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IN AGRICULTURE (REPOSA)

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FEMALE PARTICIPATION IN THE AGRICULTURAL SECTOR OF THE NORTHERN ATLANTIC ZONE OF COSTA RICA

Provision of employmemt on farms and packing plants specified to gender

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CENTRO AGRONOMICO TROPICAL DE
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THE REPOSA PROJECT

The Research Program on Sustainability in Agriculture (REPOSA) is a cooperation between Wageningen Agricultural University (WAU), the Center for Research and Education in Tropical Agriculture (CATIE), and the Costa Rican Ministry of Agriculture and Livestock (MAG). In addition, REPOSA has signed memoranda of understanding with numerous academic, governmental, international and non-governmental organizations in Costa Rica.
The overall objective of REPOSA is the development of an interdisciplinary methodology for land use evaluation at various levels of aggregation. The methodology, based on a modular approach to the integration of different models and data bases, is denominated *USTED* (*Uso Sostenible de Tierras En el Desarrollo*; Sustainable Land Use in Development).
REPOSA provides research and practical training facilities for students from WAU as well as from other Dutch and regional educational institutions.
REPOSA's research results are actively disseminated through scientific publications, internal reports, students' thesis, and presentations at national and international conferences and symposia. Demonstrations are conducted regularly to familiarize interested researchers and organizations from both within and outside Costa Rica with the *USTED* methodology.
REPOSA is financed entirely by WAU under its Sustainable Land Use in the Tropics program, sub-program Sustainable Land Use in Central America. It operates mainly out of Guápiles where it is located on the experimental station *Los Diamantes* of MAG.

EL PROYECTO REPOSA

REPOSA (*Research Program on Sustainability in Agriculture*, o sea Programa de Investigación sobre la Sostenibilidad en la Agricultura) es una cooperación entre la Universidad Agrícola de Wageningen, Holanda (UAW), el Centro Agronómico Trópical de Investigación y Enseñanza (CATIE) y el Ministerio de Agricultura y Ganadería de Costa Rica (MAG). Además REPOSA ha firmado cartas de entendimiento con organizaciones académicas, gubernamentales, internacionales y non-gubernamentales en Costa Rica.
REPOSA ha desarollado una metodología cuantitativa para el análisis del uso sostenible de la tierra para apoyar la toma de decisiones a nivel regional. Esta metodología, llamada USTED (Uso Sostenible de Tierras En el Desarollo) involucra dimensiones económicas y ecológicas, incluyendo aspectos edafológicos y agronómicos.
REPOSA ofrece facilidades para investigaciones y enseñanza para estudiantes tanto de la UAW, como de otras institutiones educacionales holandesas y regionales.
REPOSA publica sus resultados en revistas científicas, tesis de grado, informes informales, y ponencias en conferencias y talleres. REPOSA regularmente organiza demostraciones para investigadores de Costa Rica y de otros países para familiarizarlos con la metodología USTED.
REPOSA es financiado por la UAW bajo su Programa del Uso Sostenible de la Tierra en los Areas Trópicos. La sede de REPOSA está ubicada en la Estación Experimental Los Diamantes del MAG en Guápiles.

PREFACE

This report is a result of my traineeship as part of the study Agricultural Engineering on the Wageningen Agricultural University (WAU). During the period July - October 1997 this traineeship was performed at the REPOSA-project in Guápiles, Costa Rica.

This research, which is divided in two parts, aims to give insight into female participation in the agricultural sector of the Northern Atlantic Zone of Costa Rica. The first part focuses on female labour with respect to on-farm agricultural production activities. Information according to this subject was gathered from literature and interviews with field experts. Outcomes of this investigation are given in chapter 2 of this report.
During the second part of this traineeship various post-harvesting plants or *empacadoras* were visited in order to give an overview of both labour demand and division in this sector. Interviews were held on the packing plants of banana, root and tuber crops, palm heart, pineapple and macadamia. In the chapters 3 to 7 a brief description of these crops, their post-harvest process and the main data obtained are given, whereas chapter 8 gives the conclusions and recommendations of the second part of this research.

Chapter 1 starts with an introduction into the REPOSA-project, the used methodology, the study area and the structure of my research. The last chapters of this report concern acknowledgements and my personal experience. Data which are not mentioned in the main text are presented in appendices just as a list of abbreviations, a copy of the interview used to collect the data and some figures concerning the post-harvest of bananas.

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1. INTRODUCTION

In this chapter an introduction to the REPOSA-project, the USTED methodology, the study area and the structure of my research is presented. Especially the first items are discussed in great detail because of my engineering background and interest. Unless stated otherwise, the information presented is mainly derived from Bouman et al. (1997).

1.1 The REPOSA-project

Main objective of the REPOSA-project, formerly called the Atlantic Zone Programme, is the development of a methodology for analysis and evaluation of alternative scenarios for profitable and sustainable land use at the (sub)regional and national level. This involves the assessment of trade-offs between income, sustainability and environmental objectives. In 1987 the project started and the first years were mostly dedicated to disciplinary research: the main disciplines involved in REPOSA are soil science, agronomy, economics and marketing. Since 1991 however, the research has focused more on the development of an interdisciplinary methodology for the evaluation of alternative land use scenarios, because it became more and more clear that this was the only way to meet the issues of sustainability and the lack of tools for assessment of the effects of policies on agricultural land use.

The methodology developed within REPOSA is named USTED (*Uso Sostenible de Tierras En el Desarrollo*; Sustainable Land Use in Development) and is an integration of various techniques, like the collection, processing and analysis of relevant land use information (Figure 1.1). Modelling is performed on the regional level, though it is a result of gradually upscaling, beginning at the settlement level (some 5,000 ha) via the district level (some 50,000 ha) to the region (some 450,000 ha), which in this case is the Northern Atlantic Zone (NAZ) of Costa Rica. According to Figure 1.1 the core of the methodology is formed by a Linear Programme (LP) model and two so-called Technical Coefficient Generators (TCGs). Further on these two items will be discussed in greater detail.

The LP model is used to select alternative land use options (both crop and livestock) per sub-area and soil type distinguished. In general the goal or objective function is the maximisation of regional value added, while restrictions are related to the amount of recourses available (e.g. land and labour), marketable volumes of products and sustainability and environmental considerations. The input data for the LP model are generated by the TCGs using a target oriented approach. This means that for alternative production systems, a target production level is set and that subsequently the TCG calculates the amount of required inputs and outputs using known input-output relations for the production system under consideration. Examples of these inputs and outputs, which are denominated Technical Coefficients (TCs), are yields, costs, labour use and sustainability and environmental indicators. Two different TCGs are distinguished, one for crops and the other for pastures.

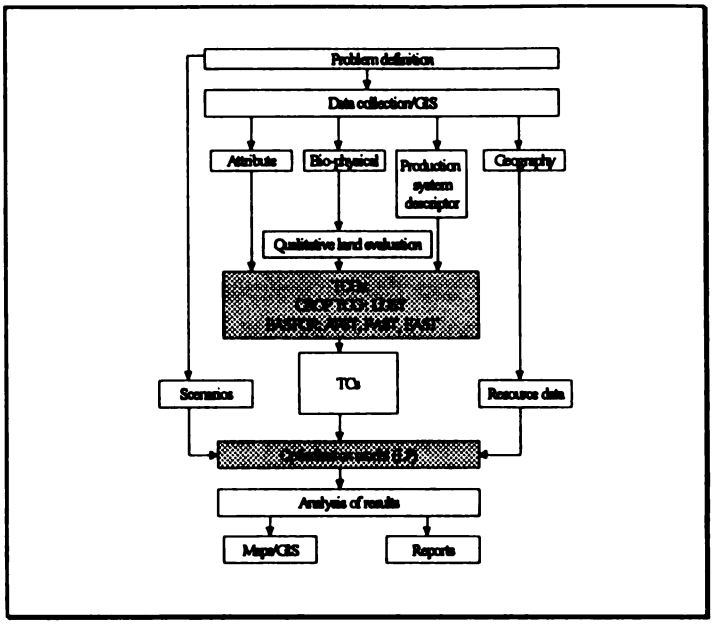

Figure 1.1 Diagram of the main steps in the USTED methodology.

The main data requirements of the USTED methodology include attribute data (e.g. prices and chemical compositions), bio-physical data like production potentials and soil properties, geo-graphical data to describe e.g. road infrastructure and to formulate sub-zones and its labour availability and the description of land use systems which consists of system input-output data differentiated by soil group, target yield level and level of technology. The geo-referenced data are archived and manipulated using a Geographic Information System (GIS). All the data are obtained by means of expert systems, literature review and farm surveys.

Technical coefficient generators

The two TCGs used within USTED are CROPTCG (CROP Technical Coefficients Generator) for cropping activities and PASTOR (PASture and livestock Technical coefficients generatOR) for livestock activities. The outputs generated by CROPTCG can be seen as one single crop option consisting of a combination of a land unit (soil group) and a land use type with a specified technology, called LUST (Land Use System with a defined Technology). Within the study area, three different land units are defined based on fertility and drainage features, while the number of LUSTs reaches over 300 land use options. Thus, each LUST describes a single crop cultivated on a certain soil type and using a certain technology. These technologies distinguished between LUSTs are for example determined by various levels of fertiliser or chemical input and different mechanisation grades. The crops currently included in USTED are: maize, cassava, pineapple (both annual and perennial), beans, banana, plantain, palm heart and forest.
The TCG for livestock activities, PASTOR, is a little more complicated and consists of three different systems. The first one is PAST (PASture production system at a defined Technology), the second one is APST (Animal Production System at a defined Technology), which calculate TCs given the target production for either cattle breeding or cattle farming (both in target live weight gains) at a defined technology. Finally PASTOR also generates FASTs which stands for

Feed Acquisition Systems at a defined Technology. PASTs can be compared with LUSTs since they are both truly land-based production systems. However, FASTs and PASTs have a different character since they only generate nutritive values to feed the cattle in the APSTs.

The target production levels offered to the two TCGs are given as a certain range (e.g. from 30% to 100% potential yield) and can be set by the user. Also the step size (or in other words the difference between the distinguished production levels) can be given. For all these production levels the TCG calculates the inputs needed, which can be divided into four different groups. Firstly, production TCs, e.g. crop yield and cattle nutritive value. The second group of TCs are the economic TCs, which consists mainly of the costs of production and labour use and are calculated within all four production systems. The third kind of TCs distinguished are the sustainability indicators, calculated within the LUSTs and PASTs. These parameters are the main indicators for sustainability within the USTED method. According to Pearce and Turner (as referenced in Alfaro et al., 1994), one of the main aspects of sustainability is the utilisation of renewable resources at rates less than or equal to the natural rate at which they regenerate, and keep waste flows to the environment at or below the assimilative capacity of the environment. From this point of view the sustainability indicators are said to be soil nutrient balances for the three main elements, nitrogen (N), phosphorus (P) and potassium (K). Negative balances (which often occur in the NAZ, see description below) cause soil mining, implying unsustainable production. This can be seen from the fact that target yield levels can not be maintained in the long run when soil nutrient balances are negative. Therefor, one of the often used restrictions in the LP model is the imposition of zero soil nutrient balances, thus aiming for a sustainable land use alternative.
Last kind of TCs are the so-called Environmental Effects Indicators (EEIs), also only occurring in the two systems describing optional land use systems, LUSTs and PASTs. The difference with the earlier mentioned sustainability indicators is that the influence of effects described by EEIs on long term production level is not evident. However, the influence of the factors reflected by the sustainability indicators on the natural environment is obvious and should be accounted for when developing a sustainable land use evaluation model. The EEIs are divided into two groups, namely a pesticide related group and a group of indicators that refer to total N losses to the environment. The first one consists of the total amount of active ingredients used and a pesticide input use indicator, the PEII (Pesticide Environmental Impact Index), which is calculated based on pesticide quantities, their percentage active ingredients, their degree of toxicity and their persistence in the environment. The second group of EEIs consists of indicators describing total N losses via leaching, volatilisation, denitrification and nitrification, all which together cause e.g. acid rain, soil water pollution and greenhouse gas effects.

Optimisation model (LP)

Once the TCGs have generated the Technical Coefficients for all possible land use options, the LP program is used to calculate the option that will give the highest regional value added: of all the agricultural production activities, each of which can be performed by a range of technologies, which on their turn all have their own economic value as well as sustainability and environmental effects, the most economic option is chosen. By defining a certain set of restrictions the effects of several policy instruments on land use, income and the environment can be investigated. Thus,

different scenarios can be run, like a base run, which is an income maximisation without any restrictions on sustainability and environmental effects, and various other runs using restrictions on sustainability, pesticide use, export marketing or a combination of these. Results will not be discussed here, because they are outside the scope of my research.

The objective function of the program is the maximisation of regional value added. The regional value added is defined as the sum of the output values of the different sub-zones in the NAZ minus input costs (like cost for fertilisers and the depreciation of machinery and buildings) and labour costs. The output value per sub-zone is defined as the sum of farm-gate prices which are calculated by subtracting transportation costs from wholesale prices.
Stratification of the sub-zones is performed on basis of the transportation costs. This is justified by the fact that there exists a high variation in the NAZ with respect to the distance to the nearest market outlet and the infrastructure, while on the other hand soil types and climate do not differ much. With the help of an automatic GIS procedure which made use of the geographical centre of each sub-zone and four different road types possibly available, the NAZ was divided into 12 different sub-zones of more or less equal transportation costs. For each zone the amount of different soil types and the labour availability was calculated. Thus, product (both animal and crops) transportation costs, labour mobility costs (based on local bus fares), hectares per soil group and labour availability are all present in the LP model.

1.2 Research area

Costa Rica is a small country situated in Central America, bordered by Nicaragua in the north and northwest, by Panama in the southeast, by the Pacific Ocean in the south and west and by the Carribean Sea in the east. The country lies entirely in the tropics. The study area of the REPOSA is the northern part of Limon province and is more frequently indicated as the Northern Atlantic Zone of Costa Rica. The NAZ is completely situated between northern longitudes of 10°00' and 11°00' and western longitudes of 83°00' and 84°00', thus being the most north-eastern part of Costa Rica, as shown in Figure 1.2.
The area is characterised by a humid tropical climate, with mean daily temperature of 26 °C (variation through the year of only 2 °C), mean annual rainfall of 3000 to 6000 mm and an average relative humidity of 85-90%. All months have a precipitation surplus, though the first three months of the year are relatively dry. Elevations vary from sea level to 400 masl.

Table 1.1 *Estimated land use (1992) in the Northern Atlantic Zone of Costa Rica (based on Belder, 1994, referenced in Bouman et al., 1997). Surface area of roads, rivers and villages are implicitly included in all land use types.*

Type of land use	ha	%
Primary and secondary forest	214.054	48
Pasture/cattle	174.928	39
Banana plantation	42.300	10
Crops	15.510	3
Total	446.792	100

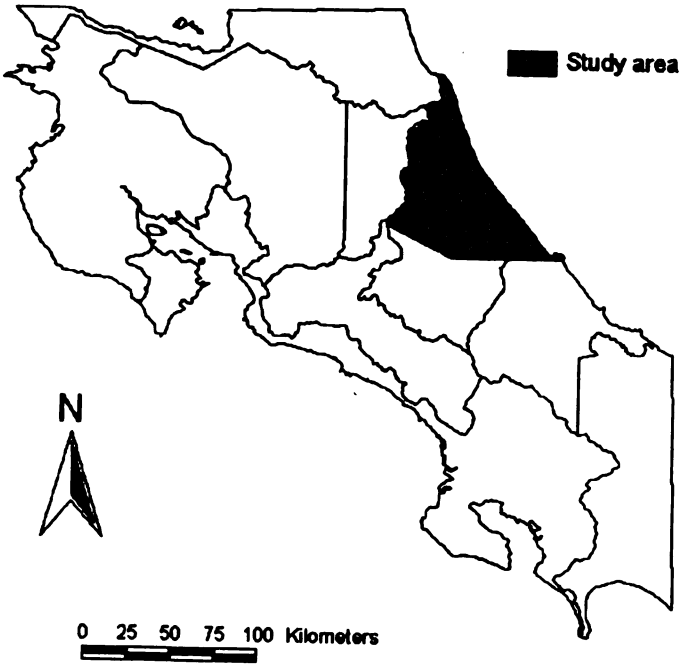

Figure 1.2 Case study area in the Atlantic Zone of Costa Rica.

