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CIEPCA NEWSLETTER

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Editorial

This issue of our Newsletter carries several reports that focus attention on the complex interrelationships between cover crops and disease and pest problems. This is a sometimes forgotten area that deserves some attention.

As our newsletter progresses, we receive more input from our readers. We wish to express our gratitude to A. Ahanchédé and B. Sinsin of the Faculty of Agricultural Sciences of Benin Republic, Luc St-Laurent of University of Montréal, and D. Chikoye, F. Schulthess, and M. Sétamou of IITA for their valuable inputs to this edition. It is our hope that you will send us your impressions as well as some information you would like to share through our future editions.

It's also an opportunity for us to thank our donors for their support over the years. The International Development Research Centre (IDRC) in Ottawa has contributed approximately 65% of the CIEPCA budget during the past 3 years. The MOIST/CIIFAD (Cornell University, USA) program, which still hosts our web page and our French language listserv, also contributed partially the publication of the proceedings of the CIEPCA workshop held in IITA-Benin in October 1999. The Rockefeller Foundation funded an "exploration" on cover crops and green manure in which CIDICCO (Honduras) and CIEPCA participated. We hope that other institutions will work with us in the field of cover crops and will contribute to the quality of this newsletter.

In this issue

Plant health and cover crop results

Tropical legumes and *Callosobruchus chinensis*

Ofuya, T.I. and Bambgbola, K.A. 1991. Tropical Agriculture 68(1): 33–36.
Address: Department of Crop Production, The Federal University of Technology, PMB 704, Akure, Nigeria

The damage potential, growth, and development of *Callosobruchus chinensis* on 8 different tropical legumes were investigated under laboratory conditions. One or more larvae caused significant weight loss in single seeds of pigeon pea *Cajanus cajan* (> 14%), cowpea *Vigna unguiculata* (> 10%), soybeans (> 5%), and African yam bean (*Sphenostylis stenocarpa*) (> 3%), whereas 2 or more larvae caused significant weight loss in a Bambara groundnut (*Vigna subterranean*) seed (> 4%). The pest did not grow and develop on the seeds of winged bean *Psophocarpus tetragonolobus* or mucuna bean *Mucuna pruriens*, and only a few adults could be reared from lima bean *Phaseolus lunatus*. Developmental period was longer in soybean and African yam bean than in Bambara groundnut, pigeon pea, and cowpea. The heaviest females were reared from seeds of Bambara groundnut and the lightest from soybean. Females reared from Bambara groundnut were most fecund and lived longest.

***Mucuna* sp. infected with the cowpea strain of tobacco mosaic in Togo**

Gumedzoe, M.Y.D. 1993. Cahiers-Agricultures 2(5): 352–355.
Address: Université du Bénin, Ecole Supérieure d'Agronomie, BP 1515 Lomé, Togo, West Africa.

Of 705 field samples from different cowpea production areas in Togo, 63.1% reacted positively to at least 1 of 6 cowpea virus antisera tested. Double diffusion in agarose gel and DAS-ELISA were used to identify cowpea (aphid-borne) mosaic virus [blackeye cowpea mosaic potyvirus] (BCMV), cowpea mottle virus (CMeV), cowpea mosaic comovirus (CPMV), southern bean mosaic sobemovirus (SBMV), cowpea mild mottle carlavirus (CMMV), and the cowpea strain of tobacco mosaic tobamovirus (TMV-CS). CPMV was the most widespread. Mixed infections were observed involving 2 or more viruses. Various wild plants were infected with 5 of these viruses, including *Cassia hirsuta* (SBMV), *Centrosema pubescens* (CMMV), *Nauclea latifolia* (CMMV and BCMV), and *Mucuna* sp. (TMV-CS). In tests using artificial inoculation, cultivars TVX1850-01E, IT82E-16, IT83S-818, IT81D-1007, 58-146, IT82D-703, IT82D-786, and TVX3236-01G were resistant to at least 1 of the viruses.

