Farmer strategies and tule (*Cyperus canus*) production systems in Honduras

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Abstract. The cultivation of tule (*Cyperus canus*) takes place in wet environments in several locations in Honduras. The dried culms of tule are used to weave 'petates', which are mainly utilized as sleeping mats. This study explores people's knowledge of tule and 'petate' in the primary production center of Honduras. Farmers produce a relatively high value on small tule fields. The position of the moon is a central consideration in planting and harvesting tule. Tule cultivation is flexible with regard to the timing of labor use, which encourages the incorporation of tule into farming systems. Most women in the research location were involved in 'petate' production. The concentration of 'petate' production in one village has led to the development of a complex set of labor relations with a seasonal variation.

Keywords: Economic botany, farming systems, local knowledge, minor crops, moon, seasonality.

Resumen. El tule (*Cyperus canus*), la materia prima del petate, es cultivado en varios lugares en Honduras en ambientes húmedos. El petate, una alfombra trenzada que se ocupa para dormir, es tejido con las hebras secas de tule. Este artículo investiga el conocimiento local de productores de tule y petate en el centro primario de producción en Honduras. Los productores de tule pueden lograr un alto valor en áreas relativamente pequeñas. Los productores toman en consideración la posición lunar para sembrar y cortar el tule. El cultivo de tule es muy flexible en cuanto al uso de trabajo, lo que favorece la incorporación del cultivo de tule en los sistemas de producción agrícola. En la localidad de investigación casi todas las mujeres se involucran en la producción de petates. La concentración de la producción petatera en un sólo vecindario ha resultado en distintas formas de relaciones de trabajo con una variación estacional.

Palabras claves: Conocimiento local, cultivos menores, luna, relaciones de trabajo, variación estacional.

INTRODUCTION

The dried culms of tule (*Cyperus canus*) are used for making sleeping mats. Throughout Central America wild stands of tule are harvested, but in several locations tule is cultivated and of crucial economic importance. Some of the uses of *Cyperus canus* are mentioned in the various botanical descriptions (Adams 1994; Standley 1931, 1937; Standley and Steyermark 1958; Tucker 1983, 1994) but, apart from the short description in Castro *et al.* (1991), no study describes the mode of use in a situation in which the plant is cultivated. This article explores the characteristics of tule cultivation and processing in Honduras. It focuses on the village of El Níspero, the most important center of production in the country.

MATERIAL AND METHODS

The research took place in El Níspero, a village of less than 500 houses. Practically all the farmers cultivate maize and beans, mainly for household consumption, and half of the farmers cultivate coffee. Tule and sleeping mats are produced in the central village and four of the seven smaller hamlets around El Níspero. El Níspero is a village in the south of Santa Bárbara district in the northwestern part of Honduras. It is located at 550 m.a.s.l and most of the tule is more or less cultivated at this altitude. The rainy season lasts from May to December and the mean annual rainfall is 1615 mm. Rainfall distribution shows two major peaks in June and September, but both drought and excessive rain occur regularly. The mean annual tem-

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perature is 24.4°C (Almendárez 1986; Chávez *et al.* 1987).

The wider research project focused on how the social context and historical past of mountain agriculture in Honduras have shaped environmental degradation. In the project a qualitative research approach was applied (Jansen 1998). During this project it appeared that in El Níspero tule production was particularly important for the local economy. Hence, special attention was paid to the production system of tule and the related production of sleeping mats in 108 semi-structured and open interviews, through participant observation and during field visits. The principal objective was to record the local knowledge about this crop, its cultivation, and the production of sleeping mats. Furthermore, ten producers were followed over a period of a year (1994) and data were collected about labor, yields, and crop husbandry on a monthly basis. This allowed for gathering systematically quantitative data on crop production. It is, for example, very difficult to estimate yields per year simply by interviewing farmers, due to reasons to be discussed below. Therefore, after each cutting period (moon) ten farmers were asked about cultivation practices and harvests. These ten producers were selected to have a range of producers with smaller and larger tule fields, and to have five producers with coffee and five producers without coffee cultivation, in order to observe possible interaction between coffee and tule cultivation. One or two extensive interviews were held with these selected producers, mostly while in their tule fields to measure crop area and plant distance, to observe soil characteristics and the state of the crop, and to discuss field-specific growing conditions. Furthermore, each month a short interview was carried out about the actual state of the crop and to gather data on how many tule they had cut, labor use, moon position while harvesting, and by whom the tule was processed.

