CARDI
CARIBBEAN AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTE

REPRINTED: JUNE 1993
ORDER NO.: AP–F / 31·92

Factsheet

TREE LEGUMES FOR LIVESTOCK AND CROP PRODUCTION

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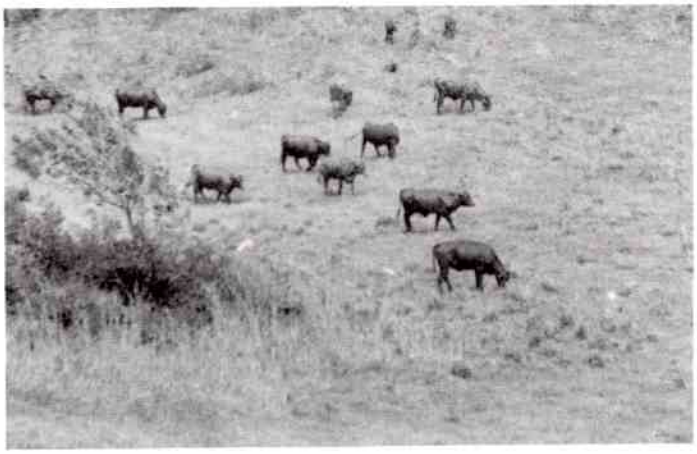
The states of the Caribbean region, like other small countries in the developing world, are under severe economic pressure. While their agricultural exports are experiencing growing competition and falling relative prices, the costs of imported inputs continue to rise. Balance of payments problems demand that agriculture becomes more efficient, producing more and better quality goods with less access to foreign exchange. New and innovative techniques are required and tree legumes have a growing role in the search for greater efficiency.

USES OF TREE LEGUMES

Legumes are plants which are able to make use of nitrogen from the air, so they need less fertilizer than other plants. Tree legumes are particularly important because they are long lived and deeply rooted. The most useful tree species grow rapidly and will quickly resprout after cutting. They have many uses as follows:

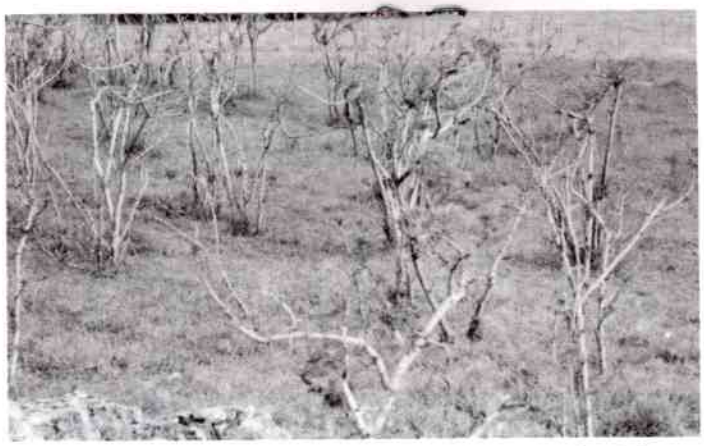
1. **Animal Production:** tree legumes form a high quality supplement for livestock. They can be browsed, fed green in a cut and carry system or made into leaf meal for storage until needed. The leaves usually contain over 22 percent crude protein compared with 16 percent in diary concentrate. Trees can be used as living fence posts and they also provide shade for grazing animals.



Tree Legumes in a grazing pasture.

2. **Crop Production:** the leaves can be used as green manure, either dug into the soil or placed on top as a short term mulch. Live trees can form supports for crops such as yams while long shoots can be cut as bean stakes.

3. **Soil stabilization:** because of their deep tap root system, they help to stabilize slopes, preventing land slips. They help to improve soil structure, reducing erosion by increasing water penetration into the soil.



A Leucaena stand planted on sloping land to control erosion.

4. Fuel: the woody material from tree legumes can be dried and burnt as firewood, or can be made in to high quality charcoal.

5. Other: some species have been successfully used for making paper and synthetic fabrics while in some parts of the world, flowers and young pods of the wild tamarind are used as human foods in salads and stews. Clearly, some of these potential uses will compete with each other (e.g. the leaves can either be used as green manure or as animal feed), but tree legumes can find a use on almost any farm in the region.