Total surface area is some 447.000 ha, of which only 275.000 is suitable for agriculture, partly due to the 59.000 ha protected for nature conservation (National Park Tortugero). Table 1.1 gives an estimation of land use in the NAZ in 1992, thus showing the relative minor role of crop growing in the area. Cattle keeping and banana cultivation account for the majority of total non-forested land used, leaving only 3% for crops like plantain, palm heart, tuber and root crops, papaya and ornamentals. This land use pattern is typical for the area and was initiated by the colonisation of the NAZ which started in the late 19th century, following substantial deforestation. Most of the deforested parcels where used for extensive cattle ranging, partly because one of the national laws considering colonisation states that he who tills a certain parcel has the proprietary rights, when the official owner (if there is one) can not be traced any more.
Because of this expansion, natural pastures are mining out the soil nowadays causing an increasing infestation of weed which on its turn influences the yields, thus resulting in decreasing returns and a even higher grade of expansion.
Due to the in 1987 introduced changes in the agricultural policy of the Costa Rican government (described by Jansen et al., 1996), pesticide use in the NAZ increased significantly; farmers changed their way of farming and started with the cultivation of non-traditional export crops like palm heart and ornamentals. However, these crops (together with banana cultivation) account for a relative high fertiliser and pesticide input. Bearing in mind the fact that, under given conditions,

about 60 percent of total pesticide input is not fixed but flows directly to the environment, total agriculture in the NAZ can stated to be highly unsustainable and possibly environmentally harmful.

According to agricultural census data of 1984 285.316 ha in Limon province was suitable for agriculture in those days (*Censo Agropecuario*, 1987). Table 1.2 gives the farm size distribution in absolute acreage and in percentages for Limon province and is presented to give a general indication of the farm size distribution in the research area. More recent data are unfortunately not available and a new census will not be held until next century.
However, it is known that there exist two counteracting developments which might have changed land use division between these different farm types. The first one is the aggregation of small farms to farms cultivating over 20 hectares, because the smaller farms have become more and more uneconomic. It is likely that this development occurred in the past decade in the NAZ (A. Nieuwenhuize, pers. com.), not in the last place as a consequence of the earlier mentioned governmental policies which favours large-scale production. This might have been counteracted by the second development, the possible further expansion of the number of IDA (*Instituto de Desarrollo Agrario)*-settlements. This institute has as main task the assignment of (small) parcels of land to those who have applied for it. The lack of quantitative information concerning these developments makes it hard to give a good assessment of current farm size distribution.
Another phenomena occurring in relation with above described developments is the fact that small farmers in the NAZ more and more tend to perform off-farm work, e.g. on banana plantations, in order to obtain additional income.

Table 1.2 *Farm size distribution in Limon province (1984, Based on: Censo Agropecuario 1987).*

Farm size (ha)	# farms	%	# hectares	%
< 2	807	8,9	736	0,3
2 - 5	1.407	15,6	4.334	1,5
5 - 10	1.695	18,8	11.712	4,1
10 - 20	2.288	25,3	29.473	10,3
20 - 50	1.690	18,7	48.472	17,0
50 - 100	614	6,8	40.427	14,2
100 - 500	473	5,2	94.181	33,0
> 500	59	0,7	55.981	19,6
TOTAL	9.033	100,0	285.316	100,0

1.3 Objective of this research

Until this research was started gender aspects were not taken into account in USTED. Or with other words, there exists no differentiation to sex concerning the various agricultural activities included in LUSTs and APSTs. Labour availability per sub-zone is derived from census data reflecting the agricultural labour force, thus also taking into account the participation of women and children older than 12 years.

However, two considerations initiated uncertainty with respect to the justification of this treatment of the labour force. The first one was motivated by the experience in some African agriculture production systems, where women are responsible for the cultivation of certain crops. Thus, they participate significantly in the production process and derive a certain status and income of their own, since earnings of this cultivation are often spent by the women themselves. This money is mostly dedicated to school fee for the children or attributes for housekeeping, issues often overlooked by men, who are in a lot of cultures still the ones making the decisions with respect to money spending.

The second consideration concerning the realisation of this research was the increasing attention paid to women's participation in agriculture during the last decades. Several social researches claimed that labour of women within agricultural systems undeservedly was said to be negligible and that they do far more than just domestic labour. To meet these considerations and to investigate if available labour within the USTED methodology should be divided into separate male and female labour pools, initial research questions were:

- Investigate the situation with regard to women labour in the NAZ.
- Investigate if and how labour differentiation can be addressed in USTED, based on the results of the first research question.

Within a few weeks the conclusion could be drawn that there exists no clear differentiation with respect to women's participation in agriculture: in general they perform all the occurring production activities, though their prime task is usually domestically work. The importance of their activities on own income generation is negligible which supports the conclusion drawn. All this will be discussed in greater detail in the next chapter.

However, during the investigation it turned out that the post-harvest process of several crops cultivated in the NAZ (like the packing of banana, palm heart and root and tuber crops) might have quite a great share in the provision of female employment. It was very interesting to collect some data concerning labour division on those packing plants (or *empacadoras*), especially since such information was not available within REPOSA. To know the consequences of certain land use options chosen by the LP program on labour availability in the post-harvest phase, further investigation focused on this subject, using the following general research question:

- How much labour (differentiated to sex) per harvested or packed unit is generated in the post-harvest process of main crops grown in the Northern Atlantic Zone?

Investigated crops were banana, root and tuber crops, palm heart, pineapple and macadamia. Together with the study of colleague student K.M. Faulkner (1997), which was carried out in the same time period and investigated the social background of women working in banana and ornamentals empacadoras, the second part of this study is intended to give insight into gender aspects in the post-harvest sector of the NAZ of Costa Rica.

1.4 Methodology

After a period of literature research into the project and the methodologies used, the first part of the study presented in this report was carried out by means of literature research and interviews with experts on the subject of women's participation in agriculture in the NAZ. Results of this investigation were laid down in an intermediate report which is presented as the second chapter of this report. A general interview with respect to labour division in the various empacadoras was formulated, also using knowledge obtained from field experts. This interview, presented in Appendix D, was only set up as a general manual, not primarily aimed to be used during the conservations with the foreman (with whom most interviews were done). The interviews were carried out by heart, thus trying to make the foremen feel more comfortable and to lose as less time as possible while interrupting them from their work.
Two administrators of the general offices of some of the biggest exporting companies of bananas were visited too. These companies were the Banana Development Company (BANDECO, commercial mark: Del Monte) and *Compañia Bananera Atlantica* (COBAL, commercial mark: Chiquita). The *Ministerio de Trabajo* was visited to obtain some information about minimum wages. The last part of the research was mainly dedicated to the processing and reporting of the data obtained.
In the chapters 3 to 7 the provision of employment in the post-harvest of the crops investigated is given by means of two parameters, namely PEI and PEO (Provision of Employment related to the process Input and Output). The units in which these indicators are given are man-hours per processed or packed unit respectively.

2. ON-FARM FEMALE LABOUR IN THE NAZ OF COSTA RICA

2.1 Introduction

As mentioned in the previous chapter the main aim of this part of the research was the acquisition of knowledge concerning the quantification of women's participation in the agricultural production activities in the Northern Atlantic Zone of Costa Rica in order to make a recommendation about the desired way of treating the labour pool in the USTED methodology. It has to be stated that this is mainly an issue on small farms (< 20 ha), for production on large-scale farms is much more efficient and often performed with the help of hired labourers, who are always of the male sex.
The main problems faced during gender studies are discussed in this chapter as a first introduction on the subject, while further on the results of literature research and interviews with field experts are given. Finally these results will be discussed and some conclusions are drawn.

2.2. Problems concerning gender studies

Women's activities can be divided in three categories: reproductive (or domestic) labour, productive labour and social or community activities (Aguilar et al., 1996; Guzman, 1991; Lubbers, 1991). This seems a clear and useful distinction that can be implemented easily when studying female labour, but appearances are deceptive. One of the main problems faced by gender researchers is the invisibility of women's labour (Aguilar et al., 1996; Orcherton, 1996; Karremans et al., 1993; Kleysen et al., 1996;), which is caused by several issues.
Most of this issues are initiated by stereotyped and strong Latin American culture-bound beliefs. For example, concerning labour division by gender everyone has always been taught that productive labour (which is usually considered to be the only valuable) is masculine in nature, reproduction chores have to be done by women. Most female agricultural labour is unpaid and performed in the farm yard, for which reason women are not often seen in public; men claim the jobs which have any relation with the external world for themselves. All this is very narrowly related to the occurring phenomenon of Latin American women stating that they do not perform any work at all (Acosta, pers.com.)[1]. A striking example of this effect was given by Alfaro (pers. com.): during his stay in the IDA-settlement Agrimaga he met a woman who denied that she ever participated in agricultural production. Still she was sowing grass seed when she stated this, meanwhile looking after her youngest child. Finally, attempts to resolve the invisibility of female labour often fail since interviews used to collect information about women's participation often still focus too much on paid (and thus productive) labour according to Karremans et al.(1993).

The invisibility of female labour is one of the main causes of the lack of sufficient statistical information; the information available is in most cases very unreliable, since it underestimates women's participation (Campillo, 1994; Chiriboga et al., 1995). Both authors calculated for the period 1989-1992 in Costa Rica an official registered Female Agricultural Economic Active Population (FAEAP) of 8%. On base of surveys of rural homes and agricultural and population

[1] Interviews that sustained the research are given in appendix B.

censuses, researchers of an IICA/BID project estimated this FAEAP. Outcomes were 25-30% (Chiriboga et al., 1995) en 27% (Campillo, 1994).
Guzman (1991) concluded that these problems affect all women and have huge implications of which a few are mentioned by Campillo (1994): technology generation and transfer policies and programs reflect this stereotyped distribution of labour, causing difficulties for women food producers' access to and use of technology and other production resources. Concluding, we have to study the available information with respect to gender related issues in agriculture very carefully: there are many mistakes to learn from.

2.3 Women's activities in Costa Rican agriculture

Literature references to the average daily amount of female labour on Costa Rican farms range from 12 hours (Hooijschuur, 1991) to 16 hours (Chiriboga et al., 1995; Kleysen, 1996). This are all estimates of women themselves, mostly obtained by interviewing country women living on small farms. In an IICA/BID project the study to women's work was done on small farms, producing basic cereals (corn and beans). Chiriboga et al. (1995) judged them to be representative for total Costa Rican agriculture: more than 70% of small producers produce basic cereals, representing a significant percentage (more than half) of the total Costa Rican production of this cereals, playing an important role in the national consumption pattern.
Participation of women depends on different aspects of which a few are named by Chiriboga et al. (1995): the amount and age of children, the presence of other adults in the family, the possible off-farm work of the men, the use of hired labour, the crop rotation on the farm, the cultivation techniques used and the possible female management (permanent or temporary) of the farm. Riviera (pers. com.) confirmed this and concluded that it therefor is very difficult to give a general description of women's participation. In this section women's activities are studied using the earlier given division of labour.

Table 2.1 *Dayactivities of the 30 interviewed women, average hours they spent for different activities, amount of women participating, the range in hours and the percentage of the total active labour time (Source: Hooijschuur, 1991).*

	Average # hours	# of women	Range in hours	% of total
Housekeeping	8:00	30	3:00 - 15:00	73.5
Animal husbandry	1:20	27	0:15 - 2:30	11.0
Cropping	2:12	20	0:30 - 5:00	13.3
Work for wages	1:53	4	0:30 - 3:00	2.3
TOTAL	11:00	30	4:00 - 15:15	100.0

Reproductive labour

Literally this means 'maintenance of the species' or in other words bearing children, though in practice all housekeeping jobs are included. Women spent on average 9 hours a day on domestic labour (Ramirez A. et al., 1994). Main activities are: looking after the children, cooking three meals daily, washing, ironing and repairing clothes, gathering fire wood and water (in those areas

where no electricity or water pipes are present), cleaning the house and shopping. Karremans et al. (1993) name also the education and socialisation of the children as an important women's job. Table 2.1 shows that for the women of 'El Indio' in the Atlantic Zone of Costa Rica 73.5% of their available time is dedicated to reproductive labour (Hooijschuur, 1991).

Productive labour

Since domestic labour is mainly done on-farm, majority of women's productive activities is also farm yard bound. One of the most important jobs is participating in the food production in the family gardens. In most cases, these activities are the only way to diversify the family diet and an important source of income (Campillo, 1994). A recent and detailed quantitative study on this subject was done by Orcherton (1996). He carried out two case studies on carefully selected farms on an IDA-settlement in Guanacaste (Costa Rica) and investigated all the activities done on the farm, and especially in the family garden. One of his main conclusions was that 90-95% of the realised production in the family garden is intended for autoconsumption and that women and girls contribute to over half (29-56%) the family labour requirements in the management of the family garden. Total contribution of women and girls to the overall family labour requirements on the farm equalled 54% and 64% respectively. The amount of hired labour was small, respectively 15% and 5% of total labour and in both cases family members did not perform any off-farm work. Another important task in and around the farm-yard done by women is the care for all the animals apart from the cattle, like chickens (collecting eggs), pigs, horses and young or sick animals (Ramirez A. et al, 1994; Hooijschuur, 1991). Unfortunately, all these activities are often not considered as being productive, although its share in creating a living for the family is very essential.

Table 2.2 *Labour dedicated to different activities as percentages of total family manual labour for two cattle breeding farms, divided to gender (Source: Orcherton, 1996). Rompevientos are the so-called 'wind breakers'.*

Production systems	Farm 1* %					Farm 2* %			
	Women (1)	Girls (3)	Men (1)	Boys (1)	subtotal (6)	Women (1)	Girls (3)	Men (1)	subtotal (5)
Family garden	5	24	1	12	42	44	12	7	63
Tomato	3	7	10	0.7	20	-	-	-	-
Cattle raising	2	8	5	1.1	16	8	-	27	35
Sweet peppers	1	1	6	-	8	-	-	-	-
Maize	1	0	3	-	4	-	-	-	-
'Espeque' beans	1	0.3	3	-	4.3	-	-	-	-
Reforestation	0.1	-	2	-	2.1	-	-	0.3	0.3
Fruits	0.2	1	0.4	0.3	2	0.5	0.02	0.4	0.92
'Tapado' beans	0.05	-	1	0.05	1.1	-	-	-	-
'Rompevientos'	0.03	0.3	0.2	-	0.5	-	-	0.4	0.4
TOTAL	13	41	32	14	100	52.5	12	35	100

* The family division of the two farms is the following:
Farm 1 : Man (45), woman (44), a boy (7) and three girls (17,16 and 14)
Farm 2 : Man (61), woman (56) and three girls (30, 13 and 9)

Table 2.3 *Women's participation by type of activity in Costa Rica and Central America (Source: Campillo, 1994). The percentages represent those women who, among all the women interviewed on maize plots, carry out the activities described.AHW are the Average Hours Worked by the women performing the given activity.*

	Region			
	Costa Rica		Central America	
	%	A.H.W.	%	A.H.W.
Agricultural plots*	84	5.1	72	4.2
Family gardens	46	1.4	57	2.3
Livestock	13	-	11**	-
Transportation	22	1.6	33**	1.6**
Domestic labour	100	7.0	100	7.3
Other activities	83	3.2	78	3.8

* Principal crops: corn and beans, ** Not all Central American countries are included in this average

Focusing on women's participation in the various activities of the commercial crops cultivation and livestock farming, Table 2.2 reflects data for the two farms studied by Orcheton (1996). Aquilar et al. (1996) reports productive female labour on a cattle farm to be 4-6 hours daily on base of dozens of interviews. Processing of milk, cheese and custard and the care of the smaller species are typical female activities: respectively 65% and 54% of the total time needed for these activities was contributed by women. Of all the other activities done in livestock farming women only do not participate in vaccination, fertilisation and the burning of residues. In other activities women's participation ranges more or less from 5% to 20%.
The results of the earlier mentioned IICA/BID project are given by three different authors and are shown in table 2.3 en 2.4 (Chiriboga et al., 1995; Campillo, 1994; Kleysen, 1996). For both Costa Rican and total Central American producers Table 2.3 gives women's participation per type of activity. Table 2.4 gives the participation for several activities in maize cultivation. The percentages represent those women who, among all the women interviewed on maize plots, carry out the activities described. In the analyses by country, it turned out that Costa Rica and Panama have the highest levels of women's participation in food production. Chiriboga et al. (1995) use the meridian as an indicator to state that 50% of Costa Rican country women spend 5 hours daily on agricultural activities.
From the study of Hooijschuur (1991) the conclusion can be drawn that contribution of women in animal husbandry and agricultural activities in IDA-settlement 'El Indio' is 46% en 16% of total time required respectively. In agriculture existed no activities that were done by women only, all the jobs were carried out in co-operation with men.

Social or community labour

Lubbers (1996) distinguished between various social or community related activities during a study in Honduras and Nicaragua: conversation with visitors, visiting people themselves or joining (religious) reunions. It is likely that the time amount country women in the NAZ spent doing

social or community labour is negligible, in most cases the other two kinds of activities take all available time according to various field experts.
Van Hel (1987) names a few other social activities in which some women living in the settlement La Lucha (Atlantic Zone, Costa Rica) are involved: meetings of a committee that teaches them how to use and cultivate medicinal plants and participation in committees that aim to raise funds for educational appliances or the building of a catholic church. Ramirez A. et al. (1994) state that a lot of women are afraid of doing anything off-farm. They consider their on-farm jobs as their only duty and are afraid of the negative reactions of the men when they should withdraw from this old concept. According to Alfaro (pers. com.) men often feel threatened in their position of being the only one earning family income and for this reason often forbid women to do any off-farm work.

