 50 g tubers of *Ipomoea* digitata, 50 g roots of *Withania somnifera*, 50 g

tuber of *Curculigo orchioides* and 50 g tuber of *Salmalia malabarica*. Take one teaspoonful of this powder orally with one glass of water in which sugar candy is already dissolved, twice a day for a month.

iv. Infertility (In men): Put 10 g roots of *Mucuna pruriens* s glass of cow milk. After few minutes the colour of this milk change to black. Take this glass of milk orally in the evening once a day for seven days.

v. Leucorrhoea: Grind the seeds of *Mucuna pruriens* into powder. Take one teaspoonful of this powder orally with 10 g honey twice a day for fifteen days.

vi. Scorpion bite: Grind the seeds of *Mucuna pruriens* with water to make a paste. Apply this paste on the affected area twice a day for four days.

vii. Snakebite: Extract juice from the roots of *Mucuna pruriens*. Take orally one teaspoonful of this juice three to four times continuously just after snake bite. Grind 100 g root of *Mucuna pruriens* to make a paste. Mix 50 g molasses to this paste. Take this paste orally with water just after snakebite.

viii. Toothache: Sundry the root of *Mucuna pruriens*. Grind this dried root into powder. Apply this powder on the aching teeth.

ix. Worm infection in cattle: Grind the fruit of *Mucuna pruriens* to make a paste. Administer orally this paste with water to the cattle twice a day for four days. Grind the seed of *Mucuna pruriens* into paste. Administer this paste orally with water to the cattle once a day until cured.

x. Worm infection: Grind together the root of *Mucuna pruriens* with the root of *Cassia occidentalis* to make a paste. Take this paste orally with a glass of water once a day for three days.

Mucuna Work in Mexico

RED/gac (Network/Cover Agriculture Group) is a network of non-governmental organizations and academic institutions working on green manure/cover crops in Mexico. Most of the organizations involved have been collaborating since 1992, first as a network of projects that were funded by the Rockefeller Foundation, and more independently since 1997. Currently, the group is working together on germplasm collection and multiplication, development of a KIT on green manure/cover crop systems for Mexico, human resources, and animal feed issues, among other topics.

The institutions involved in the group have conducted a number of research projects on *Mucuna* to date. In 2001, a group will initiate several new research projects. The work will be conducted in two states, Chiapas and Yucatan, in the facilities of Universidad Autónoma de Chiapas and the Universidad Autónoma de Yucatan (Autonomous University of Chiapas and Yucatan, respectively). In addition, a cooperative consisting of farmers and extensionists, Sociedad Cooperative Mok Cinti (Cooperative Society Mok Cinti), is also participating in the work.

The following projects will be initiated:

- Evaluation of young bulls feeding on a corn-*Mucuna* stubble in an agropastoral system
- Use of *Mucuna* seed as a supplement for dual-purpose cows during the dry season
- Incorporation of *Mucuna* in nutritional blocks
- Evaluation of diets with *Mucuna* for the fattening of sheep in pens
- Evaluation of the chemical composition of the grain and pod of *Mucuna*
- Study on the acceptability and consumption of *Mucuna*
- Adaptation and adoption of methods to utilize *Mucuna* in the communities of Sahcabá and Hocabá, Yucatan
- Partial and total substitution of soybean with *Mucuna* as a protein source in the diet of sheep
- Evaluation of diets with *Mucuna* in the fattening of sheep in pens in the Sierra de Santa Marta region of Veracruz

For further information, contact Wel Olvein Cruz Macias in Chiapas (wel.cruz@correoweb.com), José B. Castillo Caamal in Yucatan (jcastillo12@hotmail.com) or Cristina Guerrero or Balente Herrera in Veracruz (stamarta@dns.moomsa.com.mx).

Research on the Taxonomy of Mucuna

At Auburn University in Alabama, USA, Ludovic Capo-chichi is conducting Ph.D. research on the taxonomy of the genus *Mucuna pruriens* mainly by using molecular techniques. L. Capo-chichi had two research sites in 2000: one where 18 (in 1999: 40) hill-plot, single-plant accessions of *Mucuna* species were grown on trellises with two replications and another, where 40 accessions were grown in plots with four replications. The purpose of the first was to produce seed and to collect samples for AFLP (Amplified Fragment Length Polymorphism) analyses, while in the second site, biomass and seed production were measured, morphological characteristics evaluated, and specimens collected. L. Capo-chichi has already conducted some crosses between *Mucuna* accessions as well as some AFLP analyses, which indicate relatively high variability among the species studied. Interestingly, the grouping patterns obtained through AFLP analysis coincided well with length to maturity, with large genetic difference found between early- and late-maturing accessions included in the study. These early-maturing accessions were mainly obtained from farms in Alabama. For further information, contact L. Capo-chichi cludovic@acesag.auburn.edu

Key Sources of Further Information

For Central America – contact *CIDICCO* (Centro Internacional de Información Sobre Cultivos de Cobertura): Director: Milton Flores; Coordinador Servicio de Información, Enlace y Publicaciones: Raúl Alemán [Apdo. Postal 4443, Tegucigalpa MDC, Honduras C.A. cidicco@gbm.hn, cidicco@sdnhon.org.hn

http://rds.org.hn/miembros/cidicco/
El CIDICCO es una organización no-gubernamental creada en 1990, con el objetivo de localizar, documentar, diseminar, investigar y/o promover la investigación sobre el uso de abonos verdes y cultivos de cobertura (av/cc) para pequeños agricultores. La utilización de av/cc ha tomado gran importancia en los ultimos años dada su contribución a la conservación de materiales orgánicos, fijación biológica de nitrógeno, protección del suelo, mantenimiento de la humedad y disminución de la erosión, así como la oportunidad de obtener alimento para personas y animales. En la región Mesoamericana se ha identificado una diversidad de experiencias con el uso de plantas leguminosas como *Mucuna sp*., *Canavalia ensiformis, Dolichos lablab, Phaseolus coccineus, Vigna sp*., y otras que se usan en diferentes arreglos y sistemas agrícolas. Es común encontrar agricultores que han desarrollado sus propias asociaciones de leguminosas y granos básicos. Pero también hay experiencias con el uso de av/cc entre frutales como los cítricos o en la palma africana. Además especies leguminosas del género Phaseolus y Vigna se emplean considerablemente en la alimentación humana.

For Benin:
http://www.iita.org/info/impact/mucuna.pdf

Newsletter called *Mucuna News* that focusses on mucuna for human food and animal feed.
http://ppathw3.cals.cornell.edu/mba_project/CIEPCA/MuNews.htm

This site will soon carry extension brochures on *mucuna* made for Uganda and for southern Africa.

Other organizations that have information are:
MOIST (http://ppathw3.cals.cornell.edu/mba_project/moist/home2.html)
ECHO (http://www.echonet.org/

For the LEXSYS (Legume EXpert SYStem)
Cover Crop Database (LEXSYS) - http://www.iita.org/research/lexsys.htm

Useful Books

Cover Crops in Hillside Agriculture: Farmer Innovation with Mucuna by Daniel Buckles, Bernard Triomphe, and Gustavo Sain (IDRC / CIMMYT 1998)

Regenerating Agriculture by Jules Pretty (1995, Earthscan, London)

Cover Crops in Smallholder Agriculture by Anderson, Gundel and Pound (2001, ITDG Publishing, London)

Fertile Ground by Hinchcliffe, Thomspson, Pretty, Guijt and Shah (1998, IT Publications, London)

Legume Green Manures, Principles for Management Based on Recent Research by D J Lathwell. (June 1990,. Cornell University, Ithaca, NY)