FROM THE INTERNATIONAL CENTER FOR TROPICAL AGRICULTURE (CIAT), CALI, COLUMBIA

Dr. Douglas Laing, Deputy Director General of CIAT writes :

In Newsletter #7 of November 1991 I promised to bring the Network members up-to-date on the research conducted at CIAT on erosion control in cassava production systems. We at CIAT have been researching this subject for many years. Recently, various initiatives have come together in a series of experiments being conducted in a collaborative project between CIAT and the University of Hohenheim. The results reported here are the work of **Mr. Martin Ruppenthal** who is about to leave CIAT to finish writing his PhD thesis in Germany.

The long-term treatments at two locations involve a series of cultural options that we have developed over the years, compared two cassava treatments viz: the system used by farmers in the region (treatment #2 -planting cassava at about 10,000 plants/ha in rows 1m apart, no other cultural practices). The other treatment (#3) is cassava planted on (about) 30 cm high contour ridges; involving a considerable amount of manual labor. Treatments 4, 5 and 6 were designed to study cover species (Zornia, Centrosema and kudzu) underplanted beneath the cassava to provide not only groundcover but soil improvement possibilities. Treatment 7 is cassava planted on the flat with elephant grass (*Pennisetum purpureum*) living barrier strips where the grass occupies about 25% of the total plot area. The advantage of this system would be that elephant grass could be used for fodder.

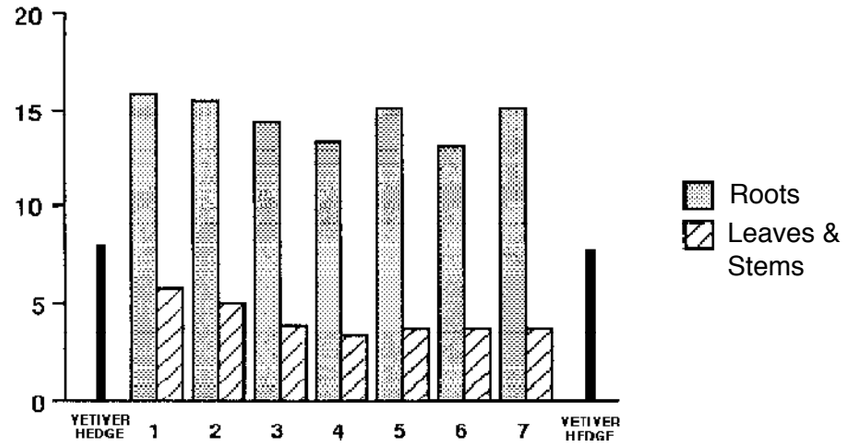
Treatment 8 is cassava planted on the flat with vetiver grass barriers occupying about 12.5% of the plot area. The vetiver grass, not the cassava, is underplanted (at the same time as the planting of the cassava) with the forage legume *Arachis pintoi*. All these treatments are compared to a clean weeded, bare fallow (treatment #1) where the soil is allowed to erode in accor-

Table 7. *Cassava and forage productivity, soil loss and runoff data for a range of cassava production systems compared to bare fallow on an Oxic Dystropept[1] at CIAT's Santander de Quilichao Station, Colombia (1,000m altitude; growing season rainfall, 10 months 1240mm)*

System	Cassava Fresh Root Yield, t/ha [2]	Forage Yield t/ha	Runoff mm (10 months)	Runoff % Rainfall	Soil Loss t/ha (11 months)
1. Bare Fallow	na	na	144.0	11.6	142.0
2. Cassava on Flat Cultivation	35.7	na	46.0	3.7	8.3
3. Cassava on Contour Ridges	35.6	na	44.0	3.5	3.1
4. Cassava Underplanted with Zornia	27.2	3.4	80.0	6.5	27.4
5. Cassava Underplanted with Centrosema acutifolium	31.8	3.4	38.0	3.1	12.8
6. Cassava underplanted with kudzu	20.7	2.9	43.0	3.5	15.4
7. Cassava on Flat with Elephant Grass Strips [3]	23.6	5.3	50.0	4.0	4.0
8. Cassava on Flat with Vetiver Grass Hedges [4]	31.0	1.1	45.0	3.6	1.3

1 - Acid soil (pH 4.2), Al saturation 50-85%, low nutrient status in shallow A horizon (15-25cm); average slope 0-15%.
2 - Cassava yields for 11 months (1990-91); Vetiver plots planted one month after other treatments thus cassava yield for treatment 8 was adjusted to an 11 month basis using growth in root yield per day data available from a similar experiment on the same station in the same year.
3 - Area occupied by elepahant grass is 25% of the plot.
4 - Area occupied by vetiver grass is 12.5% of plot area; Vetiveria zizanioides was transplanted and under planted (only under grass barrier) with Arachis pintoi at time of planting cassava.

Figure 2. *Cassava/Vetiver -- Contourbarrier; Yields per row (each row contains six plants) in kg of fresh roots and leaves and stems.*



dance with the rainfall received.