No literature was found that describes tule cultivation and its use in Central America, apart from some minor remarks in documents of development projects. The description below is thus principally a farmer's description, complemented with my own observations and the survey of the sample of ten producers.

THE BOTANY OF TULE

Cyperus canus Presl, Reliq. Haenk. 1: 179. 1828. is one of the few cultivated species of the *Cyperus* genus in Central America. Tule from both cultivated and natural stands is used for the weaving of 'petates' or sleeping mats. From the description of Standley and Steyermark (1958:120) the most important characteristics are as follows: a glabrous perennial with short thick rhizomes, the culms robust, mostly 1-1.5 m tall, 4 mm thick at the apex, 6-10 mm thick at the base, obtusely trigonous, multistriate, smooth or very minutely scaberulous, stiff; leaves reduced to sheaths at the base of the culm; bracts 20-30 cm long, 6-12 mm wide, subequal; rays of the umbel 10-18, compound; staminate spikelets at the ends of the raylets, 6-10 mm long; pistillate spikelets 5-14 mm long. For more extensive descriptions see Tucker (1983; 1994). The plant is dioecious. The culms can become much taller than in the botanical descriptions of the species (1 m in Standley 1931; 50-100 cm in Tucker 1983, 50-100 (-150) cm in Tucker 1994): in the dry season many culms of 2 m or even taller are harvested. Plants with taller culms may be a result of a selection process in cultivated tule; whereas many described specimens may have been taken from natural (or semi-cultivated) stands. Castro *et al.* (1991) observed significant morphological differences between cultivated and wild *C. canus*. The cultivated tule had more culms per plant and longer culms which had a larger diameter.

C. canus has been observed in Mexico, El Salvador, Guatemala, Nicaragua, Honduras, and Costa Rica, as well as in Colombia; besides tule it is also called 'junquillo', 'sivate', 'cañita', 'pimi', or 'say' (Adams 1994; Castro *et al.* 1991; Standley 1931, 1937; Standley and Steyermark 1958; Tucker 1983). Tucker (1983:13) suggests that the species was possibly introduced to Central America from Mexico for cultivation, whereby by chance only pistillate plants were brought. He found only pistillate plants from Guatemala to Costa Rica while both staminate and pistillate plants occur in Mexico. Williams (1981) also supposes that *C. canus* was introduced into Central America. *C. canus* is sometimes mistaken for *C. alternifolius*. *C. alternifolius* is a native species of Madagascar that is used for ornament (Standley 1931); it is called 'tule de jardín' in El Salvador.

Standley and Steyermark (1958) state that *C. canus* is rather scarce in the wild state. According to Honduran informants 'petate' producers in most of the production centers in Honduras and El Salvador use wild tule (called 'cimarrón'). This tule 'cimarrón' is semi-cultivated, i.e. not planted wild stands are regularly harvested and weeded. Only in a few locations, such as El Níspero, tule

is fully cultivated. Standley and Steyermark (1958) observed small patches of cultivated fields in Cobán in Guatemala and Castro (1994) refers to cultivated tule in Mexico. The farmers of El Níspero consider their cultivated tule as a different type ('clase') or cultivar from the wild tule. The wild tule is more capable of competing with weeds, but the culms are more scaberulous, less smooth, thicker, and harder, and therefor less suitable for making 'petates'. Farmers have different opinions whether they cultivate one or more cultivars (types). Many discern 'yellow' (or 'white') and 'green' tule. Yellow tule has a white to light brown sheath ('carrizo') at the base of the culm and thicker culms which are easier to split. The culms of the green tule are less thick, generally harder to split, and more sharply trigonous; this tule has a purple sheath. One farmer asserted that green tule grows and matures faster. There are, nevertheless, also farmers who have, for example, yellow tule which is hard to split and green tule which is easier to split. It appears that there is no unified local knowledge about the different types of tule. Some farmers argue that these are not types of tule but that their characteristics simply depend on the soil and other growth conditions. Other farmers, however, maintain that when they transplant a specific type to other locations they will always get plants of the same type. One farmer stated that tule which stands for long periods of the year under water or which grows under shade will get hard and more scaberulous culms. A plant of the 'green' type with thin culms that was planted in our garden got shoots with thick culms. Hence, it is not necessarily genotype difference to which farmers refer. Most farmers do not find the type of tule a very important characteristic, and they put forward that mainly women discern the different types and give them names. Female petate makers consider it important how hard it is to split the culms and whether they will 'harm their nails' while weaving 'petates'. Moreover, they prefer the yellow tule as it is considered more beautiful.