Macrophomina phaseolina on the tropical cover crop *Mucuna pruriens* var. *utilis*

D.K. Berner, A.S. Killani, E. Aigbokhan, and D.C. Couper. 1992. Plant Disease. 76: 1283.
Address: IITA, PMB 5320, Oyo Road, Ibadan, Nigeria
(Reprinted with kind permission from Plant Disease)

During the rainy season of 1991, severely reduced plant stands and severely stunted plants were observed in several fields of the cover crop *Mucuna pruriens* (L.) DC. var. *utilis* (Wallich ex Wight) Baker ex Burck at the International Institute of Tropical Agriculture in Ibadan, Nigeria. Initial outbreak of symptoms followed a brief dry period, and subsequently more than 75% of the crop was lost. When the sites were replanted, the mucuna was again severely affected, although there was no dry period. Stunted plants had necrotic crowns and numerous necrotic lesions along the roots and runners. Only *Macrophomina phaseolina* (Tassi) Goidanich was consistently isolated from these lesions. Infestations of sterilized soil with a drench of a homogenized *M. phaseolina* culture, isolated from a symptomatic plant, resulted in poor seedling emergence in the screenhouse. Necrotic root symptoms were evident on emerged seedlings as well as on older mucuna plants taken from infested pots. *M. phaseolina* was reisolated and Koch's postulates proved. Tropical farm management increasingly relies on *M. p. utilis* as a rotational cover crop to restore fertility after cereal cultivation. This first report of the pathogenicity of *M. phaseolina* on mucuna indicates a potentially serious threat to this rotation.

Canavalia ensiformis and *Mucuna pruriens*, alternative hosts of the maize pest *Mussidia nigrivenella* Ragonot (Lepidoptera: Pyralidae)

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In West Africa, the maize cob borer, *Mussidia nigrivenella* Ragonot (Lepidoptera: Pyralidae), is a commonly occurring pest which occasionally causes serious damage to maize grain in the field and store and to cotton balls. In addition, *M. nigrivenella* damage predisposes maize to pre- and postharvest infestations by storage beetles, *Aspergillus flavus* Lk.:Fr. infections and subsequent aflatoxin contamination. Also, damaged ears cannot be sold as seed or green maize, an important source of cash in urban West Africa.

Surveys in different agroecological zones of Benin, conducted between 1993 and 1997, revealed about 20 plant species from 11 different plant families hosting the borer, but only 13 host plants enable the borer to develop to the pupal stage. Population densities of *M. nigrivenella* on crops vary with agroecological zones, with highest infestations in the Guinea savannas. These high population densities are due to the high abundance and diversity of host plant species comprising several economically important trees, such as the locust bean, *Parkia biglobosa*, and the shea butter, *Butyrospermum parkii*. Whereas a maize crop usually supports one generation per season only, several generations of *M. nigrivenella* were recorded on some alternative hosts, depending on the length of the fruit setting period and whether fruit setting is deterministic or not.

In a field experiment at IITA, Calavi, the highest population of the borer occurred on jackbean, (*Canavalia ensiformis*) and velvet bean (*Mucuna pruriens*), the most common and most suitable host plants besides maize in the south of the country. Life table studies on *M. nigrivenella* showed significant host plant species effect on larval survival and developmental time as well as on adult fecundity. Highest larval survival was recorded on jackbean and lowest on maize. Mean larval developmental period was longest on maize and shortest on *C. ensiformis*. Fecundity was highest for females emerging from larvae fed on *C. ensiformis*.

It can be expected that an expansion of the area planted to these cover crops will affect the population dynamics of *M. nigrivenella*. Because of the high suitability of *C. ensiformis* and *M. pruriens*, planting of those cover crops should be timed in a way that the emergence of female moths from mature pods does not coincide with the presence of maize in a stage attractive to ovipositing female moths and suitable for development of larvae. In addition, it is recommended to screen all promising cover crop species and cultivars for suitability to this pest. Ideally, a cover crop species would be attractive to ovipositing females but not allow for completion of the life cycle, thus acting as a trap plant.

Cover crops and the distribution of cowpea pests and natural enemies

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Natural vegetation, as much as crops, is a potential food source or haven to cowpea pests and natural enemies. Thus, a better management of vegetation around farms using adequate cropping practices may help in reducing the problems associated with phytosanitary protection. For this purpose, two leguminous cover crops (*Calopogonium mucunoides* and *Crotalaria juncea*), one poacea (*Cynodon dactylon*), and cowpea (*Vigna unguiculata*) were intercropped following a particular spatial arrangement in order to monitor insect population dynamics. The insect samples collected were identified (as natural enemy or auxiliary) in the Insect Museum of IITA by Dr G. Goergen (see table below). The plants were classified as "host plants" or "alternative hosts" depending on the presence (permanent or temporary) of the pests or natural enemies.