Table 2.4 *Women's participation in agricultural activities in the production of maize for both Costa Rica and Central America (Source: Campillo, 1994). The percentages represent those women who, among all the women interviewed on maize plots, carry out the activities described.*

	Region	
	C.R. (%)	C.A. (%)
Clearing	57	49
Planting	59	52
Fertilizing	43	41
Manual weed control	38	45**
Applying dangerous herbicides	25	19**
Traditional pest control	20	15**
Pest control	33	28
Harvest	47	59
Post-harvest	30	50
Sales	10	27

** Not all Central American countries are included in this average

2.4. Discussion

Though the data presented in forgoing sections are quite obvious, some additional comments have to be made, especially concerning the correctness of the representation for the NAZ. With respect to this last aspect, the farm size division of the zone, as given in table 1.2, has to be borne in mind. As mentioned before, all revealed items concerning the participation of women in Costa Rican agriculture occur primarily on small farms of some 20 hectares and less. Although they represent over half of total farms, their importance on total land use in the area is relatively low and expected to be still decreasing.
The same applies for the share of the basic grains in the land use in the Atlantic Zone. Due to the reorientation of nation's agricultural policy of 1987 basic grains represent nowadays only a relatively marginal production area of total arable farming. For this reason the data obtained by the IICA/BID project, which are actually the data we had in mind when we started this research, will not be of much use within the USTED methodology.

The second remark concerning the outcomes of this investigation is the extend to which the various presented data correctly representate the situation in the NAZ. In fact, the results of the IICA/BID project have to be considered the only representative, since they were obtained by researchers living on farms for a whole crop cycle while writing down all female activities performed during the day (Chiriboga et al., 1995; Campillo, 1994; Kleysen, 1996). The other studies can be used as a good indication concerning women's participation in agricultural and cattle raising activities. Still, the given percentages are not representative enough to be included in LUSTs or APSTs. For example, the study of Orcherton (1996) favourites a relative high participation of the female sex since the family divisions were not distributed normally: on the first farm lived two men and four women, on the second farm one man and four women participated in agricultural labour. The given data of Hooijschuur (1991) were obtained from a group of farmers, who were all members of UNAINDO, a co-operation which organises separate male and female groups in the IDA-settlement 'El Indio', thus representing a selective sample population.

Finally it is important to mention that nowadays small farmers in the NAZ often perform part-time off-farm work, in order to obtain additional income (Alfaro, pers. com.); as mentioned before actual production on the small farms is hardly sufficient to earn a subsistence, which makes a lot of small producers decide to replenish their income by hiring themselves out as day-labourers on other farms or on one of the several banana plantations (*bananeras*), where they can make a relative high amount of money (see also chapter 3). In these cases the woman is regularly the one responsible for the agricultural production left, thus accounting for a higher participation in occurring activities. This also appears in the frequent occurring divorce cases, where women are mostly the ones staying behind at the farm with the children, after the men have run away from them searching for a new future.

2.5. Conclusions

The conclusion of Kleysen et al. (1996) can be used as a good summary of all the studied literature: the data of the IICA/BID interviews show that women play an important role in all activities in the agricultural production process. Contrary to the widespread belief in the sector, their participation is not marginal or related to certain low- weight tasks. In this context it is worthy to mention that women's participation is not restricted to specific crops neither is orientated exclusively to the production for autoconsumption.
These outcomes are confirmed by field experts: in general women participate in every agricultural production activity. Very often they are involved in most of the decision making on the farm (though the final decision is always a male task) and are in practice often the managers, especially with concern to income generation: in those days when there is no yield to be sold, women often have something in reserve, like a few chicken which can be sold. Bearing in mind the diversification of all the farms in the Atlantic Zone, mainly caused by differing farm sizes, cultivated crops and family distributions, it is however impossible to give general data concerning women's participation in agricultural and cattle raising activities. The information that is available and reliable does not cover all the activities considered within the LUSTs and APSTs and will for that reason not be much useful to the REPOSA-project.

With respect to my second research question, the importance of women's activities on a separate income generation, it can be concluded that because of the fact that women do hardly any off-farm work, own female income generation restricts to the selling of fruits, vegetables and some small live stock. Predominantly the earnings of these activities, just like all the other production activities women participate in, merge into family income. If not, the money is spent on food or clothes most likely.

Considering all this, the final conclusion to be drawn is that the structure of women's participation does not give rise to a further and more detailed study aiming at the introduction of a separate women labour pool in the land use model: there exists no clear differentiation of female participation in agricultural activities, and its importance on own income generation is negligible. Principally, women participate in every agricultural activity and those rare activities which they seem to perform a little more, like sowing and harvesting, are carried out in peak times when labour availability is restrictive and women and children are ordered into the field to support the men.
Therefor, labour in USTED is treated in a correct way since sex-differentiation is not LUST- or APST-specific and the different land use scenarios generated by USTED for this reason do not affect on-farm female labour in the NAZ.

3. THE POST-HARVEST OF BANANA

3.1 General description

Banana (*Musa cvs.*) is the most important of the tropical fruits, being second on the world list of fruits production. Centre of diversity is the Malaysian area, though nowadays the greatest acreage of bananas is found in Africa (Purseglove, 1985). That does not alter the fact that the Northern Atlantic Zone is very suitable for banana production too. One advantage of the REPOSA research area is that irrigation systems are not needed because of the constantly high precipitation. Combined with the year round mean daily temperature of 26 ° C, which is about the optimum for the banana growth, time from planting to harvesting for the plant crop is restricted to 9 months, a minimum according to Purseglove (1985). Drainage systems are used on all the plantations since they highly increase the aptitude of the soil (Velzen, 1996).

Banana is considered to be the most important agricultural crop in the Atlantic Zone: with its 46.383 hectares it represented in 1996 over 94% of total Costa Rican banana production area (*Corporación Bananera Nacional*, CORBANA, 1997). Total exportation from the Atlantic Zone in that year amounted to 100.898.612 boxes of 18.14 kg each. The production takes place in semi-industrialized plantations (*bananeras*), which are mostly owned by international fruit companies and sometimes by small farmers who sell their bananas to these companies. Every plantation has one or more packing plant (*empacadora*) in which the post-harvest process takes place. The mean acreage of the plantations in the NAZ in 1997 could based on the earlier mentioned CORBANA statistics be calculated as 270 ha/plantation.

3.2 Description of the post-harvest process

The first figure in Appendix C gives the different parts of the banana plant. The bunch (*pinzote*) with fruits that is cut during the harvest is called *racimo*, the groups of fruits are the hands (*manos*), while the fruits themselves are named fingers or *dedos*.
The post-harvest process is illustrated in the other figures of Appendix C. After being cut the racimos are transported to the empacadora in a 'train' along a iron rail (see detailed figure at the end of app. C) This train is pulled by the so-called carrier (*carrero*), who is a member of the harvesting group, the *cuadrilla*. Usually these cuadrillas exist of three or five members of which respectively one or two are carreros. The train contains about 20 - 25 racimos, depending on their weight. Once the racimos have entered the empacadora they are checked on weight and quality after which usually 1-3 % are rejected for further processing. The plastic bags that covered the racimos for 12 weeks and which were mainly used for their insecticide and fungicide coatings, are removed (*deschemisador*) just like the flowers of the racimo (*desflorador*). The racimos are transported to a basin where the *desmandores* cut the manos from the pinzote, which is carried off as a residue and sometimes may be used as organic matter in the field. Other jobs that have to be done before cutting the manos are the co-ordination of the incoming and outgoing trains, including their breakdown and reconstruction and the removal of the bandages fitted between the various manos to protect the fruits during transportation.
After being cut, jets of water transport the manos (which are floating) to the other end of the basin. There they are taken out by the *selectores* who select them on maturity, quality and length

of the fingers. Minimum length of first class bananas has to be about 8 pulgadas (20 cm). The colour of the fingers is the major criterion for maturity; when the bananas are exported to Europe they have to be less mature than when their destination is for example the USA. When the manos are turned down for first class export, they are either placed on a conveyor belt that takes them to the packing line for second class exportation (if there is an order for second class that day) or loaded on a truck as being definitely rejected. In this case they only can be sold on the local market or used as cattle feed.

The fruits that are suitable for first class exportation are placed in a second basin called *pila de desleche* where a chemical is added to the water to stop the fresh cut fruits from loosing their latex which would make them turn black. After this treatment, *sacadores* select the fruits in three different categories according to their size and put them on plates, the so-called *bandejas* or *panas*. The fruits are (manually or automatically) treated with fungicide and *selladores* affix the stickers with the commercial name on the manos. Thereafter, they are packed in the boxes by the *empacadores*: small manos at the bottom of the box and the big ones on top. When the boxes arrive at their destination, their net weight has to be 18.14 kg. Since they loose fluid during transportation, 20.2 kg. is packed per box in the empacadora (Kruiter, 1989).

The empty boxes are delivered from the attic, where they are stored, to the packing site by means of an iron rail along which the boxes slide downwards. The boxes are fold and stapled in the attic by a couple of *engrapadores* who also put a plastic bag in the boxes. After being packed and weighed this bag is sometimes vacuum sealed to stop the maturation process during the time the containers are at sea.

Transportation from the packing site to the containers is performed using conveyor belts and rollers and the last operations are carried out: the *monjero* closes the plastic bag and a *tapadero* puts the cover on the box, after which the *cargadores* pack them either directly in the truck or on a pallet. In this last case the *paletadores* secure the pallets as illustrated in the last figure of Appendix C.

Table 3.1 *Main data of the visited banana packing plants. The numbers of the farms correspond with the data given in Appendix B2. The given wages are paid to the entire harvesting or packing force per unit. To calculate the wage per person it has to be divided by the number of workers performing the respective activities.*

		Farm					
		No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Acreage	ha	234	210	182	254	132	161
Total number of workers	-	109	125	119	142	55	73
Production that day	boxes	960	960	1965	2495	3360	1968
Harvested that day	racimos	1000	980	1500	2265	2896	1625
Number workers harvesting	-	18	18	25	34	45	35
Number workers packing	-	23	24	35	39	48	36
Net working hours	hours	6,75	6,25	9,0	-	9,0	8,25
Wage packing force	colon/box	50,0	51,84	41,09	-	41,01	41,0
Wage harvesting force	colon/rac.	46,0	42,0	60,0	-	-	55,0

Table 3.2 *Labour division of four banana packing plants in the Northern Atlantic Zone of Costa Rica. The numbers of the farms correspond with the last four bananeras given in Appendix B2.*

	Farm											
	Farm no. 3			Farm no. 4			Farm no. 5			Farm no. 6		
	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
Preparation	6	6	0	6	6	0	7	7	0	8	8	0
Cutting manos	2	2	0	2	2	0	3	3	0	2	2	0
Selection 1	7	6	1	7	6	1	9	8	1	7	6	1
Selection single	1	0	1	1	1	0	1	0	1	0,5*	0	0,5
Sacadores 1	3	3	0	5	5	0	6	6	0	4	4	0
Sacadores single	1	1	0	1	0	1	1	0	1	0,5*	0	0,5
Putting stickers	2	0	2	4	0	4	3	0	3	3	0	3
Packing 1	5	5	0	5	5	0	7	7	0	4	4	0
Packing single	2	2	0	2	2	0	1	0	1	1	0	1
Engrapadores	3	3	0	3	3	0	3	2	1	3	3	0
Closing plast. bag	0	0	0	0	0	0	2	0	2	0	0	0
Covering the box	1	1	0	1	1	0	1	1	0	1	1	0
Cargadores	2	2	0	2	2	0	2	2	0	2	2	0
Secure the pallets	0	0	0	0	0	0	2	2	0	0	0	0
TOTAL	35	31	4	39	33	6	48	38	10	36	30	6

* Both activities were carried out by one person.

The various activities are described in section 3.2. Preparation activities are all tasks carried out before the manos are cut from the pinzote. The fincas visited produced also a few boxes *single* daily. In these boxes only single fingers were packed. These fingers are treated separately and thus selecting, placing the manos on the bandejas (*sacadar*) and packing tasks are divided to prime class and singles. Engrapadores are responsible for the delivery of the empty boxes to the packing site, while cargadores place the boxes on pallets or directly into the container.

On most farms the plastic bags were closed by the same persons covering the boxes. Only on farm no. 5 the bags were vacuum sealed requiring two extra persons.

3.3 Results of the interviews

The main characteristics of the 6 banana packing plants visited are given in Appendix B2. As an example for all the different kind of packing plants visited, the interview used to collect the data is given in Appendix D, whereas Table 3.1 gives the main production data on the day that the interview was performed. On the two farms first visited, respectively 15 and 9 women were employed. Since there was no production on these farms on that moment, data on the labour division (Table 3.2) could only be collected on the last four farms.

Working hours as presented in Table 3.1 are the net hours needed to pack the ordered amount of boxes that day. As most farms were visited in the morning these data are mainly calculated on base of estimations of the foremen. Working time is not primarily restricted to an eight hours working day but to the amount of boxes that has to be packed that day. Processing ends not until this ordered amount is packed and the foremen decide per day how many workers have to be called up on base of some much-used guidelines: for the packing of two and three thousand boxes per day respectively 36 and 42 workers have to be called up. As can be seen from Table 3.1 these recommendations match the number of workers hired on the various farms visited.
However, working hours differ in relation with the amount of boxes to be packed. For example when up to 3000 boxes have to be packed, the net working day may consist of some 9 hours. Overtime hours are better paid (150%) and when for example processing is delayed because of lack of electricity minimum wage (or *tiempon*) is paid. According to the Ministerio de Trabajo (see Appendix B2) and W. Ulate (BANDECO, pers. com.) this is 1760 colon daily or 220 colon on a hour base.

Payment is done on different bases according to the activities performed. In general a certain amount of money is available per container packed, which has to be divided between the employees. Workers in the so-called preparation (as defined in Table 3.2) are paid on a hour base, while all the others working in the packing plant are paid per box packed. This distinction is possibly initiated by the fact that the first group of people only can regulate their working rate to a low extend, since they are limited by the processing rate of the desmandores. The men harvesting in the field are all paid per racimo cut.

3.4 Conclusions

The complete labour force working on the six farms visited consisted for 24% of women, mostly participating in selection and the affixture of the stickers. The range of these data is relative great, since minimum and maximum female participation was respectively 11 and 65%.
In Table 3.3 the provision of employment per farm is given in relation to the number of boxes. The data are classified in order of the amount of boxes packed and given for both obtained farm data and the earlier mentioned guidelines.
A certain development can be seen data when looking at the PEOban (as defined in section 1.4): in general, the more boxes to be packed, the lower the time needed to pack one box. This might be caused by the way the workers are paid. When processing is started they already know what they will be earning that day and for this reason they will take their time when a relative small amount of boxes has to be packed. On the other hand they shall work harder when for example

over 3000 boxes have to be packed, since the amount of money to be earned that day is already known (and can not be influenced) and they can not go home until all the boxes are packed. Still, prudence is called for because all these data are general estimations. In practice this development may not be as strong as suggested here.

The relation between PEIban and PEOban is not very clear, since the box/racimo ratio varies considerably between farms and parcels. For example, for the six farms visited mean box/racimo ration of that day amounted to 1,12 (variation from 0,96 to 1,31), while based on 54 week averages for 6 other farms in the Atlantic Zone an overall box/racimo ratio of 1,26 could be calculated with the different ratios ranging from 0,98 to 1,55. These data were obtained from W. Ulate (BANDECO). However, provision of employment in the post-harvest of bananas can on base of this research said to be varying between 0,13 and 0,16 man-hours per box packed and about one quarter of total labour is performed by women.

Using the data as given in Table 3.1 the daily wage of the workers can be calculated. Depending on the production 2000-2500 colon can be earned in the packing plant, whereas wages earned by the ones harvesting are in general a couple of hundreds colon higher because of the higher physical requirements. This makes working in the post-harvest of bananas quite attractive, though it is a hard job and long term social provisions mostly not are ensured because of the so-called 'three month work structure'. This illegal but much-used practice consists of the firing of employees after three months in order to evade social obligations (see also Appendix B1, R. Alfaro).