Tule is distributed from sea level to 1500 m in wet environments such as marshes, streambanks, lake shores, and moist wooded hillsides (Tucker 1983, 1994). It develops well in direct sunlight and its growth is impeded by heavy shade. In El Níspero, the plant flowers in the dry season (January-May), especially in February and March. The culms with flowers grow taller and women prefer these culms to make petates. At the transition of the dry season to the rainy season, some culms (which farmers call the 'tule madre') grow taller and develop propagules ('hijos') at the apex of the culm which root when the culm bends and touches the ground. If the temperature rises too high in the dry seasons, the culms tend to kink which may render them useless.

The culms of tule are used in Honduras and neighboring countries to produce 'petates'. The word 'petate' originates from the Nahuatl word 'petlatl'; the word tule stems from 'tollin' or 'tullin' (Siméon 1977). 'Petates' are used as sleeping mats, but also for making partitions in houses and for decoration. Wealthy seaside visitors use a 'petate' at the beach during their short vacations and throw it away afterwards. Tucker (1983) mentions that tule is used for making ropes but we have never heard of this practice in the Santa Bárbara district. The soft and spongy inner part of the culm ('corazón') is used to make non-durable articles, such as fans to blow fires, to bundle harvested beans or other crops, or to make seats ('lomillas') that are placed on pack animals before putting a pack on top. Recently, an external demand has emerged from small industries in the city which use 'corazón' to make furniture or to adorn objects such as mirrors.

TULE AND PETATES IN EL NISPERO

The history of tule in El Níspero

Inhabitants of El Níspero regard tule and petate production as the typical patrimony of their village. The estimation of CDI (1988) of the total number of tule cultivators is 199. This number refers to persons who own one or more plots with tule. However, a much larger number of villagers in the tule business are petate producers. El Níspero is the municipality with the largest number of 'petate'-making women in Honduras (859 'petateras' in 533 households in 1974; DGEC 1977), and it produces by far the largest number of 'petates' for the national market. Roquas (1994) gives as her lowest estimation a production of 6,000 'petates' per month, while Baide Velásquez (1991) estimates that 20,000 'petates' are produced each month in the municipality. The main local trader in 'petates' estimated that 6000 'petates' leave the village each week in periods of high production. In several statistics on the 19th century, El Níspero did not appear as a place with an extraordinary large 'petate' production (Rosa 1929; Vallejo 1893); it only got this status in the course of the 20th century. It is unclear why tule

expanded in El Níspero and not in other locations but the following factors may have been important: (i) an historical knowledge of how to cultivate tule and make petates, (ii) relatively good access to the northern regions of Honduras which were colonized in the 20th century and where people prefer 'petates' to sleep on due to the hot climate; other main 'petate' producing areas are in the South, at a larger distance from these colonization centers, (iii) periodically flooded river terraces with good soils to which the villagers got access in the 1930s and 1940s, just when demand for 'petates' was growing. Older informants also state that women have got more time recently to make 'petates' as they now have water taps at home and mills for grinding the maize nearby. In the past, fetching drinking water, going to the river to wash cloths, and the hand grinding of maize took a lot of time. 'Petate' production was further boosted when a dirt road was constructed in 1968.

The above-mentioned number of 199 producers includes producers living in the municipality center as well as the hamlets. When we prepared a village map of the center alone with local informants in 1992, we estimated that of the 456 mapped households, 105 (23%) households owned tule fields, 160 (35%) households owned coffee grooves while 54 (12%) households had both coffee and tule; 245 (54%) households had no coffee nor tule.