PRINCIPLES OF USE

Leguminous trees are included in a farming system in order to optimise production in a non-destructive, sustainable manner with the minimum use of expensive agro-chemicals. They can be planted as single spaced trees or as single or multiple continuous rows in hedges, but in most cases, the aim is to grow other plants (crops or pasture) between the trees. The combination of taller tree species with other shorter inter-crops has greater production potential than either type grown alone. The deep-rooted trees are able to absorb and recycle nutrients from the soil beyond the reach of most crops.

Over a period of time, soil fertility is improved because leguminous trees are able to fix nitrogen from the air and use it for their own growth. They also have a beneficial effect on soil structure. They are therefore able to improve the yields of the companion crop and work in Nigeria and elsewhere has shown that under good management, trees can have the same effect as applying 60kg per/ha (54lb/ac) of nitrogen, equivalent to 286kg per/ha (225lb/ac) of sulphate of ammonia, but without the harmful acidifying effect of the fertilizer.

This effect has been obtained by pruning the trees 3 or 4 times per year and returning all the leaf material to the soil in the spaces or strips between the trees. Prunings are dug into the soil before planting the inter-crop, and later clippings are placed on the soil surface as a mulch. If the tree leaves are used to feed animals instead of fertilizing the crops, the effect on crop production will be reduced, but if the animals are kept in sheds and the manure is returned to the field, the reduction will be minimal.

The trees must be pruned hard just before the planting of the corp, in order to reduce the effect of shade. This will provide leaf material for incorporation into the soil, as well as long, slender stems for use as bean stakes and often woody material which can be directly used as fuel, or made into charcoal. Further pruning during the cropping season will produce mainly soft, leafy growth for mulching (and/or animal feed).

Some species such as wild tamarind produce heavy crops of seed if allowed to grow and flower, and where grazing is not permitted, the seedlings have potential as troublesome weeds. Frequent cutting during the cropping season prevents flowing, but the danger period is during the drier months after the harvest of the crop. It is best to graze or cut the trees and use the crop residue for animal feed at that time, but where animals are not available, care should be taken to cut and incorporate the material at flowering time to prevent seed set.

A wide range of companion crops has been grown between rows of trees. These include corn, sorghum, grain legumes (beans, peas,) and root crops (yams).

EXAMPLES OF USE

1. Cropping on sloping land: Quite steep slopes can be stabilized by use of tree legumes. Two or more rows of trees should be planted along the contours of the slopes. Spacing within the rows should be no more than about 50 cm (20 in) and the rows should be about 75 cm (30 in) apart. The spacing between the strips of trees should be no more than 3 m (10 ft) on steeper slopes, but could be extended to 4·5 m (15 ft) on more gently sloping areas. It is best to establish the trees into narrow, cultivated strips and to allow them to grow for a year before disturbing the areas to be cropped, as this will minimise erosion. At

the end of the establishment year, the trees should be cut back. The leaf material should be spread for incorporation into the soil between the strips, and the woody stakes placed at the base of the trees to form a barrier which will become a silt-trap. Large stones dug fromthe cropping area should also be used to reinforce the barrier. With the passage of time, a series of natural terraces will be formed as the trees, sticks and stones collect the soil and reduce the run-off of surface water.

2. **Cropping on level land:** Where there is no danger of erosion, it is not necessary to wait until the trees are established before starting the cropping. Single rows are often planted at 4 m (13 ft) intervals although double rows of trees could be planted at 6m (20ft) spacings between the double rows. The wider apart the rows of trees, the less green manure will be available for the cropping area. If the trees are to be used as living stakes for yams, spaced trees should be planted at no more than 2 m (6 ft) both between and within rows. It is common practice to establish the trees in the first year with a row-crop such as corn, before planting more scrambling crops in the second year.

3. **Animal Production:** Highly palatable trees do not generally survive if subjected to continuous heavy grazing and so it is necessary to allow them a rest period of up to about 3 months once per year to ensure survival. This consideraton is not important where the trees are used in a cut and carry system, since defoliation will then be sporadic, rather than continuous.

   Where it is expected to graze the animals it is best to consider the trees as a protein bank (reserve), or as the protein component of a protein-energy bank. These techniques are fully explained in the Cardi Bulletin No.13, *The Management and Use of Forage Banks*, which is available from your nearest CARDI office. Banks are intended as reserves for use only in the worst months of the grazing year when feed is scarce. During the wet season, they are left to accumulate feed for later use. The tree legumes are best planted in blocks of 4 or 5 rows, 60 cm (2 ft) apart, with passages of at least 2m (6 ft) between blocks. This will improve access and utilization by the animal. If the area is intended to be a protein-energy bank which will supply a balanced diet, the trees should be spaced about 1 m (3 ft) apart and the passages between the trees planted to a grass. Guinea grass (*Panicum maximum*) is one of the most shade-tolerant grasses in the region, and is well suited to this use.

