The Quesungual system in Honduras

An alternative to slash-and-burn

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Slash-and-burn agriculture is an efficient system as long as population pressure is low enough to limit impact on the tropical forest. As the rural population grows the cycle of land clearing becomes shorter, leaving little chance for the vegetation and soil to recover. The lack of fertile land pushes subsistence farmers onto steeper hillsides and into the more humid forests. This leads to accelerated deforestation and environmental degradation and land use becomes increasingly unsustainable.

In Central America, and especially in Honduras, slash-and-burn agriculture has been 'technified'. In an attempt to modernise basic grain production by small farmers, projects and NGOs have promoted credit, fertilisers and other inputs without changing the production system. The result has been even worse for the small farmer and the environment: the rural population has become debt-dependent and the process of deforestation and degradation of land and water resources has accelerated further. This has increased the vulnerability of the countryside to natural phenomena such as hurricane Mitch in 1998 when many died and rural incomes dropped dramatically (see LEISA Magazine Vol.17, No.1, p.18-20).

The Quesungual system

In the department of Lempira, one of the poorest and most isolated regions of Honduras close to the border with El Salvador, small farmers cultivate their land (1-5 ha) on hilly terrain, 200 to 900 meters above sea level. Supported by the Lempira Sur collaborative project initiated by FAO, a massive shift to a new production system has taken place over the past ten years. This system is called "*Quesungual*", after the village in which it was first developed. It is a Conservation Agriculture system with a tree component which allows small farmers to cultivate their land on steep slopes continuously while regenerating it.

The Quesungual system is an adaptation of an indigenous agroforestry system, which can be found in the dry tropical forest ecosystem (140-800 masl). This system is characterised by three layers of vegetation: mulch, crops, and dispersed shrubs and trees. It usually combines grain crops with naturally regenerated trees and shrubs with high-value/ multipurpose timber and fruit trees. A typical plot has numerous pollarded trees and shrubs and about 15-20 large trees: timber and fruit species. The diversity of species in the system is high (see table 3).

Burning has been abandoned, vegetation and plant density are controlled by hand and in addition some farmers use herbicides prior to sowing. Maize is intercropped with sorghum and beans, using zero-tillage, mulching and direct sowing technologies. The natural vegetation is used as a cover crop, in between the grain crops.

In the dry season, the trees and shrubs are pollarded at a height of 1.5-2 m, in order to eliminate the branches and regrowth, and to provide light for the future crop. The pollarded material is used as mulch to cover the soil. The branches and trunks, which can be used as firewood and poles, are removed from the plot. In general, high-value timber trees and fruit trees are not pruned. Farmers achieve an ideal density through the management of the natural regeneration. Before sowing the second crop (often beans) the field is cleared a second time but trees and shrubs are not necessarily pollarded. Mineral fertilisers are expensive and thus used only when maize and sorghum are both grown as first crop. Only once during the cropping season, weeds are cleared either manually or by using a herbicide. The crops are harvested in the traditional way (FAO, 2001).

Impacts on resilience, natural resource base and production

For the farmers it is the moisture retention qualities of the system that makes it so attractive. The agroforestry system retains 15% more water in the soil in the driest month (April) than the slash-and-burn system (8% humidity in a traditional field and 23% in a Quesungual field). This difference is equivalent to 20mm of rainfall, which means that crops can be sustained 20 more days without rainfall. And it is this difference that counts for the success or failure of a crop in a climatic regime with irregular dry spells during the rainy season.

Besides better infiltration of rainwater into the soil profile through the soil cover, the increase in soil moisture can be explained by the increase in organic matter content of the soil. The organic matter content was monitored during four years, in three different places, and increased from 2.4% to 4.5%. At the same time soil erosion has been nearly stopped. The loss of nutrients through erosion has been estimated to be more than 10 times lower in the Quesungual system than in the slash-and-burn. Taking into account only the nutrients, these losses represent US$34/ha under the Quesungual system, instead of US$396/ha, in the slash-and-burn system.