Soils and tule fields

During the first part of this century, tule was only cultivated near water streams nearby the village. Later, it was planted farther away from the village, on the river terraces near two rivers that come together upstream of El Níspero. These soils are medium to slightly acid (pH (H_2O) between 5.4 and 6.6), and have a medium to high organic matter content, and a medium to high cation exchange capacity. Loamy or clayey soils are preferred. However, as the terraces may be flooded periodically, layers of sand and clay or clay-loam sometimes alternate. Tule fields may be lost when the river deposits a thick layer of sand, but in case a layer of light clay has been deposited, new shoots will soon appear and form vigorous tule plants. Tule may develop unexpectedly well on sandy soils when there are underlying layers with loam or clay. It grows very well in fields which are waterlogged during several months of the year.

Tule fields are generally small and are measured in the square measure 'tarea'. A 'tarea' is 431 m^2 (one sixteenth part of a 'manzana') but the local 'tarea' is somewhat smaller as farmers measure 12 x 12 'brazadas' (length of stretched arms; about 1.7 m). In the CDI (1988) study, 58% of the tule cultivators had a tule field of one 'tarea' or less. Very few tule fields exceed four tareas. The tule fields of the producers in our sample varied between 354 m^2 and 2,220 m^2. It was not possible in this research to calculate the total area of tule fields in El Níspero.

Husbandry

The best season to plant tule is in September or October, because of local precipitation patterns. First, the field is cleared and, in most cases, burnt. Tule does not set seed and is propagated with young shoots with rhizomes and roots cut off from the mother plant or with propagules from the 'tule madre' culms. From a developed plant up to five good shoots can be cut off. 'Tule madre' culms especially develop on young tule plants. Propagules from 'tule madre' culms are the preferred planting material. Planting material is generally given away to friends. A small hole is made with a digging stick and the young plant is put into it. The local standard for spacing is one 'brazada', approximately 1.7 1.7 m. Variations in spacing occur as farmers weigh up differently the easiness of working in a field with a lower plant density and the likelyhood of a higher incidence of weeds. Some fields were planted in existing maize crops to which the spacing was adapted. Tule stands are often intercropped with beans or maize during the first, and sometimes also the second year, until the canopy closes.

Weeding and the cover crop Hoja Pollo

Farmers indicate that developed tule stands hardly require any weeding. Young stands require more weeding, especially in August and September, halfway through the rainy season. Farmers weed superficially about two times per year, simultaneously with a harvest. The growth of 'Hoja Pollo' (Commelinaceae), is encouraged. Farmers scatter plants of this species over their tule fields, where it covers the soil under the tule, in order to suppress weed growth. They also recognize its influence on microclimate and soil humidity when they observe that Hoja Pollo 'keeps it cool' ('más fresco') and 'retains the humidity' ('guarda la humedad') in the field, which stimulate crop development. Debris and leaf litter of tule, left after harvests, also suppress weed growth and only temporarily suppress the growth of Hoja Pollo.

Fertilizing

Until recently, tule never received manure or fertilizer. While being interviewed, many farmers posed questions about how to fertilize tule. Some farmers have started experiments with the fertilizers they have been using in coffee and maize production for a decade. They reported positive reaction to urea (good growth and tall culms) and NPK mixtures (a young planting started to produce early when a NP mixture was applied). A negative result was obtained with a mixture that contained the trace elements magnesia and sulphate: all culms matured at once ('se sazonó de un solo viaje') and no culms were left to support the growth of new shoots.

Harvesting

On good soils, the first harvest can take place after a year. Although tule is harvested throughout the year, there is a clear seasonal variation. The first part of the dry season, from January until April, gives the best yields with tall culms both from flowering culms and 'tule madre'. The drying of the culms is also easier in this season. From May to July, yields are lower but reestablish themselves after several months with rains.

The people cut each culm that is 'mature' ('sazón') at about 2-3 cm high with a sharp knife. Farmers consider it a crucial skill to know when a culm is mature. The sheath at the base of the culm has to be dry before one can cut; the culm itself should still be green. Experienced cutters do not look at the sheath nor at the state of the inflorescence bracts, but just feel whether the culm is soft or hard as this indicates their maturity. They emphasize that one should only cut the 'mature' culms as the remaining culms will 'give the plant strength to feed the shoots'. People tell with some disapproval about cutting all the culms with a machete as is practised in places where wild tule is harvested. According to the Nispereños, this will weaken the plant and result in a less vigorous regrowth. A few older farmers remember that some villagers did the same in earlier days. Nowadays, tule cultivation is being practiced more intensively. Several fields in El Níspero are nevertheless complete regrowths; namely those fields that were burnt accidentally, when a fire passed from an adjacent field that was being prepared for bean or maize production. The owners stated that this tule had no longer thick culms, only thin ones.

