

**INTEGRATING PASTURES INTO THE TRADITIONAL SLASH-AND-BURN
CYCLE IN NORTHEASTERN PARÁ, BRAZIL**

S. Hohnwald¹, B. Rischkowsky¹, R. Schultze-Kraft², J.M. King¹ and A.P. Camarão³

¹Institute for Crop and Animal Production in the Tropics and Subtropics, University of

Göttingen, Germany

²Institute of Plant Production and Agroecology in the Tropics and Subtropics, University of

Hohenheim, Stuttgart, Germany

³Embrapa Amazônia Oriental, Belém, Brasil

Abstract

A project to test possibilities to integrate pastures into the traditional slash-and-burn cycle of small farmers in the Bragantina region in northeastern Pará, Brazil, is presented. Whereas in practice the traditional grass-only pasture is managed separately from the crop/fallow cycle, two options for integration are tested: a *Brachiaria humidicola* pasture enriched with two bushy and one herbaceous legume, *Cratylia argentea*, *Chamaecrista rotundifolia* and *Arachis pintoi*, and a *B. humidicola* pasture allowing a controlled regrowth of secondary vegetation ("Capoeira"). The regeneration performance of these pastures for a subsequent cropping period is compared with plots of undisturbed regrowth of Capoeira concerning soil chemical and physical properties, botanical composition and biomass accumulation. To evaluate comparative pasture productivity and animal performance, a traditional grass-only pasture is included in the comparisons. The results will show if these alternative pastures lead to an ecologically more appropriate management concept for grasslands in the humid tropics.

Keywords: Capoeira, cattle, enriched pastures, humid tropics, legumes, secondary vegetation, smallholder

Introduction

Traditional agriculture of small farmers in the Bragantina region in north-eastern Pará is based on the exploitation of the regenerative potential of the secondary vegetation ("Capoeira"): a fallow period is followed by slashing and burning the accumulated biomass to fertilize the soil for the subsequent cropping phase. The traditional cycle consists of 1.5 years maize (or upland rice), sometimes beans and cassava followed by 5 to 10 years Capoeira. In the last two decades cattle husbandry has become an important additional farming activity in the region. Cattle keeping of small farmers are mainly based on pastures planted with *Brachiaria humidicola* whose productivity and ecological stability under traditional management are low. Generally, unfertilised pastures in the Brazilian Amazon region are said to reach an advanced state of degradation after 7 to 10 years due to decreasing soil fertility, insect pests and invading woody vegetation (Serrão and Nepstad, 1995). The stocking rate has to be gradually reduced until the costs of maintaining the pasture (slashing, burning and fencing) are no longer justified and the pastures are abandoned after 10 to 15 years of use. Eight years after abandonment moderately and heavily used pastures still show a retarded or disturbed regeneration of forest vegetation as indicated by a comparatively lower biomass, lower number of tree, especially forest, species and higher depletion of soil nutrients compared with only light-use pastures and mature forests (Buschbacher et al., 1988; Uhl et al., 1988). Since cattle husbandry is often only a short-term engagement of small farmers and herd sizes vary considerably between the years (IBGE, 1998, Ludovino et al., 1998), integrating pastures into the agricultural cycle could be more appropriate for the smallholder situation than keeping them on separated pastures.

Approaching an agro-silvipastoral system

A pasture supposed to function as an intermediate stage in the crop/fallow cycle could either precede or replace the traditional fallow period. Loker (1994) presented a conceptual model combining cattle, secondary vegetation and annual crops. He proposed to make use of the gradual recolonisation of pastures with woody vegetation instead of countering this process by slashing or herbicides. Such a pasture would then function as a temporary (4 to 5 years) succession stage in the crop/fallow cycle. A subsequent shortened Capoeira phase of two to three years would complete the cycle by eliminating the grasses and accumulating enough biomass for the next cropping phase.

The 'Loker approach' is challenged by the idea that a well-managed pasture enriched with adapted legumes could take over the function of Capoeira to regenerate the fields for the subsequent cropping phase. This would allow a permanent productive use of the field also avoiding the laborious slashing of the Capoeira. The legumes would increase soil fertility by fixing nitrogen and improve the animal diet. A combination of herbaceous and shrub legumes could further increase the biodiversity and the inclusion of woody components makes the vegetation closer to the climax vegetation. This study intends to test the functionality of these two alternative pastures hypothesizing that

1. A "Capoeira pasture" – balancing forage grass with a controlled regrowth of secondary vegetation – preserves the full regenerative potential and allows an animal performance that is comparable with a conventionally managed pasture.
2. A legume-based pasture can replace the agroecological function of the Capoeira in the traditional slash-and-burn system.