Table 3.3 *Provision of employment in the post-harvest of bananas. PEIban and PEOban respectively reflect the provision of employment related to product input and output of the packing process. The farm data and estimations obtained from different foremen are ordered in sequence of the amount of boxes packed. Estimation 2000 for example is calculated using the by foremen estimated amount of workers needed to pack 2000 boxes bananas. For the two estimations respectively an working day of 8½ and 9 hours is assumed.*

	# boxes	PEIban	PEOban
		man-hours/ racimo	man-hours/ box packed
Farm no. 1,	960	0,155	0,161
Farm no. 2,	980	0,153	0,156
Estimation,	1000	-	0,152
Farm no. 3,	1965	0,196	0,151
Farm no. 6,	1968	0,183	0,151
Estimation,	2000	-	0,153
Farm no. 4,	2495	0,150	0,136
Estimation,	3000	-	0,126
Farm no. 5,	3360	0,150	0,129

4. THE POST-HARVEST OF ROOT AND TUBER CROPS

4.1 General description

The root and tuber crops are mainly grown for their edible underground parts. The two main species grown in the NAZ nowadays are cassava (*Manihot esculenta*) and yam (*Dioscorea alata*), with their local names being respectively *yuca* and *ñame*. Other root and tuber crops, like tannia (*Xanthosoma sagiattifolium*, tiquisque), eddoes (*Colocasia esculenta var. antiquorum*, chamol or ñampi) and dasheen (*Colocasia Esculenta var. esculenta*, malanga) also occur according to Stolzenbach (1989), but are not taken into account in this research. This is done partly because of their relative low importance in the land use of the NAZ and partly because only cassava is distinguished in USTED.

Also known as manioc or tapioca, cassava is a specie occurring in cultivated state in almost all the tropical areas (Purseglove, 1987). It is essentially a lowland tropical crop that is often used as last crop taken into rotation in shifting cultivation, since it will produce an economic crop on exhausted soils unsuitable for other production. It requires low financial and (manual) labour input (Stolzenbach, 1989). In the period from planting till harvesting (on average some 10 months) it reaches an altitude of 1-3 meter. Since the roots begin to rot within 48 hours after being taken from the ground, they are usually dug individually as required, accounting for a yield of some 12-15 tons per hectare.

The yam specie mostly cultivated in the NAZ, *Dioscorea alata*, is also known as greater yam, water or white yam and Asiatic yam, the last name being derived from its original cultivation area, South-east Asia. It is the highest yielding of the cultivated yam and is for this reason one of the most preferred yam species world-wide (Purseglove, 1985). It requires at least 1.500 mm of rain for maximum production. The tubers are variable in size, shape and colour and are usually produced single, normally weighing some 5-10 kg each. After a growing period of about eight to ten months the yam is harvested, yielding on average 12 ton per hectare (Stolzenbach, 1989).

Great majority of the roots and tubers produced in the NAZ are sold on the international market, whereas the USA and Puerto Rico together import about three-quarter of Costa Rican national production. Other significant importer is Europe. For some reason or another prices received by the producers and the packing plants vary considerable, especially on the long term. For example, actual price for a box cassava (23 kg) is about $ 11,- but varied during the last couple of years between $ 5,- and $ 14,- (E. León, pers. com.). This instability is narrow related to the occurring fluctuations in cultivated area: due to its relative short growing period and its low financial input a lot of farmers decide to plant cassava in periods of high prices. This extension of the cultivated area make the prices drop, thus initiating a reduction of the amount of grown cassava on the contrary. Stolzenbach (1989) names a few other market related problems concerning the cultivation of root and tuber crops, which will not be discussed here.

4.2 Description of the post-harvest process

The post-harvest of root and tuber crops is in general not very complicated; only the application of the paraffin wax in case of cassava requires mechanical equipment. The wax is needed to prevent the centre of the root to become black and thus inedible. Good logistic planning is required, since the paraffin preferably must be applied the same day that the cassava is harvested. On rainy days, the packing process is therefor significantly less efficient, as the product has to be dried with the help of heated air. On the other hand, yam is (just as most other root and tuber crops) normally harvested two or three days before planned packing, thus creating sufficient time for the drying process.
After the product is taken out of the ground it is brought to the packing plant where it is washed (sometimes mechanically) and dried. In the case of cassava the paraffin is applied as soon as the product is dry, whereas yam is enfolded in some kind of paper and directly packed into the cardboard boxes. All the various root and tuber crops are packed into boxes with a net weight of 50 libras (22,7 kg) when exported to the USA and Puerto Rico. European boxes weigh only 45 libras (20,4 kg), but their quality is higher because of the longer journey that has to be undertaken and they value in general one dollar more than the American boxes.

Table 4.1 *Number of workers (divided to gender) and aimed daily production of cassava and yam for various packing plants of roots and tubers in the NAZ. The two last quantities reflect the answers when questioning how many boxes (23 kg. each) could be packed daily if only cassava or yam was produced. Thus, this does not reflect the mean production since there is not packing every day. The numbers between brackets reflect the amount of workers needed for this production.*

	Number of workers			cassava production	yam production
	Total	Men	Women	(boxes/day)	(boxes/day)
Plant 1, a*	25-30	20-25	5	500-600 (30)	-
Plant 1, b*	31	25	6	500 (30)	1500 (15)
Plant 2	20	11	9	150	-
Plant 3	11-14	9	2-5	100-150 (11)	-
Plant 4	15-20	7-12	8	300-400 (15)	1000 (10)
Plant 5	20	12	8	-	800 (6)

* This plant was visited twice and thus two different persons could be interviewed. See also Appendix B2.

4.3 Results of the interviews

The packing plants visited are given in Appendix B2, whereas Table 4.1 gives the main data obtained during the interviews. Beside the average amount of workers, the mean daily production rates of cassava and yam as estimated by the interviewed persons are given.
Amount of product processed depends strongly on the demand on the market; only when a production order is received the owner starts to look for product to be processed. Because of the

significant market fluctuations, amounts of products processed per month or year can hardly be given.
Labour forces vary since in general a certain number of permanent workers is completed with temporary labour force when work pressure is high (note the varying number of workers as given in Table 4.1). The number of workers needed is estimated by the foremen on base of the kind of product, its quality and total time available. Especially the quality of the product has a strong influence on the packing rate: a clean and dry product can be packed up to three times faster than a soiled and wet product. In general an 8 hour working day was reported but in practice work does not end until the planned amount of tubers is packed. Sometimes this may be in the second half of the evening.
Most of the plants visited have their own acreage, but buy additional product from other (small) farmers. When these farmers do not have sufficient labour force for e.g. the harvesting, employees of the plant can be hired to perform this task. The same applies for other production activities like soil preparation and sowing. On a harvest day male workers start with the harvest early in the morning and continue until the needed amount of roots or tubers is collected. After that they may help the packing force to finish the process in the plant. All the described variations make it very hard (even for the foremen themselves) to give a good indication of the time needed to pack a certain number of boxes cassava or yam. This will be shown in the next section.

Representative data concerning the labour division on the packing plants of roots and tubers could only be obtained at the first farm, since it was in full process when it was visited for the second time. The labour division as observed in the second part of the afternoon is given in Table 4.2. In the morning the men had harvested the cassava, while the women started packing yam. After lunch the whole labour force was working in the plant to pack the production for that day: 350 boxes cassava and 1080 boxes yam.

Table 4.2 *Labour division divided to gender on a packing plant of roots and tubers. The two first row concern the packing of yam, whereas the other activities are related to the processing of cassava.*

	Number of workers		
	Total	Men	Women
Folding/stapling boxes (yam)	1	1	0
Packing boxes (yam)	7	5	2
Collecting dried product	6	6	0
Transporting product to packing site	2	2	0
Packing it into special iron baskets	2	2	0
Applying paraffin	2	1	1
Packing boxes	4	2	2
Weighing boxes	2	2	0
Packing the pallets	2	2	0
Affixing stickers	1	0	1
Miscellaneous	2	2	0
Total	31	25	6

4.4 Conclusions

About 30 % of the total labour force of the visited plants is female. Women tasks during the packing process are mainly selecting, packing and affixing the stickers with the commercial names. When there is no product to be packed they mostly participate in the washing of tubers and roots (which is packed a few days later) and the preparation of the sowing-seed which consists of the cutting of the roots and tubers in smaller pieces. Men always do the harvest and other occurring production tasks like sowing and fertiliser application. An estimation of the total worked acreage is hard to give since labour is often hired to other farmers. In general minimum wages are paid according to the interviewed foremen.

Table 4.3 gives the provision of employment for packed boxes of both cassava and yam, calculated on base of estimations done by the interviewed persons. PEIcas is derived from PEOcas using an estimated amount of 60% of gross yield being exported as first class product. This percentage was not available with respect to yam and therefor PEIyam could not be calculated.
The difference between the exactness of data concerning this two crops is striking: whereas the provision of employment for the yam processing is obvious some 0,07 man-hours per box, the indicators concerning cassava show a high variation. This can be caused by earlier mentioned phenomena like different crops qualities, which makes it even for the professional foremen difficult to give estimations of the daily production rates. The first plant visited seemed better organised than the other ones (e.g. mechanical washing was performed), thus accounting for a higher efficiency. Note that the three different PEOcasses calculated for this farm show low variations, which indicates that they are a good representation of the provision of employment on this packing plant.

Table 4.3 *Provision of employment in the post-harvest of cassava (PEOcas) and yam (PEOyam) in man-hours per box (23 kg) packed. All indicators are based on estimation by the foremen except for Plant1_b2, which was calculated on observations during processing.*

	PEIcas	PEOcas	PEOyam
	manhours/ kg	man-hours/ box	man-hours/ box
Plant 1, a*	0,012	0,44	-
Plant 1, b1*	0,013	0,48	0,08
Plant 1, b2*	0,011	0,41	0,07
Plant 2	0,022	0,83	-
Plant 3	0,019	0,70	-
Plant 4	0,009	0,34	0,08
Plant 5	-	-	0,06
Average	0,015	0,58	0,07

* A and b are based on data obtained during two different visits. B1 reflects an estimation of the foreman, whereas b2 is based on own observations.

5. THE POST-HARVEST OF PALM HEART

5.1 General description

Peach palm (*Bactris gasipaes H.B.K.*) is cultivated for two different purposes, both occurring in the Northern Atlantic Zone. Originally it was grown in Central and northern South America for its fruit, the pejibaye. During the course of this cultivation trees may reach an altitude of some 18 meters, starting to bear fruits at 5-8 years and continuing production for 50-75 years (Purseglove, 1985). However, the last decade there has been a growing demand for palm heart, the inner part of the peach palm stem. These palm hearts, locally known as *palmito*, are prepared from the growing tips of the trees and are harvested in the juvenile stage. Mostly this is after 12-18 months, before reaching the stage of sexual reproduction. When the palm hearts are harvested stem diameter varies from 9 till 15 cm (MORA UPRI et al., 1984, as referenced in Roeland, 1994), with the former noticed more and more in the NAZ nowadays. Since every year two or three palm hearts can be harvested per plant, yields vary from 5.000 up to 10.000 palm hearts/ha/year, primarily depending on weed control and fertiliser application.
Climate conditions in the NAZ are excellent for the growing of peach palm. It is believed that peach palms performs at best in those regions that are characterised as humid tropical forest, the natural habitat of peach palm. Requiring precipitation of 2.000 - 6.000 mm (preferably with low variation through the year), temperatures between 24 and 28 °C, and an altitude between 0 and 2000 masl, palm heart occurrence in the NAZ is not limited by climate conditions.
Since palm heart is of a growing economic importance, cultivated area in the NAZ has been increasing during the last decade and a further upraise is expected due to the actual high prices. Zamorra (1990, as referenced in Chin-Fo-Sieeuw, 1994) stated that 98% of all the palm heart grown in Costa Rica can be found in the regions Huetar Atlántica and Huetar Norte. About ninety percent of total produced palm heart is exported to France, while the USA and Canada also import this product and other countries like Guatemala, El Salvador and especially Australia are potential importers. Actual price of a box first class palm hearts is about $ 28,-, which is converted some $ 5,30 per net kilogram canned.

5.2 Description of the post-harvest process

The information presented in this section is based on observations in packing plant *Palmitos de Guápiles*. Processing in this plant is mainly carried out with the help of manual labour, in contrary to packing plant DEMASA, which has a far higher mechanisation rate, especially concerning the peeling and cutting of the palm hearts. Therefor DEMASA handles great majority of regional produced palm heart, as will be shown in the next paragraph. Since visiting of DEMASA is not allowed by the owners, exact data with concern to this plant lack, though main principals are the same for all the plants.

The fresh harvested palm hearts are mostly brought into the processing plants by the farmers themselves, after which a sample is taken to check the degree of acidity[2]. The product is put into large round baskets (*canastas*), each one containing about 200-250 palm hearts, in order to scald

[2] This is only reported for DEMASA by A. Nieuwenhuyse (pers. com.), it is not clear if it is carried out in the small plants visited too

them for about 10-15 minutes in water of some 95 °C. This is primarily done to facilitate the peeling and cutting of the palm hearts. The outer peel and the meristem are removed manually and from the residue three or four parts (according to the length and quality of the palm heart) of about 9 cm are cut. Since only the inner part of the thus formed cylinders is suitable for first class exportation, the outer part, which is too hard, is removed. The remaining product is placed on a conveyor belt and transported to the packing site, where they are lightly scraped and packed into cans with a net weight of 220 grams each. During this first part of the packing process the palm hearts have been handled in chlorine water continuously to prevent contamination.
The cans are filled with a solution of water, salt, sodium chloride and citric acid, after which they are pasteurised for about one minute. The cover is affixed with the help of high pressure. Finally a sterilisation of about 15-20 minutes is performed to make the product commercial acceptable. In addition to this De Haan (1988a) mentions only a single thermal treatment (93 °C) of 90-120 minutes after the cans have been secured. The meristem and other hard parts not suitable for first class exportation are processed by a special labour force and exported as residual product.
Once the product has been canned no special storage conditions are required, only a 15 days observation period is needed. When the product is contaminated in one way or another the cans will distend due to the rotting process and are naturally excluded from exportation. However, when no problems occur, the cans are packed into cardboard boxes (24 cans per box) and a label is stuck on before they are loaded into the container.

Table 5.1 *Main data of three palm heart packing plants in the Northern Atlantic Zone.*

		Packing plant		
		DEMASA	Colegio Agropecuario	Fincas de Guápiles
Production per day	palmh./day	100.000	4.600	4.000
Number of workers	-	390	16	30
Number of men	-	190	4	6
Number of women	-	200	12	24
Wage	colon/day	1.850	2.000/2.500	1.740

5.3 Results of the interviews

5.3.1 Empacadora DEMASA, Guápiles

Data with concern to this plant were obtained from A. Nieuwenhuyse (pers. com.) and since there are no possibilities to visit this plant, only general data can be presented in this section.

Appendix B2 gives the main characteristics of the visits of the tree palm heart packing plant, whereas Table 5.1 gives the main data obtained. From the 200 female workers of DEMASA, only 5 have administration tasks. All the labourers work 5 hours extra (next to the normal 40 hours) on Saturdays and earn 45.000 colon on a month base. Producers who deliver their product to this plant receive 80 colon per palm heart.

5.3.2 Empacadora Colegio Agropecuario, Guápiles

Since there are some financial problems this plant did not handle any palm heart in the days it was visited.

In general the plant is nine months per year in production, handling an estimated 4.600 palm hearts per day (varying between a minimum and maximum of some 3.000 and 5.000 palm hearts per day respectively). On average 44 palm hearts are needed to pack one box of first class export product (5.280 grams). Work begins at 5 a.m. with the cooking process (two persons) and at 6 a.m. overall production starts, normally lasting till about 4 p.m. Most labour intensive activities are the manual peeling and cutting carried out by nine workers. The packing and closing of the cans is performed by two persons, while the other five workers (mostly male) are responsible for the supply and drainage tasks. Wages are paid according to the daily production: 2.000 and 2.500 colon per day when respectively 3.000 and 5.000 are handled.

Table 5.2 *Participation per activity divided to sex in the palm heart packing plant Palmitos de Guápiles. Description of the various activities is given in paragraph 5.2.*

	Number of workers		
	Total	Men	Women
Administration	3	3	0
Scalding/peeling	3	3	0
Cutting meristem	1	0	1
Cutting first part	1	0	1
Cutting part 2-4	5	0	5
Removing soft part	3	0	3
Cleaning and packing	5	0	5
Weighing	2	0	2
Adding of the liquid	1	0	1
Affixing the cover	1	0	1
Packing boxes*	2	0	2
Processing the meristem	3	0	3
TOTAL	30	6	24

* This activity is not done on the day of production but the day after.

5.3.3 Empacadora Finca de Guápiles, Roxana

Own acreage of the plant consists of 90 hectares, while as much additional product as possible is bought. Table 5.2 gives the activities performed during processing divided to gender. In total 30 persons are employed, of whom 28 are working on the day of production; the other are women who come to pack the cardboard boxes the day after.
Knowing the overall efficiency of 40 palm hearts per box, about 100 boxes are packed daily, each bringing in $28,-. Farmers who deliver their product to the plant are paid $ 0,31 which is a rise of about 30% in comparison with January 1996, when $ 0,24 was paid per palm heart of 132 grams.