With a string of 'corazón' the plant is bound together after cutting has been finished in order to make it easier to harvest other plants. The leaf-like inflorescence bracts are cut off the culm ('despuntar') and the culms are bundled in the field. One 'par' (pair) consists of four culms and one 'real' (also called 'haz') consists of 60 'pairs' of culms (if culms are very long 40 pairs may be sufficient to form a 'real'). A pack animal generally carries a pack ('carga') of twelve 'reales'. The counted amount of tule makes it easier for women, who want to buy tule, to negotiate a deal with farmers once they return with tule to the village. Culms shorter than 60 cm ('la bajera') are also cut when they are 'sazón' but they are not included in the 'reales' and thrown away. If not cut they would turn dry ('seca'), and it is said that dried culms debilitate the plant.

The influence of the moon

Farmers consider it crucial to harvest tule and to plant tule according to the position of the moon even though their opinions vary somewhat in the demarcation of the optimal position to carry out certain practices. In some other crops the moon is also regarded as an important factor, but in no other crop it regulates the real practices so much as it does in tule cultivation (Jansen 1998). The period directly after new moon is considered appropriate to harvest tule. Most people start to cut two or three days after new moon. The next few days are the most ideal. One may continue to cut until full moon. One should not harvest 'the day that the moon becomes full'. The four or five days after full moon can also be used to harvest but it is not recommended and should only be used if it is impossible to finish the work with the waxing moon. Plants will remain short if one cuts on an inappropriate day. If one regularly cuts with full moon, the culms will become thin. One farmer indicated that he occasionally cut with full moon when he felt that the culms became too thick. Farmers also consider the position of the moon important for planting tule. Planting 'with the wrong moon' will shorten the life span of the crop and plants will remain short.

Yields

Tule should be harvested about four times a year according to the local standard, but if the crop is in bad condition, for example when it grows on low-quality soils, it may be better not to cut more than twice a year. Calculations with the monthly data of the ten selected farmers reveal that the mean yield of the selected farmers in 1994

was 478 packs per hectare (or 21 packs of tule per tarea per year); that was 1.7 'real' per plant. According to the farmers it was a relative dry year; in wetter years yields will probably be higher.

Care and maintenance

Farmers consider it important to restrict extension of the plants; plants have to remain separate. The plant gradually develops a ring like shape as new shoots mainly develop at the outside of, what farmers call, the 'cabeza' (or 'head'): the whole rhizome structure. Farmers do not want 'a sea of tule' but discernible plants and thus regularly cut parts of the plant away, especially old parts of the 'cabeza' are pruned; parts of the shoots may also be taken away.

People estimate that a normal life span of a tule planting is about 15-20 years. A new planting of tule is considered when the 'cabeza' rises above the ground; due to the cutting the 'cabeza' tends to come up and become visible. The life span on bad soils is shorter and on such soils some farmers replant each six or seven years. Farmers firmly believe that bad cutting practices also reduce the life span. Some tule plantings are already sixty years old, but these are flooded once in a while and new layers of fertile soils are deposited on top.

Pest and diseases

Farmers who are asked about pests and diseases in tule tend to answer that these are of no problem: they call the crop 'healthy' ('sano'). However, during field visits, observation and in-depth interviews it appeared that pests and diseases may cause substantial damage. We observed some fields that were completely lost. Five of the ten producers in our sample had real problems with diseases or pests. Signs of fungus infestation are almost always present in tule fields, although generally damage seems to be limited. CDI (1988) mentions infestation by the fungus *Physoderma* sp. We collected various plants with signs of different fungus infestations but the consulted Honduran laboratory (FHIA) could only provide a determination of *Fusarium* sp. in one of the samples. It can be expected that other fungi will be important. Some damage is caused by a purple-grey insect of 4 mm which makes a hole in the middle of the culm to put its eggs; the yellow-white larvae (3-5 mm) live in the 'corazón' and render the culm useless. No determination of this insect could be made. Farmers report incidence of damage to tule fields by the insect 'Gallina Ciega' (white grubs; *Phyllophaga* sp.) and other insects which eat the base of the young shoots or the 'cabeza', but of which they cannot give names. Some farmers experimented with carbofuran (a broad systemic spectrum insecticide, nematicide, and aracide) in order to prevent a surge in a pest which turns the upper part of the culms yellow with black dots. They claim that carbofuran has a positive effect. On damaged plants no visible insects could be detected on the plants and it can be postulated that such a coloring is an effect of a possible infestation by soil insects and nematodes. With regard to pests and diseases it cannot be maintained that tule is more (or less) sustainable than other locally cultivated crops.