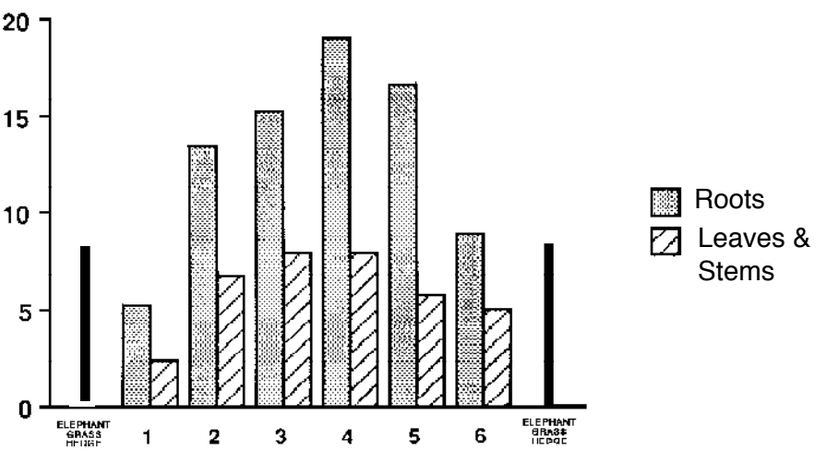
The data in Table 7 shows the final results from the first year at one site in terms of fresh cassava root yield, forage yield from the associated legume or grass species, runoff (and runoff as percentage of rainfall) and soil loss in tons of dry soil/ha over an 11-month period. The data clearly supports the view that vetiver grass is by far the best living barrier that CIAT has evaluated in the sense that the yield of cassava has not been affected, i.e. considering that 12.5% of the plot area is occupied by the grass strips, and given that the vetiver grass was only established at the same time as the cassava.

Runoff in the vetiver grass plots was extremely low representing only 3.6% of the total rainfall received and the soil loss was an insignificant 1.3 tons/ha compared with 142 tons/ha in the bare fallow plot. These results are extraordinary considering that the vetiver was only established at the same time as the cassava was planted whereas the elephant grass had been pre-established long before the planting of the cassava. The *Arachis pintoi* is now well established forming a dense mat under the vetiver grass hedge and is helping to stop erosion and presumably is providing nitrogen to the vetiver grass. As the soil and nutrients accumulate on the uphill side of the vetiver it is expected the Arachis will produce more fodder in coming years.

In Figures 2 and 3 we show the competitive effects of the two grass species on cassava in terms of per row yields at various distances from the grass strips. You can see that cassava growth was not affected by the vetiver grass whereas the elephant grass had severe competitive effects (probably root zone competition) on cassava.

We have studied the rooting pattern of the vetiver grass on an acid oxisol soil (**ed. note** - *oxisol* = *ferralsol in FAO taxonomy*) at the CIAT-Quilichao station. It is clear that the species has a cone-shaped root system where the major roots penetrate more or less vertically and then fan out slightly at deeper depths — in these highly aluminum toxicity-affected subsoils. Analysis of the vetiver grass roots have shown it to be extremely mycorrhizal with three fungal species identified on the same roots providing colonization levels greater than 80%. The demonstrated vigor of vetiver on very poor soils is clearly related to this phenomenon.

Figure 3. *Cassava/Elephant Grass Contour barrier; Yields per row (each row contains six plants) in kg of fresh roots and leaves and stems.*



The one major doubt we have with respect to vetiver is related to its palatability and digestibility for bovines. If adoption is to be successful in the region we have to find an economic use for the grass strips. We are carrying out digestibility studies (in-vitro and in-vivo) to find how vetiver grass compares with other tropical grass species in terms of some critical parameters.

Once again we have proved that there is nothing new in the world. In our on-farm research with vetiver and limoncillo we have uncovered the fact that vetiver grass (known as 'Tiva' to the local people)

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has been growing in the region for many years. We visited a farmer near Jamundi Valle (1000m altitude) who has planted vetiver grass around his house to stop the land from slipping away, thus stabilizing the foundation. Unfortunately, he had not planted the grass in his cassava field which is eroding very heavily nearby. Tiva has been grown in the Valle del Cauca for many years and one of the reasons it has not spread is probably because of its apparently low palatability to bovines.

In response to this we have made a small collection of some of the local vetiver grass materials that have been planted by farmers and found some variation among accessions in leaf 'softness'. Included in the above studies on digestibility is one of these 'softer' selections. If any members of the Network have comments to make on this issue we would be delighted to receive them. The accession originally obtained by CIAT for our work was found growing in the botanical garden at the National University in Palmira. CIAT now has small quantities of sexual seed of this accession if Network members are interested they should contact **Dr. M. Iwanga** (see editor's note below). Obviously we will continue to look for more such variation including material for high elevations in the tropics.

The above discussion on palatability for bovines and the possibility that there is variation within vetiver grass points to the urgent need for a breeding program devoted to this activity somewhere in the world. I would urge members of the Network to think about this and to contribute accessions from various sources to somebody who could begin a breeding program. This program would have to be associated with scientists who can measure palatability and digestibility (in-vitro and in-vivo) so that we can see if we can come up with a fodder grass which is more acceptable to animals and without losing vetiver's superb features as a hedge against erosion.

We are convinced at CIAT, both in our on-station and on-farm research with farmers in the mid-altitude acid soil tropics, that vetiver grass is probably the best living barrier one could possibly ask for in terms of its low competitivity with the associated crop and its extremely effective erosion control characteristics. Terraces are already forming behind the vetiver grass and the second year's harvest seems to be pointing toward longer term benefits. We will keep the members of the network posted on these results as they come to hand. Contacts with CIAT for the immediate future should be made through **Dr. Karl Mueller-Saaman or Dr. Mabrouk El-Sharkawy** in the Cassava Program.

Editor's Note : *The Network urges extreme caution when dealing with vetiver propagation with seed. One of the most important characteristics of vetiver grass is the fact that it can be introduced with little or no fear that it will become a weed. However, if one begins selecting for plants which are more easily established from seed, a problem may be created where one did not exist before.*