During a conservation with one of the administrators some additional information about packing plant DEMASA was obtained. The difference in realised product efficiency is very striking: using their peeling machinery (which peels about 40 palm hearts per minute) 60 palm hearts are needed to pack a single box.

Table 5.3 *Provision of employment in the post-harvest of palm heart for the various packing plants in the Northern Atlantic Zone. The weighted average is calculated according to the relative daily production. PEIpal are the required man-hours for the processing of one fresh harvested palm heart, while PEOpal reflects the same quantity per net kg canned palm heart (first class)*

		PEIpal man-hours/palm heart	PEOpal man-hours/kg canned
DEMASA	men	0,015	0,17
	women	0,016	0,18
	total	0,031	0,35
Colegio Agropec.	men	0,008	0,07
	women	0,024	0,20
	total	0,032	0,27
Palmitos de Guápiles	men	0,012	0,09
	women	0,048	0,36
	total	0,060	0,45
Weighted average	men	0,015	0,16
	women	0,017	0,19
	total	0,032	0,35

5.4 Conclusions

Of all the work force of the three packing plants 54% is female. At *Palmitos de Guápiles* only the scalding is carried out by men, because handling the heavy and hot canastes and peeling the palm hearts with the machetes are physical hard jobs. The more fine-tuned cleaning, cutting and selection tasks are performed by women. It is uncertain to which extend this relation occurs within the plant of major producer DEMASA since tasks to be carried out there may be a little different due to the high mechanisation level.

Knowing the estimated amount of palm hearts needed to produce one box of 5.280 grams net and the mean weight of a fresh harvested palm heart which is 1,3 kg according to H. Hengsdijk (pers. com.), a first class production efficiency for the three plants can be calculated. Outcomes are respectively 9,2%, 10,2% and 6,8% which must be seen as the weight percentages of the fresh harvested palm hearts ending up in the cans as first class palm heart. Guzmán et al. (1984) reported an overall industrial efficiency (including all processable parts) of about 21%. The lower

efficiency of DEMASA might be explained from the fact that mechanical peeling is less efficient than manual peeling.

On the other hand this higher mechanisation grade has a positive effect on the efficiency reflected in the PEIpal and PEOpal as given in Table 5.3. The indicators of the last row of this table are weighted averages, taking the various plants into account according to their relative daily production. The indicators calculated for packing plant *Colegio Agropecuario* are a little low in comparison with the two other plants, especially when the mechanisation levels are borne in mind. This is likely to be caused by the inexact estimations, but since DEMASA accounts for great majority of regional produced palm hearts the weighted averages can be used as a reliable reflection of employment provision in the post harvest process of this crop.

6. THE POST-HARVEST OF PINEAPPLE

6.1 General description

The modern pineapple (*Ananas comosus*, local name *piña*) is a cultigen which was domesticated in pre-Columbian times in South America according to Purseglove (1985). It is not only cultivated for its edible fruits for local consumption, but also for its flesh and juice for canning and export, or for the export of whole fresh fruits harvested before they are fully ripe (Den Daas, 1993). Pineapples are best suited to tropical lowlands and to areas that have more than 635 mm rainfall per annum. The best mean temperature for cultivation is between 24 and 26 °C.
Normal growing period depends on type and size of planting material used and the possible application of hormones. Hormones guarantee an earlier harvest and a homogenous ripened field and are for this reason often used to plan a constant production over the year. Den Daas (1993) concluded that in the Atlantic Zone the crop cycle last about three years, not accounting the field preparation for the new cops which normally takes about 1-3 months. In this three years two crops can be cultivated, namely the first crop and the ratoon crop. According to ANON (1984), as referenced in Den Daas (1993), fresh fruits yield in the Atlantic Zone on average 51 and 30 tons for the first and ratoon crop respectively[3]. The ratoon crop produces faster than the first crop but both the quantity and quality are lower.
Tonjes (1994) reported the cultivation of pineapple in the NAZ to be restricted to some parts of the zone. Besides an unknown number of small farmers who deliver their fruits primarily to the local and national market, two farms producing export pineapple are known nowadays. Its further occurrence may be restricted by the climate conditions (especially insufficient radiation) and the competition with banana cultivation, which occupates the best soils.

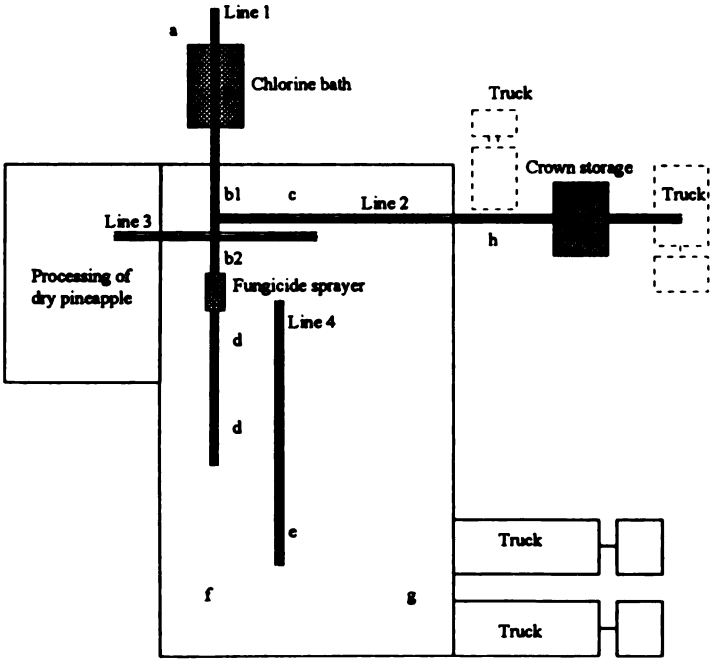

Figure 6.1 The pineapple packing plant of Finca Francia, Siquirres.

[3] Far higher yields are reported for farms visited, see section 6.3

6.2 Description of the post-harvest process

Figure 6.1 shows the pineapple packing plant of one of the visited farms, *Finca Francia*. The fresh harvested pineapples are transported from the field to the beginning of line 1 (*a*) where disinfection in a chlorine bath takes place. The pineapples are taken into the packing plant by a conveyor belt to be selected (*b1*) on basis of colour, infections and aesthetic features.
From the fruits not suitable for first class exportation the crown is taken of (*c*) to be used as seedling, in this case mostly on the other finca in the zone, *Matas de Costa Rica*. The uncrowned pineapples are either processed to so-called dry pineapple (*piña seca*, a popular kind of chips in Latin America), exported in special boxes or sold. In this last case their destination may be the local or national market or an other plant which cans the fruits. On spot *b2* someone performs this selection task. Both the fruits to be sold and the crowns are transported out of the packing plant (line 2) where they are separated (h) and stored until a truck comes to get them.
The pineapples are treated with fungicide and wax to prevent contamination and are then packed into different boxes (*d*) according to their destination. Boxes to be exported to the USA and England (19.28 kg) are bigger than the rest of the European boxes (11.79 kg). Number of pineapples packed per box differs also: at the beginning of the packing line the biggest pineapples are packed, leaving the smallest ones to be handled at the end of the line. Thus 7 to 18 pineapples can be packed into the various boxes. After being packed the boxes are placed on a rollaway (line 4) which transports them to the site where a sticker with the commercial name is stuck on and the weighing takes place (*e*). The boxes are packed on pallets (*f*), the pallets are secured and then placed into the containers (*g*).

6.3 Results of the interviews

As mentioned before, two big farms producing pineapple for the export are known nowadays in the Atlantic Zone (see Appendix B2). First one is *Finca Francia* and the second one is a farm of *Matas de Costa Rica*, a company also known for its production of ornamentals. However, production on this farm will not start till November, so that the data presented in this section are mainly obtained at the former farm.

6.3.1 Finca Francia, Siquirres

Gross production area of this farm consisted of some 200 hectares. Total number of workers is about 130, of whom 20 to 25 are daily harvesting and 24 people are working in the actual packing plant. When averaging first and ratoon crop a mean yield of 75 ton first class pineapple is produced per year and hectare. Knowing the fact that a weighted average of 29 % of the harvest product is rejected for first class exportation, average gross fresh fruit yield can be calculated as 106 ton per hectare. The weighted average is derived from earlier obtained data of the same farm, stating that respectively 25% and 35% of first and ratoon crops can not be exported as first class pineapple. The difference with the earlier mentioned literature reference of Den Daas (1991) can be explained by the far higher sowing density (80.000 plants/ha) used at *Finca Francia*.

Table 6.1 ***Labour division divided to gender on pineapple packing plant Francia. If necessary, workers may support their colleagues performing an other activity.***

Activity	Total	Men	Women
Selecting	3	3	0
Cutting the crown	2	2	0
Dry pineapple processing	10	0	10
Packing boxes	4	4	0
Affixing stickers/weighing	1	1	0
Packing pallets	2	2	0
Securing the pallets	2	2	0
TOTAL	24	14	10

Table 6.1 gives the labour division of the empacadora. The division to gender is very obvious: the only women employed on this pineapple farm are working in the processing of dry pineapple, since this is a hygienic and fine-tuned task. The pineapples are cut, dried and then packed into little plastic bags. On a week base about 900 kg dry pineapple is produced, requiring some 18.000 kg fresh harvested pineapple. Though the labour division in the actual packing plant is given, additional labour force is needed to make the post-harvest process realisable. These are mainly the five persons unloading and washing the fruits (site a, Figure 6.1), separating the fruits and crowns on line 2 outside the packing plant (site h) and loading the truck later on. For this reason 11 persons are on base of various observations added to the total post-harvest labour force. Finally, all the workers are paid 217.10 colon per hour and 150% of this wage for overtime hours. In general 6 working days of 8 hours each are reported.

6.3.2 Finca Matas de Costa Rica, Siquirres

Total area of this farm consisted of 270 hectare and still the last parcels had to be sown. On the moment 82 men were employed to do the normal production activities and an extra labour force of about 40 persons was planned when production will start: 28 workers for the packing process and 12 extra for the harvest of the fruits.

6.4 Conclusions

The total labour force accounted for in the post-harvest of pineapple on *Finca Francia* consisted for 29% of women, all working in the processing of dry pineapple. Table 6.2 gives the provision of employment divided to gender and production activity. This distinction is made since the female man-hours are dedicated entirely to the processing of dry pineapple and the total labour requirements of this activity are relative high. Further, the processing of this chips is not necessarily related to the post-harvest of pineapple; all the rejected fruits may also be sold on the national market or be canned in an other plant. It was assumed that two men are employed for the supply and drainage tasks of the dry pineapple process.
When data concerning working time and yields (obtained at Finca Francia) are combined with the few data known from Finca Matas de Costa Rica, a total PEOpinf of 3,45 can be calculated for the latter farm. This does well match the results given in Table 6.2.

Table 6.2 *Provision of employment divided to gender and production activity in the post-harvest of pineapple. PEIpinf (input) and PEOpinf (output) reflect these data with respect to the packing of (first class) pineapples, whereas PEIpind/PEOpind are related to the processing of dry pineapple. Per year and hectare about 75 ton first class pineapple and 0,23 ton dry pineapple is produced.*

	PEIpinf	PEOpinf	PEIpind	PEOpind
	man-hours/ton fresh pineapple	man-hours/ ton pineapple 1	man-hours/ton fresh pineapple	man-hours/ton dry pineapple
Men	2,72	3,83	1,39	27,7
Women	0,00	0,00	6,93	138,7
Total	2,72	3,83	8,32	166,4

7. THE POST-HARVEST OF MACADAMIA

7.1 General description

Macadamia (*Macadamia ternifolia*), also known as Queensland nut, is a small tree to 15 m tall, native of eastern Australia, but nowadays found in California, tropical Africa and the Americas (Purseglove, 1985). Commercial cultivation is mainly undertaken in Hawaii and Australia.
The fruit is a green follicle (*cascara*) consisting of a cavity which in general contains a seed, named the *concha* (Figure 7.1). This concha is spherical with a diameter of about 2.5 - 5.0 cm and has a hard, brown peel (De Haan, 1988b). The macadamia is grown for its yellow-white nut (*almendra*), which can be obtained by cracking the concha. Production rates differ enormous according to the age of the tree, planting density and climate conditions. The tree starts producing after about 4 years (± 200 kg concha/ha) and may reach a top production of 7000 kg concha/ha after its eleventh living year (Arguello A. as referenced in De Haan, 1988b). In practice most trees are cut down after about 20 years, while yearly production during this period is on average about 3000 kg concha/ha (De Haan, 1988b; M. Chacón, pers. com.).
The cultivation of macadamia is of a growing importance both on national and regional level, although its occurrence in the NAZ is still relative small compared to other cultivations. De Haan (1988b) reported that Limon province with 1941 hectares was responsible for 50 % of total national production in 1986, according to data obtained from the Banco Nacional de Costa Rica (BNCR). In these days an increase in national production area of about 1900 ha was expected for the following years. Nowadays there are four macadamia plants in the country, versus one in 1988. The macadamia nuts are mainly exported, with the USA, Japan and Europe being major importers. They can be digested in various kinds of food like bread, chocolate and cookies or are just eaten as a snack, although it is quite expensive: producers receive about $ 1,- per kg almendra. Those almendras unsuitable for exportation are destined for the local market or used as a base for oil and chips.

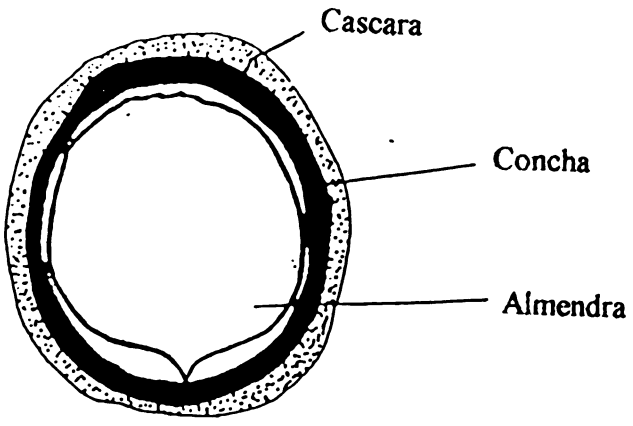

Figure 7.1 Intersection of the macadamia fruit

7.2 Description of the post-harvest process

Harvesting of the macadamia fruits is one of the less complicated: once the cascaras are mature they fall down on the ground and are picked up by the people harvesting, who earn about 200 colon per basket of 5 kg each. On the farm the outer peel is removed (the so-called *descascarado*), by using a mortar which cracks the cascaras against the wall of the iron cylinder. Because this mechanism is not capable to separate the cascara peel from the conchas manual labour is needed to finish the job. The conchas are delivered at the processing plant, where a sample of exactly one kilogram is taken. After being dried and peeled the nuts of this sample are divided in different categories: exportation class, unsuitable for exportation and unsuitable for consumption at all. The division between these different classes determines the amount of money paid to the producers. The conchas are stored in big elevators until processing is started. When the elevator is emptied the conchas are led into a small water basin as a first selection procedure: the ones that remain floating contain an infected almendra or may not contain a nut at all, the ones sinking are used for further processing.
To reduce the initial moisture content of about 20 - 25 % to the aimed 1,5 % the conchas are dried for about 8 days in a big gas burned oven, in which a air temperature of 60 ° C is generated. This low moisture content is needed to detach the almendra from the concha so that the peeling of the concha, the *descortización*, can elapse successfully (De Haan, 1988b). The dried conchas are taken into the processing hall by a conveyor belt after which a suction-pump transports them into the attic where they are cracked using the same principle as in the peeling of the cascaras. The material leaving the machinery consists, beside of undamaged almendras, of cracked concha peel and almendras of which the concha is only partly removed due to its extreme hardness. All this material is led through a big rotating cylinder with different sized holes in the wall to make a first size related selection and to separate the majority of the cracked peel as residue. All these different (product) classes fall down through a small pipe, meanwhile treated by high air pressure to remove part of the accompanying peel residues.
The selection procedure is the most labour intensive part of the whole production process: good almendras (or parts of them) have to be taken out of the material mechanically defined as residue, and on the other hand are the peel residues taken out of the almendras. Ultimate selection job is the manual division of the nuts in various size classes for those nuts that are not divided correctly by the rotating cylinder. Export classes are normally defined as Premium 1 and 2, with the latter nuts being smaller than the first ones. The selectors have the responsibility over the division between these different classes and the various classes nuts not suitable for exportation. The almendras are packed into boxes with varying weight. The residues, mainly consisting of cracked peel accompanied by nut waste, can be used as cattle feed (though very rare), fuel for the drying of coffee or as organic matter.