Making petates

The cultivation and harvesting of tule are predominantly carried out by men. Women take over once the cut tule arrives in the village. They dry the tule in the sun, which takes about three to six days. Eye-catching for every visitor to the village are the rows of tule spread out on patios, on roofs, along the road, and on the football field. After three days the sheaths ('carrizo') are removed from the culms ('descarrizar') and the crucial activity of ordering the dried culms starts in order to get the maximum number of 'petates' out of a certain amount of tule. Then the culms are split with a knife into three strips and the 'corazón' is removed. Finally the weaving of 'petates' can start. The women of El Níspero generally make the 'petates' with one connection ('añadidura'): over the width of the 'petate' a new series of strips is woven between the ends of the first series of strips of tule. Elsewhere in Honduras and in Guatemala a weaving technique without connections is used, but these 'petates' are considered to be of lower quality. The weaving technique of the women in El Níspero is similar to the one used by the Chontal in Mexico (Castro 1994). Larger 'petates' require more connections. Only when the strips are large enough (generally with strips from flowering culms or 'tule madres' culms) a 'petate' 'in one piece' can be made. These are preferred because of their longer life span.

FARMER STRATEGIES IN TULE PRODUCTION SYSTEMS

Farmers and 'petate' makers develop various strategies for dealing with labor constraints and seasonality. Some of the main strategies will be discussed on the ba-

sis of Figure 1. The lower production in March is a result of six producers who did not harvest tule; most of them indicated that they were busy with picking coffee. The low amount of harvested tule in June and July is a result of the low amount of harvestable tule in the field after the dry season. Yields tend to increase during the rainy season. The weather in 1994 was relatively dry; in more rainy years the yields in the second half of the year tend to be higher.

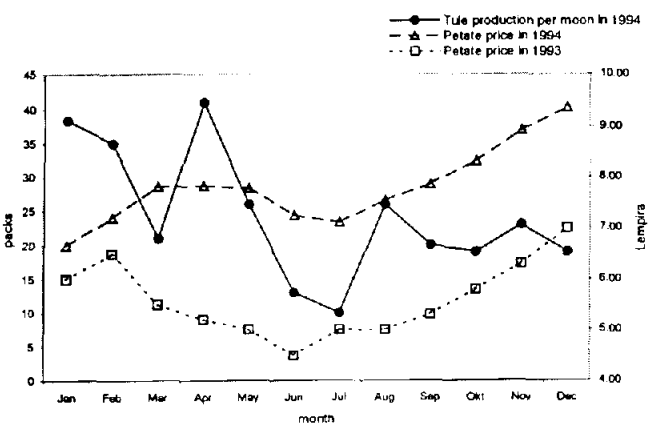

Figure 1. Tule production of ten producers and petate price in 1994. The ten producers cultivated a total of 8840 m^2 tule. Total production in 1994 was 337 packs. 'Petate' prices are in the local currency (Lempira), sold in El Níspero; 1 US$ was 8.84 Lempira in August 1994.

Labor

Harvesting tule is considered relatively light work. One person can cut seven to eight 'reales' per day. If extra help is present, e.g. a young boy in the family or, more exceptionally, a female household member, one person with one assistant tends to cut precisely one pack. The assistant does the 'despuntar'.

Characteristically, tule cultivation is rather flexible with regard to labor requirements. The producers of the sample did harvest in different time sequences. Some go once in several months to cut all the 'sazón' of the whole field, while others 'go every moon' and cut only the mature tule in one part of the field and continue the next moon with another part. This reflects the general diversity of strategies towards tule harvesting. If farmers have no time to cut, they can easily postpone the harvest to a next moon without damaging the crop.