If the area is to be used as a source of fodder in a cut and carry system, the block planting technique is also useful as it will allow access for haulage equipment. In this case, King grass (*Pennisetum purpureum x P. typhoides* hybrid) or Dwarf Elephant grass (*P. purpureum* cv. Mott) could replace the Guinea grass, since they give higher yields under cutting. They are not, however, well suited to grazing which reduces both productivity and persistence.

In Barbados, experience has shown that **Leunaena** will grow well when planted in pockets of soil on limestone outcrops. The roots grow through cracks in the rock and the trees convert very difficult, marginal areas into highly productive land. Rocky outcrops frequently present problems because they cannot easily be worked in a conventional manner. A permanent tree crop represents a way to utilize such areas efficiently.

TREE LEGUMES FOR CARIBBEAN CONDITIONS

Experience in a number of countries in the Caribbean and elsewhere suggest that the following species are well suited to crop and livestock production.

1. **Wild Tamarind** (*Leucaena leucocephala*) is well adapted to the region, occurring naturally on soils ranging from slightly acid (pH 6) to highly alkaline (pH 8.5). It is relatively slow to establish, but grows rapidly once seedlings reach a height of about 30 cm (12 in). It will tolerate low rainfall and long drought periods but even mature trees can be killed by waterlogged soils and standing water. It regrows rapidly even when cut near ground level. The foliage is rich in minerals and is readily eaten by all classes of livestock but horses, pigs and poultry should be fed only small amounts as it is toxic to monogastric (non-ruminant) animals. It is the subject of the Cardi Bulletin No.9 ***Leucaena**: A Versatile Plant* which is available from CARDI offices.

2. **Quickstick** (*Gliricidia sepium*) is well known in Central America and in the wetter areas of Caribbean countries such as Jamaica and Trinidad. It will tolerate moderately acid soils (pH 5) and is not affected by short-term waterlogging. It is usually established from stakes but when used

for soil stabilization, seedlings produce deeper root systems. It survives a long dry season by shedding its leaves, which can reduce its value as a standing fodder reserve. There are reports of trees being uprooted by strong winds if they are not cut back in May-June. The foliage is not toxic to livestock, but it is less palatible than Leucaena.

Glyricidia recovering from cutting back.

3. **Sesbania** (*Sesbania sesban* and others) is not native to the Caribbean but it grows well in the region, establishing rapidly from seed. It tends to be erect with few spreading branches. The foliage makes good mulch but the major problem of this species is that it will not tolerate complete defoliation. It must therefore be pruned with care. It makes good animal fodder. Sesbanias (there are several useful species in the group) tolerate soil alkalinity, salinity and waterlogging.

4. **Calliandra** (*Calliandra calothyrsus*) is a native of the Americas where, even though it will grow in less than 750 mm (30 in) of rain, it does best in wetter areas 2000 mm (80 in). It makes good green manure and is effective in improving soil physical and chemical properties but despite its high protein content its value as animal feed is limited by relatively low digestibility. It will tolerate moderate acid soils (pH 5) but is susceptible to waterlogging. It sprouts readily when cut, but should not be cut below 50 cm (20 in).

Calliandra recently cut back at 0·75 m (2 ft).

5. **Flemingia** (*Flemingia macrophylla*) is native to Asia and is naturalized in Sub-Sahara Africa. It is drought resistant but requires at least 1100 mm (43 in) rainfall. It survives on poorly drained, occasionally water-logged areas and will tolerate very acid (pH 4.5) soils with high aluminium contents (80 per cent saturation). The leaves decompose slowly, making it useful as a mulch. While it is poorer than Wild Tamarind or Quickstick in terms of nutrient content, it is a useful alley-cropping species because of its rapid regrowth on acid, infertile soils. Mature leaves are relatively unpalatable to livestock, but new growth is better accepted even though digestibility is quite low.

ISSN 1018-1229

ACKNOWLEDGEMENT

Support was provided for this publication by the Canadian High Commission, Barbados, from the Canada Fund.