Cowpea pests and natural enemies found on cover crops in CIEPCA collection at IITA-Benin

Order	Family	Name	Host/Alternative	Status
Coleopters	Coccinellidae	*Scymnus* sp.	*Cynodon dactylon*	Natural enemy
		Platynaspis sp.	Cowpea	Natural enemy
		Epilachna sp.	*Cynodon dactylon*	Pest
		Cheilomenes sulphurea (O.)	*Cynodon dactylon*	Natural enemy
	Chrysomelidae	*Lema* sp.	*Crotalaria juncea*	Natural enemy
		Aspidomorpha sp.	*Calopogonium mucunoides*	Pest
		Medhytia quaterna (Fairmaire)	Cowpea	Pest
		Ootheca sp.	Cowpea	Pest
	Meloidae	*Coryna hermannea* (Fabricius)	Crotalaria juncea	Pest/Natural enemy
		Mylabris fargubarsoni	Cowpea/*Cynodon dactylon*	Pest
Thysanopters	Thripidae	*Taeniothrips sjostedti* (Tryb)	Cowpea	Pest
		Sericothrips occipitalis (Hood)	Cowpea	Pest
Hemipters	Aphidae	*Aphis* sp.	Cowpea	Pest
	Reduviidae	*Haematochares obsuripennis* (S.)	Cowpea	Natural enemy
	Anthocoridae	Ind	*Calopogonium mucunoides*	Ind
	Coreidae	*Cletus* sp.	Cowpea	Pest
	Pentatomidae	Larvae ind	Cowpea	Ind
Dermapters	Forficulidae	*Diasperasticus erythrcephalus* (O)	*Crotalaria juncea*	Natural enemy
Lepidopters	Pyralidae	*Maruca vitrata*	Cowpea	Pest
	Ind	Larvae ind	Cowpea	Ind
Ortopters	Mantoidea	Larvae ind	*Crotalaria juncea*	Ind
	ind	Larvae ind	*Crotalaria juncea*	Ind
Hymenopters	Eumenidae	*Synagris* sp.	Cowpea	Natural enemy
Homopters	Cicadellidae	Larvae ind	*Cynodon dactylon*	Ind
Isopters	Termitidae	*Macrotermes bellicosus* (S.)	*Crotalaria juncea*	Pest
Arachnid	Salticidae	Larvae ind	*Crotalaria juncea*	Ind

Ind = not known

Cover crop pathogens in farmers' multiplication plots in northern Benin

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In 1998, farmers in the provinces of Atacora and Borgou (northern Benin) multiplied 4 varieties of mucuna (*Mucuna pruriens* var. *utilis, Mucuna cochinchinensis, Mucuna* spp. Rajada and Preta) and of *Canavalia ensiformis* in their farms. Foundation seeds were supplied to the farmers by CIEPCA. A team of researchers from the Germplasm Health Unit, in charge of the inspection and phytosanitary control of seeds at IITA, inspected the farmers' plots on two successive occasions and took leaf and grain samples for laboratory analysis.

During the monitoring tour, more leaf spots were observed on *M. pruriens* var. *utilis* than on Preta, Rajada, and *M. cochinchinensis*. Similar leaf spots were also observed on two wild species, i.e., *Hiptis suaveolens* (Lamiaceae) and *Pennisetum polystachion* (Poaceae) which are potential host plants. Fungi, bacteria, and a virus were isolated during leaf and seed laboratory analysis.

The following fungi were isolated:

- *Colletotrichum lindemuthianum* and *Colletotrichum gloeosporioides* as causal agents of anthracnose on the leaves, stems and seed
- *Colletotrichum truncatum* causal agent of the lesions found on the leaves and stems
- *Macrophomina phaseolina* causal agent of ashy stem blight and pod rot
- *Fusarium oxysporum* and *Botryodiplodia theobromae*, are the probable causal agents of wilt and leaf yellowing
- *Phoma* sp. was reportedly responsible for blotches and lesions found on leaves

The bacterial pathogens isolated, *Pseodomonas syringae* pv *syringae* and *Xanthomonas campestris* pv *phaseoli*, were responsible for bacterial spots and lesions on the leaves, pods, and seeds.