7.3 Results of the interviews

7.3.1 Finca Ventura, Guápiles

In total 6 fincas in Guápiles and Siquirres delivered their products to the processing plant, covering a estimated area of 300 ha. Throughout the year about 50 workers are doing the regular agricultural production jobs (e.g. spraying and fertilising) on these farms; 100 extra workers are

hired for the harvest period, normally lasting from July until January or February with peak time in September and October.
Table 7.1 gives the main production data of a few processing days for this plant. Work starts at about 6 a.m. when 6 workers begin to clean the factory before actual processing starts at 6.30 a.m. with the entire labour force. Breaks for breakfast (15 minutes) and lunch (45 minutes) are at 8 a.m. and 11 a.m. respectively. On average processing last until 2 p.m. after which everyone helps to clean the factory again. Table 7.2 gives the work division between sexes for both plants visited. In total 13 workers are actually working in the plant, though 3 additional workers are needed around the plant in the process preparation: these are jobs like the reception of the product and storing and drying of the conchas. Because they do a permanent post-harvest related job, these workers are also counted to the post-harvest labour pool within this research. This does not apply for the administrators, though a high percentage of the administration tasks (carried out by 4 persons) is directly related to the processing on the plant and only for a fraction to the finca itself. All the almendras are packed into 10 kg boxes with prices varying from $ 8,50 - $ 11,- according to the various quality classes. Mean price can said to be $ 10,- per box

Table 7.1 *Main daily production data for a macadamia plant in Guápiles. The various indicators are described in the main text after the table.*

Description	Unit	29/08/97	06/09/97	10/09/97	11/09/97
Processing time	hour	5,8	2,3	6,3	6,4
Amount of workers	-	16	16	16	16
Prod. Premium	kg	275,3	103,0	332,8	348,1
Prod. Commercial	kg	65,7	31,8	81,7	95,0
Prod. Oil	kg	52,6	28,0	42,2	47,4
Prod. Chips	kg	18,4	0,0	0,0	0,0
Total produced	kg	412,0	162,8	456,7	490,5
Bad nuts, residue	kg	21,8	17,3	38,6	38,7
Percentage residue	%	5,0	9,6	7,8	7,3
Overall efficiency	kg/hour	51,5	-	57,1	61,3
Proc. efficiency	kg/hour	71,0	70,8	78,6	76,6

* No information available about the total hours worked on this Saturday.

Processing time is the time period actually dedicated to processing itself and not to additional jobs like cleaning or the maintenance of machinery. The production amounts are given in kilograms almendra with on average 70 % of total production being exported (Premium), the remainder is dedicated to the national market or digested in oil or chips. The overall efficiency is based on the 8 hours working day, the processing efficiency on the earlier mentioned processing time. Both indicators are calculated not accounting the amount of bad nuts.

7.3.2 Planta Sol Caribe, Turrialba

This is a single packing plant not having any acreage itself. Fruits are obtained from 6 associated fincas with a total acreage of about 250 ha and from small independent farmers both living in- and outside the Atlantic Zone. Processing period is from June till the end of December also with peak

time in September and October. Estimated yearly production is 50.000 kilos almendra, corresponding with 250.000 kg concha en 500.000 kg cascaras. The relation between the amount of conchas and almendras is quite reliable: the administrator reported an overall efficiency for the whole plant of 19,5 %. This indicates that 19,5 kg almendras are produced per 100 kg conchas coming in. Mean daily production is 40 boxes export quality (*Estillo* 1 and 2) with each box containing 25 libras (11,3 kg) almendras and being worth some $ 11,-. About 75 % of total processed product is said to be of export quality. Thus the overall efficiency (as defined in table 7.1) can be calculated as 75,3 kg/hour.
Processing starts at 7 a.m. and lasts till 4.30 p.m. (1 p.m. on Saturdays), with breakfast (15 min.) and lunch breaks (40 min.). Wages are paid on a hour base, varying from 218 till 239 colon (social security included) and differ according to activities and sex: in general women are paid a little less. Table 7.2 gives the data concerning the work division on the plant. The administration tasks are carried out by two persons.

Table 7.2 Work division in two macadamia plants in the Atlantic Zone

	Amount of workers					
	Finca Ventura S.A.			Plant Sol Caribe S.A.		
Activity	Total	Men	Women	Total	Men	Women
Process preparation	3	3	0	5	5	0
Cleaning	-	-	-	1	0	1
Analysing	1	0	1	1	0	1
Selecting residues	4	0	4	2	0	2
Selecting quality	4	0	4	7	0	7
Selecting classes	3	0	3	4	0	4
Packing	1	1	0	1	0	1
TOTAL	16	4	12	21	5	16

Selecting residues consists of the separation of (part of the) almendras from the mechanical defined residue, selecting quality is exactly the opposite activity and selecting classes is the correction of mechanical defined classes. Cleaning is carried out by the whole labour force in Finca Ventura.

7.4 Conclusions

On average 75% of the whole labour force is female. Labour division is very obvious: those activities requiring high hygienic care (taking place within the actual production hall) are always carried out by women, accept for the man packing the boxes in Finca Ventura. Table 7.3 gives the provision of employment in the post-harvest phase of macadamia in the Atlantic Zone.

PEImac and PEOmac are calculated using separate data of the visited packing plants. With concern to Finca Ventura overall efficiency (as defined in table 7.1) was estimated to be 55 kg almendras per hour, for the second plant the earlier presented overall efficiency of 75,3 kg almendra per hour was used to calculate the PEOmac. Notice that, despite the fact that the PEOmac for Finca Ventura is derived from detailed administration data, the provision of

employment calculated for the second plant (based on estimations from the administrador) is almost equal to the indicators for the former plant.

Table 7.3 *Provision of employment in the post-harvest of macadamia in the Atlantic Zone. PEImac and PEOmac respectively reflect the provision of employment related to product input and output of the packing process*

		PEImac	PEOmac
		man-hours/ kg concha	man-hours/ kg almendra
Finca Ventura	men	0,015	0,07
	women	0,044	0,22
	total	0,059	0,29
Plant Sol Caribe	men	0,013	0,07
	women	0,042	0,21
	total	0,055	0,28
Average	men	0,014	0,07
	women	0,043	0,21
	total	0,057	0,28

8. CONCLUSIONS

Table 8.1 gives the data on the number of interviews performed, female participation and provision of employment in the post-harvest process, all divided to the five crops distinguished in this research. Provision of employment is given in two different units: man-hours per 100 net kg packed product (directly derived from the indicators presented in the previous chapters) and man-year/ha. The latter is done to make comparison between the different crops possible. Banana and pineapple production create the highest post-harvest employment (0,16 and 0,14 man-year/ha respectively), whereas macadamia accounts for the lowest post-harvest labour requirements, 0,08 man-year/ha. These indicators give the average labour demand throughout the whole year. Notice that some crops have a restricted harvest period in which all this labour has to be available.

Table 8.1 *Number of interviews performed, female participation and provision of employment in the post-harvest, divided over the various crops distinguished in this research. The estimations used to calculate the indicators of the last column are given in Appendix E.*

	# interviews	female part.	Provision of employment	
	(-)	(%)	(man-hours/100 net kg packed)	(man-year/ha)
Banana	6	24	0,83	0,16
Cassava	6	30	2,52	0,11
Yam	6	30	0,30	-
Palm heart	3	54	35,0	0,11
Pineapple	2	29	0,38	0,14*
Macadamia	2	75	28,4	0,08

* Only accounting for the packing of first class pineapple and not for the production of dry pineapple.

Provision of employment in the packing of bananas varies according to the amount of boxes to be packed daily. When only one container (960 boxes of 18.14 kg each) has to packed some 0,16 man-hours are needed per box, whereas this is about 0,12/0,13 when over 3000 boxes have to be packed. Knowing the average production for the Atlantic Zone (1996) of 2.175 boxes/ha/year (CORBANA, 1997) and mean acreage of 270 ha per plantation, the mean number to be processed on one day per farm is about 2.300 boxes (estimating 260 days production per year and one packing plant per farm). For this reason an average of 0,15 man-hours per box is recommended for labour requirements in the post-harvest of banana.

The structure of the roots and tubers production in the NAZ makes it difficult to collect representative data concerning the provision of employment in the post-harvest of these crops. For the packing of cassava an average of 0,58 man-hours per box of 22,7 kg was found, though variation between the various data was high: PEOcases calculated for the different plants ranged from 0,34 to 0,83 man-hours/box. For this reason further research is needed to obtain more reliable data.
The packing of yam requires a labour force of about 0,07 man-hours per box packed.

Palm heart processing in the NAZ is mainly performed by packing plant DEMASA, reaching for a daily production of about 100.000 palm hearts. Labour requirement is 0,032 man-hours per palm heart processed, which is converted some 0,35 man-hours per net kg canned. Notice that for DEMASA a conversion factor of 60 fresh palm hearts needed to pack a box of 5,28 kg is used, whereas this is about 40-45 palm hearts/box for the smaller packing plants. With respect to DEMASA this conversion factor was estimated by someone who had been working for this plant. However in practice this ratio may be a little different (most likely lower), but this was the only information that could be obtained.

On the moment *Finca Francia* (Siquirres) is the only farm in the NAZ producing pineapple for exportation. Labour demand is 3,83 per ton first class pineapple packed and 1,66 man-hours per kg dry pineapple produced. Two men and 10 women are working daily
in this last process, whereas no women are contracted for the packing of first class pineapple.

Female participation is highest in the post-harvesting of macadamia: to pack one kg almendra 0,28 man-hours are needed, of which 75% is contributed by women.

The post-harvest process of the various crops distinguished in this research are all balanced en highly efficient, except for the packing of roots and tubers. It has to be borne in mind that the data presented in this report only concern the actual situation and that future developments in the land use of the NAZ may change this. For example, when more roots and tubers are to be produced, the post-harvest of these crops may become more efficient, since a higher and more stable product supply is secured. On the other hand, when the grown amount of one of the other crops decreases, actual packing process may become too expensive, thus initiating a less efficient process and a relative higher provision of employment per packed unit.

In general the labour division on the various packing plants is obvious. Women mostly are employed to do the more fine-tuned and hygienic jobs, e.g. selection tasks in the macadamia packing plant and processing dry pineapple. The physical heavy jobs are most likely to be performed by men, whereas on the other hand the affixture of stickers is always carried out by women since this is physically a more light task. This indicates that, contrary to on-farm female labour, women's participation in the post-harvest of the investigated crops show a certain grade of diversification since it is most likely that men will not be employed for the tasks presented as typical female in this report.
However, female participation is said to be decreasing in the last years (especially in the banana sector) and various reason are given for this development. One of the main influences is the actual social provisions. Work in the post-harvest processes was often underpaid in the past, but this becomes more and more difficult nowadays because of the better provisions and the increasing check on the social laws. Since a couple of years women also have a claim to (partly) paid pregnancy leave which affect their position as cheap labour force too. Nevertheless, in practice there still exist bad working circumstances, of which the earlier mentioned 'three months work structure' on the banana plantations is just one example. The statement obtained from one of the interviewed foremen that only women who not get pregnant are employed, indicates that practical discrimination of women still exists.

All the foremen said that minimum wages were paid at least. In the banana packing plants workers are paid both per hour and per box packed, according to their specific task. This is the only sector were earnings may varies between 2.000 and 2.500 colon daily. For the other packing plants minimum wages (or a couple of hundreds colones higher) are reported. Still, stories about underpayment are heard, but it is obvious that this information never can be obtained by means of interviewing foremen.

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First of all I want to thank my two supervisors, dr. ir. W. Huisman of the Department of Agricultural Engineering and Physics (Wageningen Agricultural University) and dr. ir. B.A.M. Bouman of REPOSA. Both persons allowed me a high grade of independence with concern to the arrangement and the performance of this traineeship, for which I am very grateful.

My work at REPOSA would have been nearly impossible if I had not received help from all the other employees of REPOSA. Especially I want to thank drs. Mark Joenje, for his willingness to accompany me performing the first interviews and for even dedicating a part of his free time to this. The tico's and tica's were irreplaceable in their help of getting things organised properly and teaching me Spanish.
Unfortunately it is impossible to name all the interviewed field experts and foremen personally. However, all of them showed their kindness and hospitality in paying attention to me during their working time. If it was not for them I would never have got to know the things I am aware of now.

The four months I lived with *familia Mayorga* in Guápiles make me look back upon my stay in Costa Rica as very pleasant too, since they gave me a lot of comfort on the social plane. The same accounts even more for my fellow students Arja, Kathryn, Wendy, Ytha, Hugo, Jelger and Karel which whom I had the most personal contacts. So thanks to all of you guys, for spending the weekends together, having nice meals, playing pool and having a drink.

10. PERSONAL EXPERIENCE

In first instance the subject of my traineeship seemed quite illogical for a student Agricultural Engineering. What in the world is the relation between women and e.g. mechanisation and control engineering? However, it was confirmed that this choice was not as strange as it seemed to be in the first place and I never regretted the work I have performed here since I believe it is very refreshing to look beyond the borders of your actual field of study sometimes.
First of all I learned to know the cultivation of a lot of different tropical crops and by means of visiting different sized farms and packing plants I got insight into the wide range of social and technical circumstances occurring in the agricultural sector of the Northern Atlantic Zone. Further on, looking at the social, culture bound influences in the agricultural production activities was experienced as very instructive. I learned that social aspects definitely have to be taken into account when developing a (land use) model.

The research circumstances at REPOSA are considerably good. After arriving at Juan Santamaria Airport there was someone to pick me up, the project offers sufficient housing sites and there are always good computers available. It was up to me to decide whether or not to be accompanied by one of the employees of REPOSA during my interviews and transport was never a problem during my traineeship.
However, an aspect on the social plane embodied the two things I would regard as less positive. This aspect is the occurrence of (mostly negative) stories about former students at REPOSA. Firstly I think it is always better to talk with people instead of about them, although I often see myself fail with concern to this also. Since I happen to know some of these former students too, my second impression is that both the REPOSA project and the students in consideration would have been better of if a little more attention was paid to these students in order to get them 'back on the track'.

My presupposition that performing a traineeship in a foreign country includes a lot more than just carrying out some kind of investigation, turned out to be true. I really learned a lot here, not in the last place due to the contact with my fellow students. The atmosphere created amongst us really reflected friendliness, which is not always natural when living so intensely with people you did not know before.

It is true that living in the Costa Rican culture is not that much of a shock when coming from Western Europe. Still, there are differences that give a good indication of the mentality and attitude to life of the local people. None of us knows how ones life will develop, but one thing is sure: this practical period in Costa Rica certainly will have a positive influence on possible future decisions whether or not to work in a tropical country.

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APPENDICES

A. List of abbreviations
B. Summary of the interviews that sustained the research
C. Figures concerning the banana packing process
D. Base interview
E. Calculations used for the data given in Table 8.1

APPENDIX A, LIST OF ABBREVIATIONS

ACPSAA	Association Campesina Pro-Soberania Alimentaria del Atlántico
ALOP	Asociación Latinoamericana de Oragnización de Promoción
APST	Animal Production System at a defined Technology
AZP	Atlantic Zone Program
BANDECO	Banana Development Company (Del Monte)
BID	Banco Interamericano de Desarrollo
BNCR	Banco Nacional de Costa Rica
CATIE	Centro Agronómico Tropical de Investigation y Enseñanza
COBAL	COmpañia Bananera AtLantica (Chiquita)
CORBANA	Corporación Bananera Nacional
CROPTCG	CROP Technical Coefficients Generator
EDECO	Programa de Enseñanza para el DEsarrollo y la COnservación
EEI	Environmental Effect Indicator
EUNED	Editoral Universidad Estatal a Distancia
FAEAP	Female Agricultural Economic Active Population
FAST	Feed Acquisition Systems at a defined Technology
FOLADE	FOndo LAtinoamericano de DEsarollo
GIS	General Information System
IDA	Instituto de Desarrollo Agrario
IICA	Instituto Interamericano de Cooperación Agrícola
LP	Linear Programming
LUST	Land Use System with a defined Technology
MAG	Ministerio de Agricultura y Ganadería
MNC	Mesa Nacional Campesina
NAZ	Northern Atlantic Zone
NGO	Non-Governmental Organisation
ORMA	Oficina Regional para MesoAmérica
PAST	PASture production system at a defined Technology
PASTOR	PASture and livestock Technical coefficients generatOR
PEI...	Provision of Employment related to the process Input
PEII	Pesticide Environmental Impact Index
PEO...	Provision of Employment related to the process Output
REPOSA	REsearch Program On Sustainability and Agriculture
SFC	Standard Fruit Compagny (Dole)
SITRAP	SIndicato de TRabajadores de Agrícolas y de Plantaciones
TC	Technical Coefficients
TCG	Technical Coefficients Generator
UICN	Unión Mundial para la Naturaleza
UNA	Universidad Nacional de Costa Rica
UPAGRA	Unión de pequeños Productores AGRopecuarios del Atlántico
USTED	Uso Sostenible de Tierras En el Desarollo
WAU	Wageningen Agricultural University

APPENDIX B, SUMMARY OF THE INTERVIEWS THAT SUSTAINED THE RESEARCH

In this appendix a general overview of all the performed interviews divided to my two research topics is presented. Thus, the first part reflects the summaries of the interviews with respect to the participation in agricultural production activities in the Northern Atlantic Zone. Appendix B2 gives a survey of all the plants visited to obtain information concerning the labour division in the post-harvest of bananas, root and tuber crops, palm heart, pine apple and macadamia.