The improved soil conditions make the system more resistant to climatic phenomena. Compared to farmers who remained with the old system of slash-and-burn, the Quesungual farmers didn't experience a total loss in maize production during the dry period of el Niño in 1997. Even in the following year, when hurricane Mitch passed over Central America resulting in excessive rainfall and many farmers losing their crop for a second time, the Quesungual

Table 3: List of tree and shrub species found in Quesungual plots

Timber species		Fruit species	
Common name	**Scientific name**	**Common name**	**Scientific name**
Salmwood	Cordia alliodora	Guava	Psidium guajava
Guacima	Guazuma ulmifolia	Nance	Gyrsonima crassifolia
Honduras Cedar	Cedrela odorata	Plantain	Musa sp.
Guachipilin	Diphisa robinioiles	Cashew	Anacardium oxidentalis
Mahogany	Swietenia sp.	Avocado	Persea americana
Paradise tree	Simaruba glauca	Papaya	Carica papaya
Stinking toe	Cassia grandis	Mandarin	Citrus sp.
Orchid tree	Bauhinea sp.		
Almond	Andira inermis		
Mother of cocoa	Gliricidia sepium		
	Luhea seeamoinii		
Trumpet tree	Cecropia peltata		
	Lonchocarpus oficinalis		

(after Hellin, 1998)

A farmer in the steep lands of southern Honduras using a planting stick to sow his maize in a mulch layer of fallow vegetation. Photo: Alexandra Bot

farmers produced more or less the same quantity as the year before.

Farmers are reporting increases in maize yield of a minimum of 60%. Even more important is that yields remain stable at a higher level for longer periods. The longest period fields have been under continuous maize production is seven years. These fields, with a slope of 35% and poor soil have an average production of 2.9 t/ha. Before, on the same fields, the best yield was 1.6 t/ha while the land had to be left fallow for several years after a two-crop cycle. Besides maize and sorghum the plot is providing the farmer with firewood and poles, which give an extra value to the production. Additionally, from the first year onwards, the farmer can rent his/her terrain for livestock grazing, because of increased stover production on the field. Usually this is done for two months. Efforts are still needed to integrate livestock production better into the system.

Rural development enhanced

The Quesungual system not only meets the household subsistence needs for fruit, timber, firewood and grains, but generates a surplus, which when sold on the market generates cash income. This change is just the beginning of a process of intensifying land use and increasing land and labour returns. Once the farmer feels comfortable with the enhanced food security (maize and beans), (s)he starts to diversify into crops for the local market or home consumption, soya, sugarcane, indigo, pumpkin etc., as well as small animals for the market such as pigs and chickens. Increased grain availability is accompanied by the improvement of the household post-harvest storage system. When basic grain security is assured, families begin to invest time in improving their living conditions and education, and devote time also to community organisation. Women's production cooperatives are now making dairy products. Farmer and trade organisations have also been established. The people themselves are now taking full responsibility for planning improvements in their communities.

Obstacles to adoption

This experience has generated great interest not only in Honduras but also in the region. The south of Lempira is now known as the region where farmers no longer burn - a label they are proud of. Nowadays, the Quesungual system is being adopted elsewhere in the country and is being adapted by farmers according to local conditions. The major obstacle to large-scale change from slash-and-burn to agroforestry is not the small farmer. They are well aware of the problems connected with slash-and-burn agriculture and respond rapidly to sustainable alternatives. It is the extensionists and their professional superiors who clinch to their production-based, single-crop focus and oppose a systems approach. It is their lack of training in demand-driven participatory extension and the still dominant paradigm of rural development projects with their focus on physical, supply-driven indicators. Although much is said about collaboration between local and professional knowledge systems, the practice is still in its infancy. ■

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Experiences in El Salvador

Conservation Agriculture and rural development

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Besides knowledge, technologies and supplies, adoption of Conservation Agriculture (CA) needs a favourable (policy) environment, motivation and participation of farmers and their communities. The presence of leaders and/or farmers' organisations is important for knowledge sharing and capacity building. The combination of all these parameters with CA at catchment level results in sustainable rural development based on the integrated management of natural resources.

Productivity and conservation

In Guaymango (El Salvador), about 85% of the land area is used for agriculture, and consists of small hills and slopes between 40 and 90%. Half of the agricultural land is used for pastures, the other half for crop production (mainly maize and sorghum). Monoculture, overgrazing, burning of crop residues and intensive tillage rapidly led to severe land degradation, low yields, poor nutrition and increased poverty in the early 1970s. Following the spread of the Green Revolution in wheat and rice, the thinking on research and extension in El Salvador was conditioned by traditional extension methods, combined with a "package" approach. The package disseminated by the Ministry of Agriculture, primarily during the late 1960s and throughout the 1970s, consisted of the following technology, according to Sain and Barreto (1996):

- use of hybrid maize seed,
- use of nitrogen and phosphate fertilisers,
- increased plant densities, through reduced row distances,
- application of herbicides and insecticides.

During a diagnostic appraisal that was held in the area of Guaymango in 1973, three major problems were identified: high poverty levels, food insecurity and recurrent health problems in the community. Based on this appraisal, it was concluded that low productivity of the agricultural system was one of the main causes of the high poverty levels found in the area (Calderon, 1973). Furthermore, it was concluded that the low quality of the soils caused by serious degradation in the area was the main reason for the low productivity of the