A bacterium still unidentified has been isolated and is proving antagonistic to two fungi namely *Fusarium oxysporum* and *Botryodiplodia theobromae*. An inhibition zone was observed in a culture medium containing the unidentified bacterium and the fungi. Such an observation is a welcome basis for further biocontrol studies. The antagonistic activity of the unidentified bacterium may account for the high germination rate of some seed lots despite the presence of fungi.

A cosmopolitan virus present in the West African subregion, tobacco mosaic virus (TMV), was also diagnosed on seeds.

Those pathogens were found on seeds collected from both weedy and weed-free plots. The low germination of seeds does not necessarily correlate with the weed infestation level of the plots. For example, 5 out of the 29 seed multiplication plots were infested with weeds. The germination potential of seeds from the 5 farms were in the range of 70 to 94%. On the other hand, seeds collected from 11 (i.e., 46%) of the 24 weeded plots showed germination capacities of less than 70%, sometimes as low as 39%.

In light of the results of this analysis, it was recommended that seed lots containing *Colletotrichum lindemuthianum* and *C. gloeosporioides* should not be distributed internationally without prior treatment with an efficient fungicide such as Labilite 70% PM (manebe 50% and methylthiophanate 20%). The aim is to subsequently have seed lots that are free from those pathogens.

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Formation of CCropNet

Building on the foundation laid by CIEPCA's efforts to improve electronic connectivity of cover crops workers in West Africa, USAID has promised some additional funding to connect more cover crops workers this year.

As part of the work plan for 1999, CCropNet has been formed. The coordinator, Dr G. Tarawali collected names of potential collaborators and contacted as many as possible by email, post, or in person. Once a critical mass of workers was identified, a listserv called CCropNet was formed using the address <ccropnet@cgiar.org>.

Some workers have very dependable and effortless access. Others have access but with great difficulty and substantial effort on their part. A third category have no access at all. Dr Tarawali visited many countries and institutions during May and June. He inventoried status of connectivity and needs for improvement.

At the same time he proposed a protocol for a regional cover crop trial. The simple trial consists of intensive observations of two varieties of *Mucuna pruriens*. The trial protocol was discussed by email during May and June and seed was delivered to potential collaborators. It is expected that the data will be analyzed together, allowing us to learn more about mucuna growth requirements. However, this experiment has another objective, which is to show how electronic connectivity improves the efficiency of research and sharing of information.

Registration details

After distribution of this newsletter, we will update our database. If you wish to receive CIEPCA newsletter for the year 2000, kindly send the following information (even if you have done so before) to CIEPCA Coordinator (see address on last page) by 1st February 2000.

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Agronomic and other cover crops reports

Methods of assessing ground cover by herbaceous cover crops

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The use of cover crops to improve shifting cultivation has received considerable attention from the research and extension community in West Africa. Interest in the use of cover crops is growing in the region because they are one of the promising technologies for sustaining agricultural systems. Cover crops can only make a significant impact on the farming system if they establish fast and produce a lot of biomass. It is not easy to estimate biomass without destructive sampling. Cover assessment is an indirect and easy way of estimating plant biomass. Ground cover can be assessed in several ways depending on the objectives and resources available. In this article, I would like to share information concerning ways of assessing cover the affordable way. In future I will discuss more sophisticated ways of measuring ground cover.

Line-intercept method

Materials: A ball of string, 1 m long steel rod, 2 pegs.

Procedure

a. Mark string with ink at 10 cm intervals (or any interval can be used depending on the accuracy required).
b. Stretch string across a plot or field seeded with cover crops; tighten and fasten string to the 2 pegs.
c. Drop steel rod vertically at each mark along the string. Please do not slant the rod as this will lead to under- or overestimation of ground cover.
d. Record the number of times the steel rod touches the cover crop (α) and touches other vegetation or bare ground (β) along the string.
e. Percentage cover is computed as follows:

% ground cover = 100 × [total number of cover contact (α)]× [total number of marks touched along the string ($\alpha+\beta$)]$^{-1}$

f. Recommended that you replicate your measurements at least twice in each plot, e.g., sample diagonal towards A and B or C and D (Fig. 1).