B1 Interviews with respect to female participation in agricultural production activities

Table B1 *Persons visited in connection with the research into women's participation in agricultural production activities in the Northern Atlantic Zone of Costa Rica.*

Name	Organisation	Place	Date	Telephone
Cecile Fassaert	CATIE	Turrialba	16/07/97	556-64-31
Freddy Riviera	ACPSAA	Guácimo	29/07/97	716-50-27
Laura Perez	ALOPFOLADE	San José	30/07/97	253-30-18
Ilse Acosta	UPAGRA	Guácimo	01/08/97	716-64-59/96
Patricia Gamboa	ACPSAA	Guácimo	12/08/97	716-50-27
Rodrigo Alfaro	UNA	Heredia	13/08/97	277-32-95
Ivonne de Moor	UPAGRA	Guácimo	24/0997	716-64-59/96
Ilse Acosta *	UPAGRA	Guácimo	14/08/97	716-64-59/96
Doris Monge *	SITRAP	Siquirres	14/08/97	768-82-49

* These persons were visited with K. Faulkner in the scope of her research. Information obtained during this interviews is given in her report (see also Chapter 11, References).

Cecile Fassaert, CATIE

Cecile's concern on CATIE is the situation of the women on this institute and the attention for gender aspects in various projects.

Cecile told us not to underestimate the participation of women in agriculture and lent us two books concerning this subject. Furthermore she gave us a lot of names and telephone numbers of field experts, of which the most promising were contacted.

Freddy Riviera, ACPSAA

ACPSAA is a small non-governmental organisation (NGO) that focuses on uniting small farmers in the region around Siquirres, Guácimo and Guápiles. Their main objective is to support farmers produce more efficiently and sustainable.

F. Riviera is experienced in projectos productivos, which are projects that aim to create work for women among other topics.

With respect to gender related issues Freddy referred to a colleague at ACPSAA, Ms. Patricia Gamboa. She has done research into this subject and could give us quantitative information.
In general women living on small farms in the Atlantic Zone participate 100% in productive agricultural activities. Or with other words, there are no jobs that women principally do not perform, even the very heavy tasks are sometimes carried out by women. Beside the reproductive activities and the care for the smaller species in and around the farm-yard, they also contribute 40-50% of total agricultural production labour. However, it is very difficult to give quantitative information about women's participation in the various agricultural activities, because this differs a lot between various farms. (see also chapter 2). Riviera distinguished between five categories according to the participation of women:

- The woman supports the man (who is working full-time in agricultural production) with all the activities he wants her to. This kind of participation is the most common one in the Atlantic Zone.
- The woman takes care of all the activities on the farm because she lives alone on the farm; her husband died, left her (divorced or not) or she was never married. This does not mean that she will do all the labour herself, but she is the one in charge; she is the one that hires labour, decides what to grow, etc. A special form of this category are those women who are responsible for a small parcel of a certain crop, e.g. maize or palm heart, though this situation rarely occurs in the NAZ.
- The man performs off-farm work, e.g. for a couple of months on a banana plantation, and therefor the woman carries out most of the on-farm jobs during that period.
- Man and woman participate equally in all production activities.
- The woman has a special job by selling the agricultural products on the local market.

On our comments F. Riviera admitted that the last category is a little bit different from the other ones and can occur in combination with one of them. Finally he helped us with a long list of post-harvest plants (*empacadoras*), which was very helpful in the second part of the research.

Laura Perez, ALOPFOLADE

ALOPFOLADE is a NGO that is the Costa Rican part of a wider organisation called ALOP (*Asociación Latinoamericana de Oragnización de Promoción*), which works in whole Central en South America. FOLADE stands for *FOndo LAtinoamericano de Desarollo*. Majority of their time is dedicated to a project concerning the creation of a network that aims to support other NGOs in their tasks, especially with respect to the education of small farmers in the country side. For example, NGOs are taught how to use Internet in order to provide an updated price list of several crops. Individual farmers can

contact their NGO to obtain this information and use it in their negotiation with purchasers. Another focusing point of ALOPFOLADE is to make the total farm administration more efficient.

Laura Perez is agronomist and economist and she has been writing many project proposals during the last couple of years. She is also the project manager of the above described project.

With respect to quantitative data about our subject she promised to give us the Costa Rican data obtained during part of the IICA/BID project described in chapter 2. She referred to L. Madden[1], a name we also obtained from C. Fassaert (CATIE), as being a woman with good overview of all the available data.
Costa Rican women participate in all agricultural production activities. Only exception are the activities with a higher health risk, like the application of herbicides: in those activities their participation is usually less. It is obvious that their productive activities are not limited to autoconsumption. In most cases the women are the ones organising living, and even the production process, on the farm. When there is no yield available to be sold they have for example a few chicken in reserve which can be sold. They also sell products on-farm (selling on the market is a public job and therefor done by men) and can combine different (production) activities, e.g. taking care of the children and weeding the family garden, while the man does only one job at a time. Women participate in taking decisions as well, e.g. what to cultivate or when to sell. However, due to the 'macho culture', even the women state that men are the heads of the farm and that their own participation is negligible. Many of the official projects have been mislead by this, resulting in low efficiencies and wrong education: a lot of education is given to men, e.g. in extension work, although in many cases the women are the ones most involved. However, during the last years some changes occur, in favour of the women. There is more attention paid to women's work and they are taken more serious.
On the big production farms and post-harvesting plants, e.g. of palm heart and bananas, women's participation is very high because of the fact that they have got a very fine-tuned locomotion, which makes them very capable for e.g. selection and other activities. However, disadvantage is the fact that their work is judged by males, who are the heads of the production units, but have a worse insight in these voluntary movements. The percentage of country women participating in these activities is relatively low because they do not very often leave the farm to do off-farm labour.

Ilse Acosta, UPAGRA

Upagra is an NGO that has more or less the same objective as all the other ones: organising the small farmers and show them how to work more efficient and sustainable. It aims to be a central point for all the farmers where they can get answers to their practical questions. Upagra is a 19 year old NGO and most of the people work there on a voluntary base. Project financing is realised with the money of the same Belgian development fund that also supports ACPSAA, the other NGO we visited in Guacimo.

[1] Attempts to make an appointment with her failed since she lacked time

Ilse Acosta is the general secretary of Upagra. She participated in various projects stimulating the emancipation in different sectors.

During the first part of our visit at Upagra we joined a meeting of Costa Rican country women. They came together to discuss a project with the organisation of Christian Dutch Country Women called *Siembra Nueva*. This project aims to interchange knowledge and experience in order to develop the country side in a sustainable way. About 25 women showed up but there were also several women who were invited but did not appear. According to Ilse this is common with respect to the mobilisation of country women.
Ilse confirmed all the information we obtained got from literature and earlier discussions and did not really come up with new things: differences between varying farms are that great that it is impossible to make a general statement about women's participation. In general they participate in all production activities and because of culture bound beliefs they work most of the time in and around the farm yard. Participation is highest in sowing and harvesting because the labour pressure is very high in these periods. In most cases they participate equally with men in decision making on the farm. Unfortunately she did not have any quantitative information, she only referred to *Mujeres de maiz* (a book we already knew) as being the result of a good quantitative study.
Furthermore Ilse gave a lot of background information about the position of women general and her struggle to improve this situation, for example as being the only woman in the Mesa Nacional Campesina (MNC), the overall organisation of all the NGOs. We also got a better insight in the co-operation between various NGOs, CATIE and MAG in the Atlantic Zone.

Patricia Gamboa, ACPSAA

We visited Patricia on the advice of F. Riviera, who works for the same organisation. Patricia is the gender expert within ACPSAA.

The information obtained from literature and earlier conversations was again confirmed by Patricia. She emphasised the fact that Costa Rican country women are participating in all productive activities and are especially responsible for the work in family gardens, where most fruits and vegetables are cultivated for autoconsumption.
She stated that there exist women that do off-farm work, e.g. in other households or on plants that process bananas, macadamia and ornamental plants. The way the earnings are spent is variable: sometimes the man takes it and says what to do with it, in other situations the women are allowed to spend it by themselves. However, in this last situation the woman shall always spend this money on domestic items, e.g. food and clothes.

Rodrico Alfaro, UNA

Rodrico is the sub-director of the Escuela Ciencias Agricolas, part of the Universidad NAcional (UNA) in Heredia. The tasks of Rodrico are primarily administration and part-time education.

On this moment Rodrico is ending a thesis on the classification of different farm types in the Atlantic Zone of Costa Rica. The information this thesis is based on is obtained from 203 interviews in the cantons Siquirres, Guacimo and Pococi in the Limon province.
Part of the information refers to the place where the people interviewed were working (Table B2). Table B3 reflects the activities for those persons working off-farm.

Table B2. ***Place where the farmers are working, in percentages of total interviewed farmers.***

	Men	Women
On-farm	63.8	85.6
Off-farm	6.5	7.8
Both	29.5	6.7

Table B3. ***Activities for those farmers who only are working off-farm, in percentages of total interviewed farmers.***

	Men	Women
Day labour	42.5	23.8
Bananera/Exportation	23.3	42.9
Commercial	8.2	14.3
Others	26.0	19.0

With concern to the on-farm female work he did not come up with new things: women generally participate in every production activity and especially in planting and harvesting, because these are the activities requiring most labour.
One of the main problems in gender studies in Central America is the fact that women always will state that they are not doing any productive labour, even when they are sowing grass on that very moment, meanwhile watching their children (a situation Rodrigo bumped into once). Another problem, which was mentioned before by Ramirez A. et al (1994) is the culture-bound fear of men for their wives working off-farm: they feel threatened in their position as being the only one earning family income and for these reason often forbid women to do any off-farm work.
When women are doing off-farm work it mostly consist of working in an other household or a shop or restaurant. Rodrigo thought that women in general are able to spend this money on their own, but that it always will be dedicated to household issues.

Furthermore Rodrigo gave a lot of information concerning the general structure of agriculture in the Atlantic Zone of Costa Rica. More and more small farmers are relying on off-farm labour in their income generation. Working in a bananera is in most cases more profitable than working on their own farm. Therefore they are forced to leave their farms and do off-farm work. Rodrigo argued that due to this development the farmers in the Atlantic Zone are loosing their love for the agricultural field work.

In practice almost all bananeras use a so-called 'tree-month-work structure', which consists of the discharge of employees after three months, because they have a right to all kind of social provisions after this time period. Three weeks later the workers may be hired for another three months. Farmers, who often grow labour extensive crops like cassava, have the opportunity to do the necessary farm work in the few weeks they do not have to work on the plantations. Another option for these farmers is livestock farming, because this is also labour extensive and the cattle is a cash with a relatively constant value, whereas a lot of small crops (e.g. tuber and root crops) are often liable to high price fluctuations.

Ivonne de Moor, UPAGRA

Ivonne is a Dutch woman who has been working for over 4 years for Upagra. She can said to be the gender expert within this NGO.

As can be seen from table B-1 the visit of Ivonne took place a month after the other interviews. Thus, I could discuss all the obtained results with her, both in the investigation of female participation in the agriculture in the NAZ as in the first part of the research into the labour division in the post-harvest of the main crops grown in this area.
Ivonne agreed with the description and conclusions as given in chapter 2. Her impression was that the occurrence of family gardens in the NAZ is not that great as may be expected in first instance, though a lot of women would like to have some constant income for their own. Nowadays practice turns out that whenever there is some money to spend women will use this for food or issues for other persons and hardly never for themselves. Projects to stimulate the development of family gardens in some districts often fail due to mismanagement, a phenomenon that unfortunately occurs too often in relation with this subject. Furthermore, we had a good conservation about culture-bound influences with concern to this subject, which I appreciated a lot as to end my interviews series with.

B2 Interviews performed in connection with the labour division on post-harvest processing plants

Table B4 ***Main characteristics of the interviews performed in relation to the labour division on post-harvest processing plants. Function refers to the person with whom the interview was done. DM = Del Monte (BANDECO), CH = Chiquita(COBAL), DO = Dole (SFC). Nr. reflects the number of the farm as used in the main text.***

Produkt	Farm	Nr.	Place	Date	Function
Banana	DM, Guadalupe	1	Roxana	22/08/97	Administrador
Banana	CH, Il Banagro	2	Cariari	28/08/97	Capatas II
Banana	DO, Finca 3	3	Rio Frio	04/09/97	Capatas II
Banana	DO, Finca 4	4	Rio Frio	04/09/97	Capatas I
Banana	DO, Finca 7	5	Rio Frio	04/09/97	Capatas I
Banana	DO, Finca 10	6	Rio Frio	04/09/97	Capatas I
Root/tuber crops	3 km north Anita Grande	1a	Anita Grande	09/09/97	Administrador
Root/tuber crops	3 km north Anita Grande	1b	Anita Grande	14/09/97	Capatas I
Root/tuber crops	2 km south Jiménez	2	Jiménez	12/09/97	Comprador
Root/tuber crops	100 e, 300 n de la Bomba	3	Guácimo	16/09/97	Administrador
Root/tuber crops	Emp. Erwin León	4	La Rita	08/10/97	Administrador
Root/tuber crops	Emp. Luis Quiros	5	La Rita	09/10/97	Administrador
Palm heart	DEMASA	-	Guápiles	-*	-*
Palm heart	Emp. Coll. Agropecuario	-	Guápiles	12/09/97	Administrador
Palm heart	Palmitos de Guápiles	-	Roxana	08/10/97	Administrador
Pine apple	DM, Finca Francia	-	Siquirres	27/08/97	Capatas I
Pine apple	Finca Mata de Costa Rica	-	Siquirres	03/09/97	Administrador
Macadamia	Finca Ventura	-	Guápiles	11/09/97	Administrador
Macadamia	Finca Sol Caribe	-	Turrialba	17/09/97	Administrador

* Data obtained from A. Nieuwenhuijze.

Other visits in the scope of this reseach:

Pablo ?, 20/08/97, Puerto Viejo Sarrapiqui, Concept interview discussed.
Mininsterio de Trabajo, 21/08/97, Guápiles, information about minimum wages.
Wilmar Ulate (BANDECO), 23/08/97, Guápiles, 710-67-01, general information.
Harol Mena (COBAL), 27/08/97, Guápiles, 710-02-21, general information and interview.