Material and Methods

These hypotheses are currently being tested in a researcher-managed on-farm experiment located in Igarapé-Açu (at 47°30' W and 1°2' S) in the Bragantina region in northeastern Pará. The experimental plots were established on a 3.2-ha field, which had been cultivated with annual crops (maize, cassava) for 1.5 years preceded by the slash-and-burn of a 12-year old Capoeira.

The regeneration performance of a *Brachiaria humidicola* pasture tolerating a controlled regrowth of Capoeira and a grass-legume pasture is compared with plots of undisturbed regrowth of Capoeira in terms of soil chemical and physical properties, botanical composition and biomass accumulation. Two bushy legumes, namely *Cratylia argentea*, *Chamaecrista rotundifolia* var. *grandiflora*, and one herbaceous legume, *Arachis pintoi*, were chosen based on experiences at CIAT (Cali, Colombia) and EMBRAPA-CPATU (Belém, Brazil). To evaluate comparative pasture productivity and animal performance, a traditional *B.humidicola* pasture is included in the comparisons. Twice a year the woody vegetation in the Capoeira pasture will be slashed to maintain 70 % grass cover and retain the bigger trees and shrubs. The three pasture types are tested in three replications in a block design. Within each pasture plot an enclosure of 100 m² has been fenced to allow the undisturbed regrowth of Capoeira. Three male crossbred cattle will be allocated to each of the three treatments and then rotated between the three replications. The stocking density will be adjusted according to forage availability; grazing and resting periods of the treatments are synchronized.

Soil fertility (C/N ratio and plant available nutrients in four soil depths) and soil structure (pore volume, water holding capacity, compaction) are being measured initially and at the end of the first grazing period of one year. The succession of the botanical composition of vegetation cover, the establishment and persistence of legumes is being observed continuously in four fixed subplots of 100 m² in each experimental plot. The impact of the

cattle on the botanical composition will be assessed by observing the feeding behaviour of cattle and by examining individual plants for defoliation and effects of trampling. Pasture productivity will be calculated as daily weight gain per animal and animal yield per area, and mean grazing pressure as kg live weight per kg available dry matter forage per day. A biotest with a maize crop at the end of the first observation period will be used to reveal differences in soil fertility between the treatments.

Expected results

The results from the first year of grazing will give an indication of the long-term functionality of each treatment. For example, that the legumes contribute to the animal diet but persist in the pasture to improve soil fertility as well. As an indicator for active nitrogen fixation the nodule production of the three legume species will be evaluated because it is expected that changes in soil fertility might not yet be evident.

The indication of a successful 'Capoeira pasture' will be that the composition of the secondary vegetation has not been significantly altered by animal impact or competition from the grass. The botanical composition of the Capoeira pasture will be compared with the plots of undisturbed growth with special reference to key species. The observation on grazing behaviour of the cattle will also show if the secondary vegetation contributes to the cattle diet. The frequent measurement of forage production and quality will allow the negative competitive effects of the woody plants to be compared with their positive effect on higher water availability in the short dry season.

References

- Buschbacher R., Uhl C. and Serrão E.A.S.** (1988). Abandoned pastures in eastern Amazonia. II. Nutrient stocks in the soil and vegetation. *J. of Ecology* **76**:682-699.
- IBGE** (1998). Censo agropecuário 1995-1996, número 5, Pará. IBGE, Rio de Janeiro.
- Loker W.M.** (1994). Where's the beef? Incorporating cattle into sustainable agroforestry systems in the Amazon Basin. *Agroforestry Systems* **25**:227-241.
- Ludovino R.M.R., Lobo I.J.B., Perrot C., Tourrand J.F. and da Veiga J.B.** (1998). Evolução da pecuária na agricultura familiar e trajetórias dos sistemas de produção. O caso da Zona Bragantina do Pará. Anais da XXXV Reunião da SBZ, Botucatu, SP, Brasil.
- Serrão E.A.S. and Nepstad D.C.** (1985). Pastures on Amazonian Forestlands: A Review of Environmental and Economic Performance. CPATU, EMBRAPA, Belém.
- Uhl C., Buschbacher R. and Serrão E.A.S.** (1988). Abandoned pastures in eastern Amazonia. I. Patterns of plant succession. *J. of Ecology* **75**:663-681.