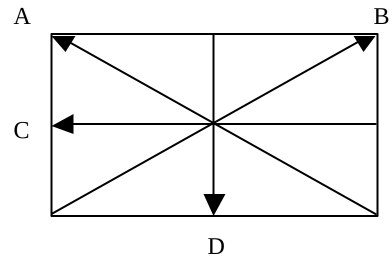

Fig 1: Sampling scheme for line-intercept method

Point-intercept method

Materials: Wooden planks (1 m high and 1 m long), 10 steel rods or wire pins, nails

Procedure

a. Assemble wooden planks into a point-frequency frame (see Figure 2). Drill guide holes through the two horizontal planks at 10 cm intervals (or desired intervals). Slot the 10 steel rods into the holes.
b. Hold the frame vertically (to avoid over- or underestimation of cover) and mount the frame over stip of vegetation to be assessed. Record the number of times the rods contact the cover crop (α) and other vegetation or bare ground (β) out of 10. Mount frame at least 10 times in each direction. It is recommended that you replicate your measurements at least twice. Instead of using 10 steel rods at once, you can use one rod for all 10 readings. This however slows down the rate of ground cover assessment.
c. Compute ground cover using formula shown above.

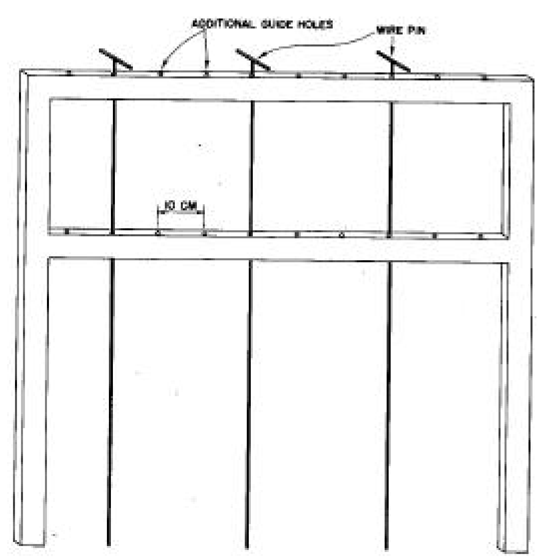

Fig. 2. Point-frequency frame

Quadrat- charting method

Materials: Graph paper, pencil, 1 m × 1 m frame or quadrat

Procedure

a. Subdivide the 1 m^2 frame into 100 subdivisions. measuring 10 cm × 10 cm (or 100 cm^2) Number the co-ordinates of the frame from 1 to 10 (See Fig. 3).
b. Mount frame over cover plot to be assessed.
c. Evaluate ground cover by counting all 100 cm^2 squares and fractions of squares filled by the desired cover crop
or
d. Outline the area covered by the species of interest on a sheet of graph paper. Area from all sheets of graph paper should be summed to get the total area occupied by species of interest in each 1 m^2
e. Sample at least 10 times from each plot or field and compute total ground cover using the formula shown above.
f. This method gives an accurate measurement of area a given cover crop occupies. Note that the method is time-consuming and does not work well for tall species.

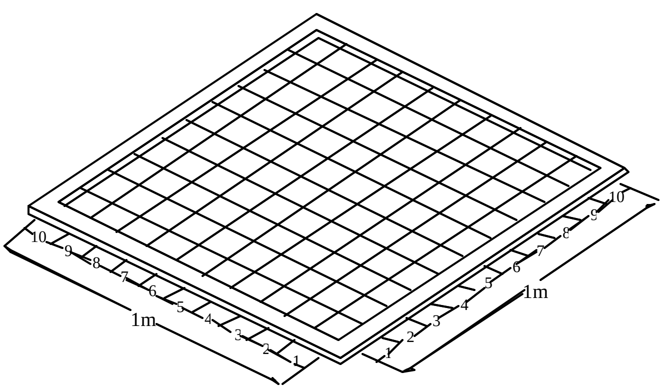

Fig. 3. Quadrat for charting method

For additional information, refer to:
D. Mueller-Dombois and H. Ellenberg. 1974. Aims and methods in vegetation. ecology. New York: John Wiley and Sons. 547 p.