The flexibility with regard to harvesting is one of the reasons why it was difficult to estimate yields simply by interviewing farmers. Harvesting patterns of farmers are very different and uneven. Some harvest with every 'moon' only a part of their field(s) while others return only twice a year to harvest all tule at once. The amount of harvested tule of those farmers who harvest often, depends more on the availability of labor than on the amount of mature tule. It is difficult for farmers to estimate the total production as is it spread over several months. Another problem to estimate yields is the climatic variation between different years. Furthermore, the quality of tule stands varies due to heterogeneous growing conditions, such as soil fertility and humidity. Questions about yields are often answered by referring to some exceptional yields farmers once had. For example, one farmer related proudly that once he harvested six reales of one plant. Others may say that one may harvest two 'real' from one plant, which is very high as a regular yield. Another problem is that many farmers do not know the area of their tule plot and may easily make errors of 50%. One has to keep in mind that tule fields generally are not perfect square or rectangular fields; they may be meandrous ribbon fields along a stream, or irregular spots on humid parts in a larger plot.

Although harvesting tule is light work, it is considered as work that requires a lot of skills. If tule is not cut properly, the 'cabeza' will rot, the plant will make fewer shoots, or the new culms will stay short. Only after years of helping with 'despuntar', sons will be allowed to cut tule. Most farmers are unwilling to contract day laborers to cut tule. It is alleged that day laborers kink good culms, cut the culms too low, and damage the 'cabeza'. It appears that farmers are much more reluctant to hire people for cutting tule than, for example, picking coffee or weeding maize. Cutting tule is perceived as much more delicate work. Day laborers, however, are still required in tule production: about 19% of the total tule in the sample was cut by hired laborers. Much of this labor was hired by a producer who had a permanent job and no time to cut tule, and by another producer who had recently built up a high productive coffee plantation. His wife insisted on the continuation of tule cultivation and took control over the tule field: she hired laborers to cut the tule for her. Her husband quarreled that these people were destroying the tule field, but he could do little against it because he was not able to fulfil his 'duties'.

Tule and coffee within one farming system

This latter example illustrates one of the many ways in which coffee is combined or competes with tule. Coffee cultivation has expanded enormously in recent decades (Jansen 1993). Many producers could buy land and invest in coffee production thanks to tule profits. It can also work the other way around: new tule fields are frequently financed with coffee profits. Many producers have not too many difficulties in combining work in tule with work in coffee, especially because of the flexibility of labor use in tule and the possibility to postpone harvests. However, larger coffee producers who intensify their coffee production tend to get rid of their tule fields. Villagers have a continuing discussion whether, and under which circumstances, tule or coffee is more profitable and in which circumstances. Several popular expressions reflect the different situations of producers. 'With tule I make little money, but tule does not require so many inputs; coffee has higher costs'. 'Coffee produces only once a year, while tule produces the whole year round; with tule you can always buy clothes'. Preferences for tule cultivation often build on typical gender constructions. 'Tule is better than coffee, because with tule the women have work'. 'Coffee values a lot, but tule is the patrimony of the women; in El Níspero life is better than elsewhere because everybody has work'. Many households depend on tule and 'petate' income to buy, what people call, the 'daily necessities': 'When there is no tule, one does not eat'. Coffee income is mainly used for buying larger commodities, house improvement, and so on. Tule is, for this category of households, the main source for buying additional food, soap, oil, and so on. People without tule (and coffee) generally belong to the poorest villagers. The poorer household have no money to buy tule fields, nor can they invest their labor in planting tule as it takes at least a year until the first harvest. Poor people often lost tule fields in the past, in periods of financial crisis in the household.

A pattern of tule cultivators emerges: the poor people without tule fields, a group of middle size farmers who produce most of the tule and often combine it with low to medium input coffee production, and a group of richer producers who no longer cultivate tule but concentrate on the intensification of coffee.

The pricing of tule land

It is not very easy to determine the market value of tule fields. Farmers like to talk about it, often in a context where they want to indicate how important tule is for them, but the prices they suggest vary a great deal. Therefore, we looked at several realized sales to obtain a price indication. Fields with tule have a relatively high value per area land: prices are per 'tarea' and range from 140 to 180 US$ per 'tarea' (more or less 3000 to 4000 US$ per hectare). Land that is suited for tule cultivation values well over 600 US$ per hectare. This is about seven to eight times higher than the value of land that is only suitable for maize cultivation. Several stories are told of people who sold land which they thought was only suited for maize cultivation. The new owner who discovered that tule grew well on this land split it up into small plots and resold it at a much higher price. Such narratives are not only told to express how stupid people can be, but also to underline the importance of tule for local people.