Mucuna cochinchinensis intercropped with maize in agropastoral zones in Northern Benin

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Mucuna cochinchinensis is a cover crop which, inter alia, can be used as feed in the rearing of ruminants. Mucuna was introduced as an intercrop with maize to selected agropastoralists in villages around Nikki, Kalalé, and Pèrèrè in the Sudan zone in northern Benin. The objective of this farmer participatory research was to identify the most appropriate sowing time of mucuna in maize plots for off-season fodder production. This type of fodder is most needed by bulls used for traction farming, non-transhumant cows and small ruminants. The experimental design was set up in the field with the full involvement of agropastoralists with whom discussions had been held on the phenology and yields of maize and mucuna.

In general good nodulation was observed on mucuna. Some nodules had a diameter reaching 5 cm. On the other hand, mucuna roots did not nodulate in lowlands. The best sowing period for off season fodder production is the last two weeks of August. Earlier sowing dates (June/July) accounted for the premature fodder biomass losses recorded under the form of litter in the fields before or a few days after the rainy season in October. As for biomass yield (stems, leaves and pods), the highest value noted (11.1 t DM/ha) corresponds to the July planting of mucuna as against 5.1 DM/ha for planting in the second half of August. Generally, mucuna–maize intercrop has a depressive effect of 1 to 28% on maize grain yield, compared to the check. Maize yield figures are opposed to mucuna dry matter production data. For example, the lowest mucuna dry matter figures corresponded to the highest maize grain yields. Other variables such as planting density impacted positively on mucuna dry matter output, but more seeds are needed.

A number of constraints were raised by the farmers. For example, the women entrusted with the harvesting of maize cobs were afraid of bites of snakes, which presumably take cover under mucuna canopy. As a result, fully covered maize stands of early planting were often avoided. This constraint is not raised for mucuna plots planted later in August. It is also worth noting that pod picking does not take place systematically within the first weeks of maturity. A lot of shedding takes place.

One important lesson drawn from this work is that the involvement of agropastoralists in all stages of the experiment enabled them to reach the same conclusions as the researchers, hence the high demand of mucuna seeds recorded over the years following this R&D.

A study of the systematics of the genus *Mucuna* at the Université de Montréal

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Velvet bean is cultivated in the tropics mainly as green manure, a cover crop, or for consumption. The plant is also known to produce L-dopa, a chemical used against Parkinson's disease. However, the presence of chemicals reduces the palatability of the seeds and a detoxification process is required before the bean is safe for consumption. It is therefore of utmost importance to know each species (variety and cultivar) if one is to optimize the benefits associated with the cultivation and the use of Mucuna. It is particularly important to be able to unambiguously identify each species in order to use them rationally.

According to many authors, all velvet bean cultivars belong to the same taxonomic entity: *Mucuna pruriens* var. *utilis*. However, this synonymous nomenclature is questioned on the basis of the taxonomic confusion arising from the great number of cultivars existing as well as from L-dopa quantification analyses showing great variability among them. The genus *Mucuna* encompasses more than 100 species, but here also, there is no consensus as to the exact number.

A few months ago I began a research project leading to a PhD in biology on the systematics of the genus *Mucuna* at the Université de Montréal. Among the main objectives of this study are to:

1. revise the classification of the species of the genus *Mucuna* using morphological, phytochemical and molecular characters within a phylogenetic framework;

2. identify the most promising species or cultivars in terms of L-dopa production.

A number of seed lots of cultivars of *Mucuna* were obtained, from the CIEPCA among others, and germinated. L-dopa content in the seeds and the leaves of each will be assessed and identified by high performance liquid chromatography (HPLC) and molecular markers, which allow for a rapid and efficient identification (even at the seedling stage) while at the same time being relatively inexpensive.

This study will allow us a better understanding of the evolution and the worldwide distribution of all species of the genus *Mucuna*. The establishment of molecular markers will allow the appraisal of genetic diversity within the species. This will in turn allow a precise selection of the most appropriate cultivars for a given use as well as providing scientists with the tools needed for germplasm conservation. Ultimately, bringing to the fore L-dopa rich or poor genomes may eventually lead to the amelioration of existing cultivars. An L-dopa rich cultivar would allow farmers growing *Mucuna* as a cover crop in developing countries to both protect their crops and to add value to their production. On the other hand, an L-dopa poor cultivar would ensure food security for local populations in some areas as well as to give the farmers a cheap source of safe food for their animals.

Legumes as dry season fallow in upland rice-based systems of West Africa

Mathias Becker and David E. Johnson. 1998. Biology and Fertility of Soils 27: 358–367
(Summary by A.C. Etèka)

The authors conducted experiments in Côte d'Ivoire between 1995 and 1996 at four characterized "bench-mark" sites with contrasting climate, soils, and rice production systems. The sites were located in the Guinea savanna (Boundiali), derived savanna (Bouaké), and the humid forest zone (Gagnoa and Man). N accumulation, N derived from the atmosphere (Ndfa), weed suppression, and the effects on rice yield were evaluated in 50 legume accessions. Legumes were grown during the dry season for a duration of 6 months between two crops of upland rice. No rhizobial inoculation of either the seeds or the soil was undertaken.

The results showed that legume fallows appear to offer the potential to sustain rice yields under intensified rice cropping. Biomass was in most instances significantly greater in the legume fallow than in the "weedy" fallow control, and several legume species suppressed weed growth. N accumulation by legumes varied between 1 and 270 kg N ha^{-1} with 30–90% Ndfa. Across sites, *Mucuna* spp., *Canavalia* spp., and *Stylosanthes guianensis* showed consistently high N accumulation. Grain yields of rice which had been preceded by a legume fallow were on average 0.2 Mg ha^{-1} or about 30% greater than that preceded by a natural weedy fallow control. At the savanna sites where fallow vegetation was incorporated, *Mucuna* spp. and *Canavalia ensiformis* significantly increased rice yield. In the bimodal forest zone, the highest rice yield and lowest weed biomass were obtained with *Crotalaria anagyroides.*

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Maintain and increase the maize yields on the red ferralitic soils in the south of Togo

J. Marquette. 1986. L'Agronomie Tropicale 41 - 2
IRAT-CIRAD, B.P. 5035, 34032 Montpellier Cedex, France
(Summary by A.C. Etèka)

Mr Marquette presents in this article the results of an experiment conducted on two types of red ferralitic soils (terre de barre) in the South of Togo: degraded and nondegraded. The study was carried out as part of a development project for this zone where food cropping is the main activity. The trial included eight treatments on each location as follows:

1. Traditional crops (maize - groundnut - maize)
2. Zero tillage + use of herbicide
3. Ploughing-in of crop residue
4. Yearly application of compost mulch
5. Very short fallow (relay cropping) with *Crotalaria juncea*
6. Fallow every other year with *Crotalaria juncea* or *Stylosanthes*
7. Continuous cultivation of maize
8. Cropping *Crotalaria juncea* or *Stylosanthes* over 30 months

The trial lasted five years. Regarding yield data, the author remarks that the most obvious gain was observed with the cultivation of green manure every other year. A 30-month fallow of green manure seems too long (Interruption of maize cultivation) in that region where land is not easily accessible. In general, the author believes that the most notable results can be obtained with the use of crop residue in the plot after their decomposition, or by incorporating a crop of green manure from the short rainy season.

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Work on cover crops at IITA-HFC in Cameroon

The Humid Forest Ecoregional Center (HFC) of IITA is located in the forest margins of southern Cameroon, near Yaounde. It has a research station in Mbalmayo with slightly acid soils (pH 6) and through collaborative agreements with the Cameroonian national research institute IRAD (Institut de Recherche Agricole pour le Developpement) access to another research station in Nkoemvone/Ebolowa on strongly acid soils (pH 4).

Since 1996, some 80 accessions of about 50 species are being screened for their performance under humid forest conditions. The same set of cover crops is used at both sites. Observations are done on single lines of 1m by 5 meters, replicated three times per site on a monthly basis for about 8 months. They relate to establishment, canopy cover development, flowering, seed production, and pest/disease symptoms.

The screening process entails 3 phases: (i) observations in single lines as specified above, (ii) testing in cropping systems on station, and (iii) on-farm testing with farmers.

Some of the best species have been taken to phase 2 for screening in niches provided by the major traditional cropping system, the mixed food-crop system (main components cassava-groundnut-maize), and emerging new systems, i.e., the sole maize system, and the plantain system in short fallows. Parameters such as biomass production, nutrient transfer to crops, and biomass management are included in this phase. Phase 3 tests have been initiated in 1999.

Some results are available in IITA's project report for Short Fallow Systems (Project 1, coordinator: N. Sanginga, IITA, Ibadan), which is yet to be published.

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