THE SEASONALITY IN SOCIAL RELATIONS OF PETATE PRODUCTION

Within the village there is a market for tule: 48% of the tule of the ten selected producers was sold and 52% was processed in their own household. Tule and 'petate' production are embedded in a complex set of social relations that have developed locally. We focus here on the question how these relations are conditioned by the agronomic characteristics of tule condition these relations. Tule cultivators can postpone the harvest and because of this flexibility in tule production women often have to put pressure on their husbands, fathers, or brothers to harvest tule, as they want tule to make 'petates'. As we have mentioned briefly above, women may also insist that they hire day laborers to cut the tule. A substantial part of the harvested tule is sold directly to women of other households. The rest comes under control of the women in the household of the tule cultivator. The tule possessor will dry the tule and bundle it in 'reales', each 'real' is enough to make one 'petate'. This selected and bundled tule may also be used to contract other women, who have no direct access to tule, to make 'petates'. Two contract types exist: 'real por real' and 'hechuras' (see Roquas 1994 for an extensive description). In the first contract the 'petate' maker receives an amount of tule (two 'reales') from which she can make two 'petates'. She returns one 'petate' to the tule possessor. In the second contract the tule possessor pays another women to make a 'petate' for her. The 'real por real' contract is more profitable for the women who makes the 'petates'. Some women of richer households with tule fields do not make 'petates' anymore but only contract other women.

The supply of tule varies over the year under influence of seasonal variation in yields and in competition for labor by other agricultural activities. This variation has its influence on the contracts that are made between women. In the first part of the dry season, large culms are harvested and many tule possessors tend to keep this tule for themselves instead of contracting other women. With this tule it is often possible to make 'petates' without connections which are easier to make, more beautiful, and can be sold for higher prices. Between December and March tule harvesting competes with coffee picking for labor and many tule cultivators only want to cut a limited amount of tule. Production is nevertheless high and there is still a lot of tule for which tule possessors search women to make 'petates' for them. They have to offer it in a 'real por real' contract. With a lot of tule available few women want to enter the low paid 'hechuras' contract. Furthermore, some poor women, who mostly live from making 'hechuras', find an alternative in picking coffee in this season. The situation is different in June and July. In this period, tule harvesting competes with the weeding of maize fields, another labor demanding task carried out entirely by men. There is less tule to harvest and thus less tule available. It is also the 'time of hunger', when poor households have run out of their stocks of maize. In this period practically no 'real por real' contracts are made. Many women of poor households search for 'hechuras' and make long working weeks to earn some money to buy food.

'Petate' prices tend to be relatively lower in June and July (Figure 1; the general tendency of prices to rise is due to inflation). The striking aspect of this lower price is that it occurs in a period when the supply is also lower (though not as a consequence of the low prices but due to the amount of tule harvested). It is difficult to explain price variation but it appears to be demand driven. One hypothesis is that the people in Northern Honduras regularly buy new 'petates', but do this mainly in the season with high temperatures when they need a cool sleeping mat, thus increasing demand in the period from January to April.

CONCLUSIONS

Tule (*Cyperus canus*) and 'petate' production is economically and culturally very important for the people of El Níspero and a dozen of other villages in Honduras. On small areas of land a relatively high value can be acquired which is not dependent upon export markets. Yields are relatively stable, but the crop is not without pests and diseases. The crop is highly flexible in the sense that harvesting, the most labor demanding task, can be postponed until labor is available. Some restriction on this flexibility comes from the local knowledge system that one must take account of the correct position of the moon.

Producers show much interest in improving the crop; they experiment with fertilizers and biocides for pest control. They recognize different cultivars of tule, although some producers argue that different tule plants are not genotypes but result from differences in growing conditions. The limited importance of tule at a national scale will probably not call for research on tule, but a better insight in the different cultivars and their response to, for example, fertilizing or manuring may help farmers to improve their crop.

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