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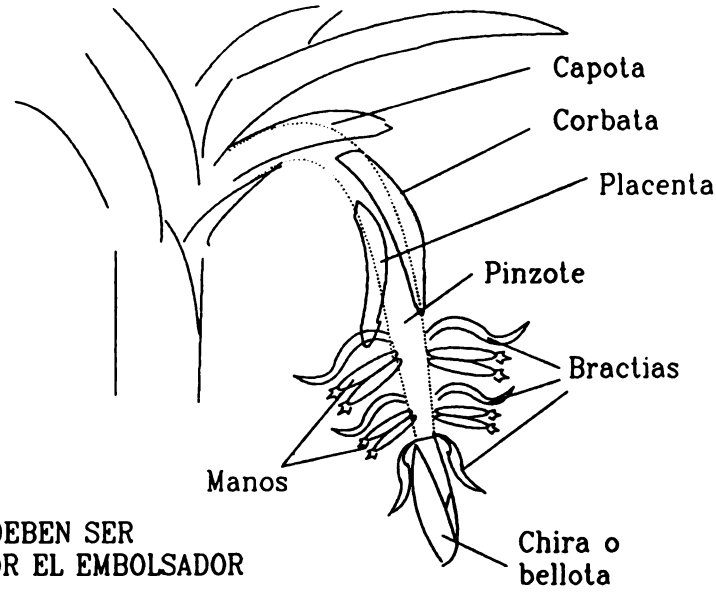
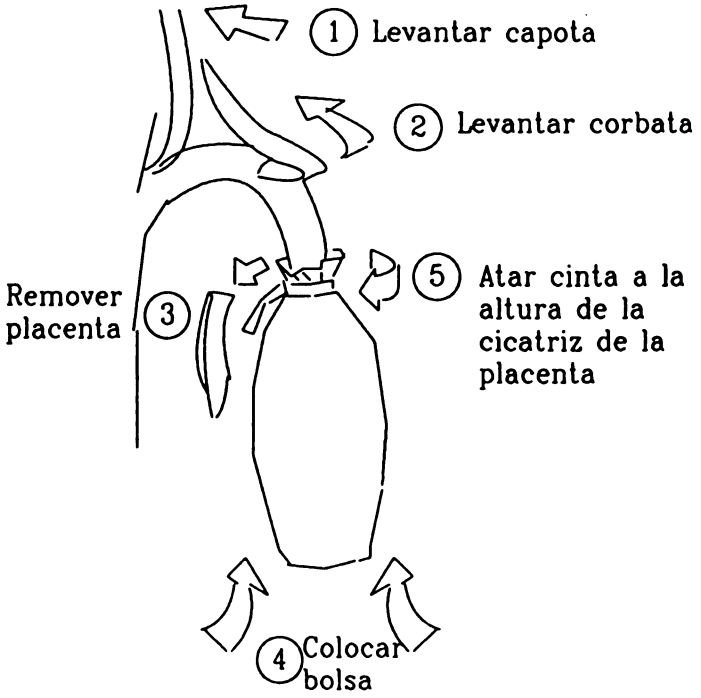


PARTES DE LA
PLANTA QUE DEBEN SER
CONOCIDAS POR EL EMBOLSADOR

PASOS EFECTUADOS DURANTE EL EMBOLSE



EMPAQUE DEL BANANO

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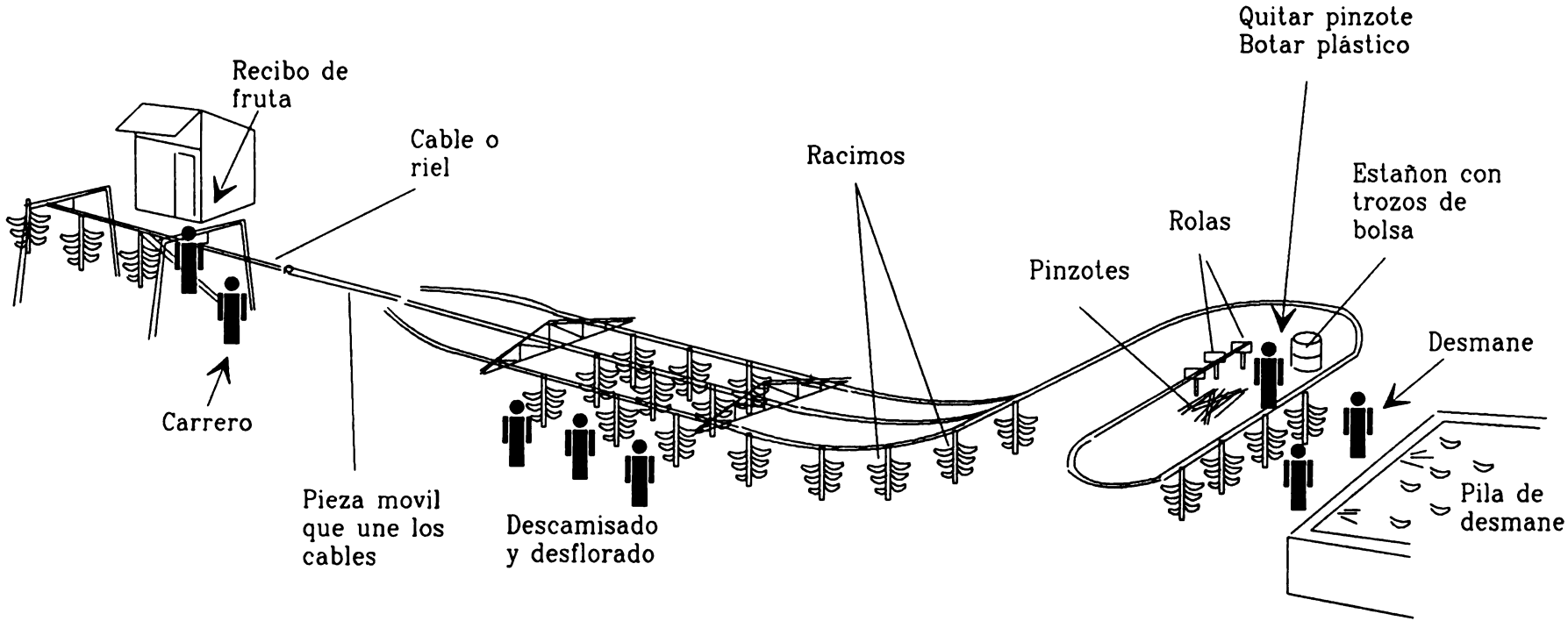

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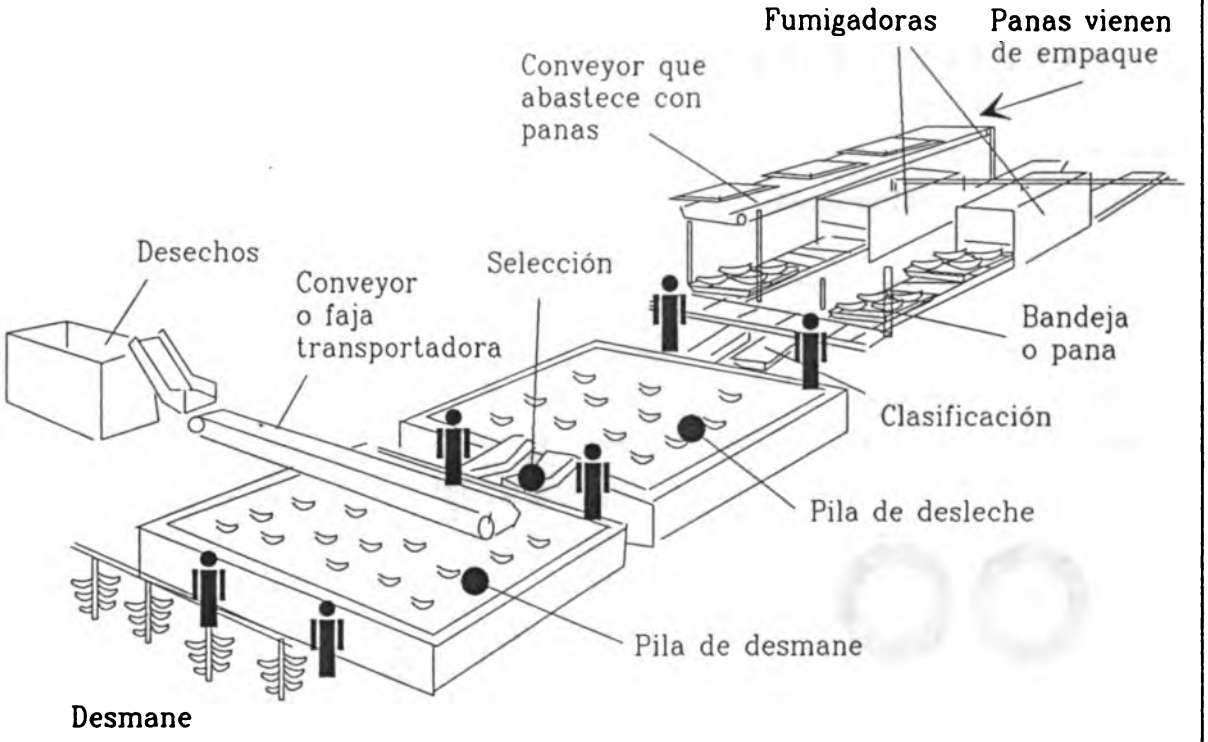

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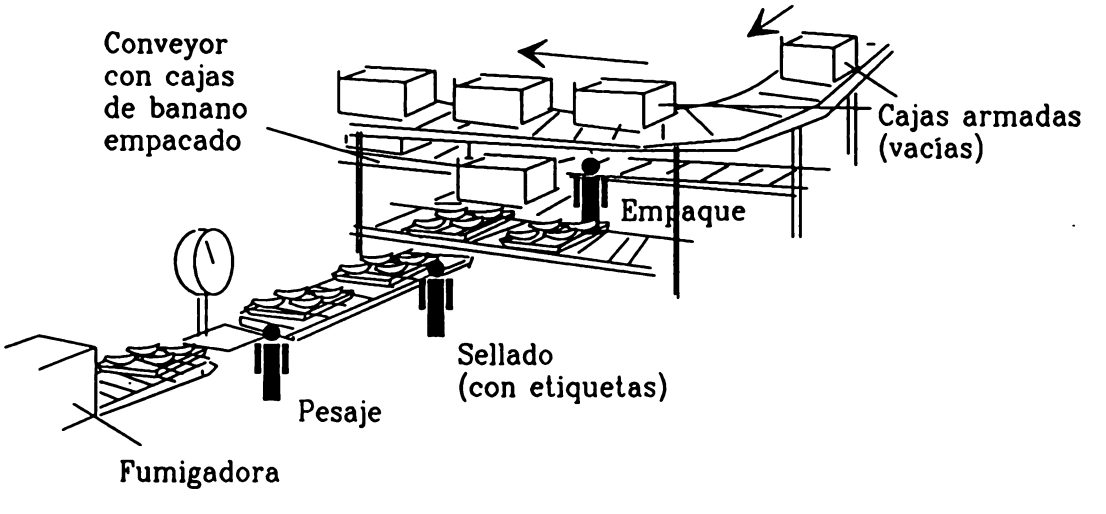
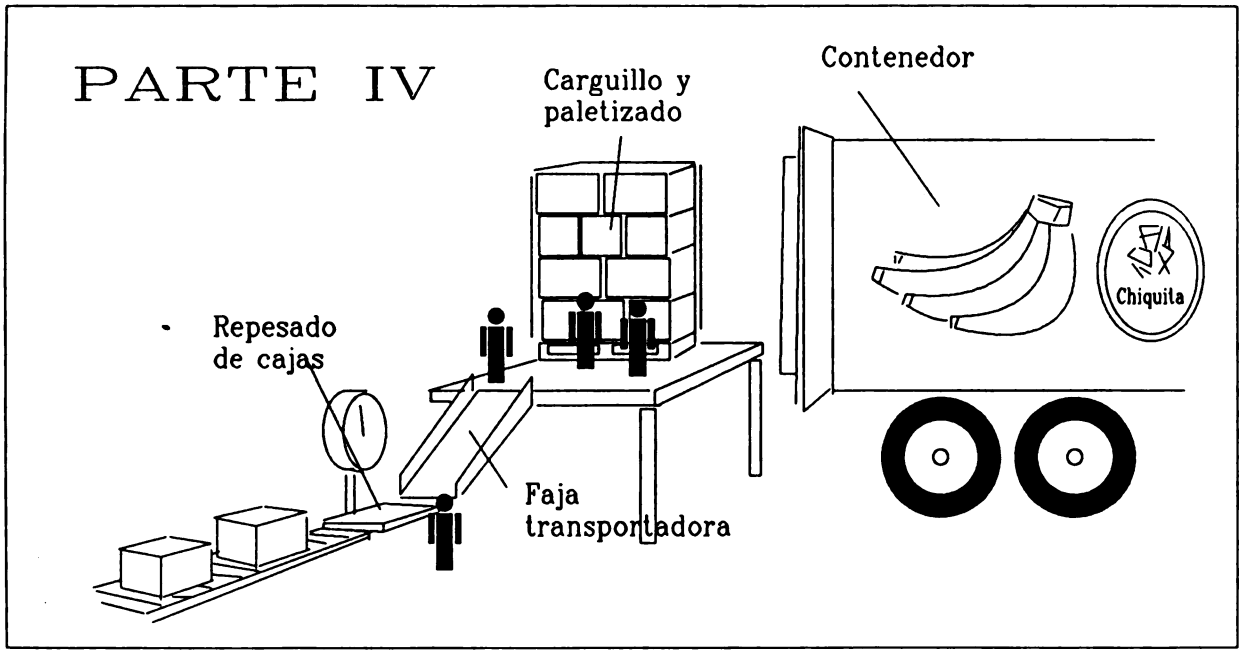
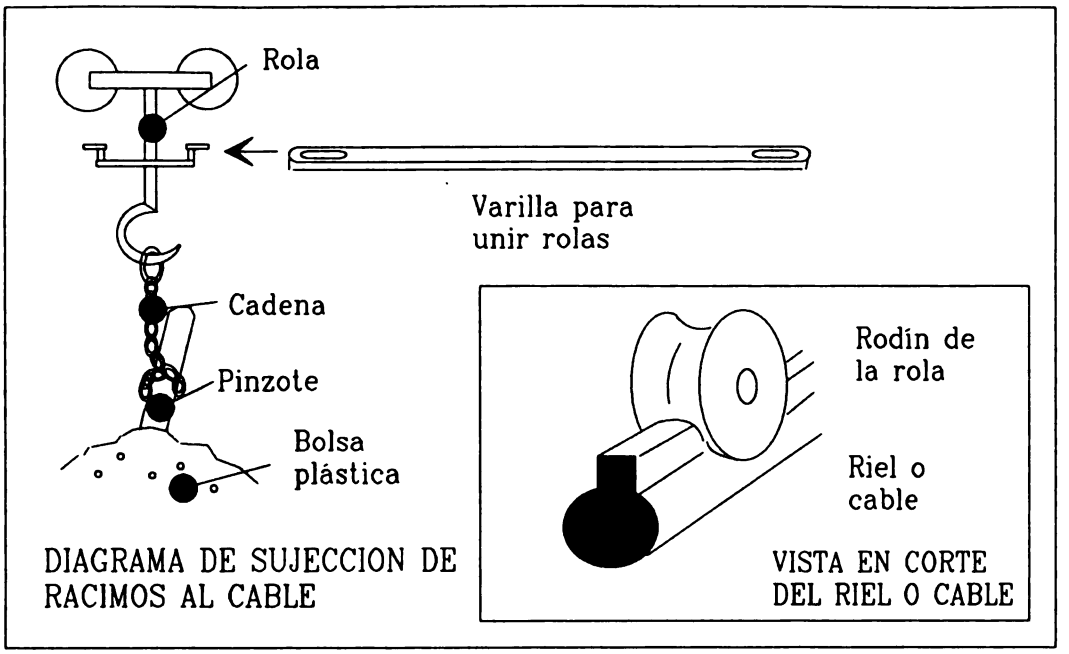
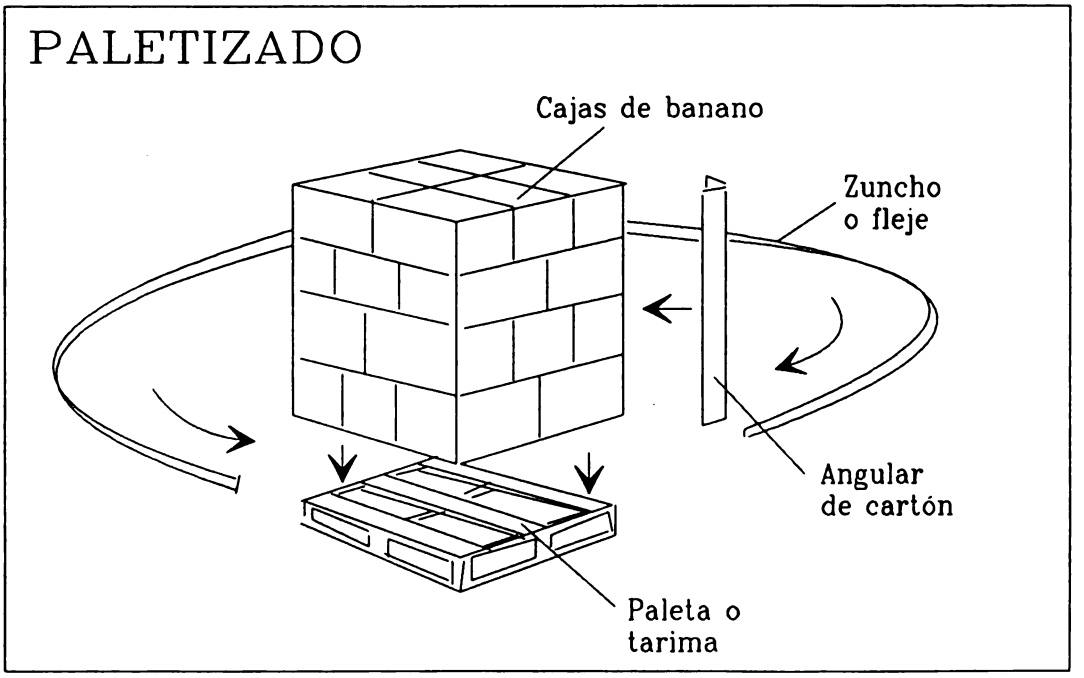


EMPAQUE DEL BANANO




Rola
Varilla para
unir rolas
Cadena
Pinzote
Bolsa
plástica
DIAGRAMA DE SUJECCION DE
RACIMOS AL CABLE
Rodín de
la rola
Riel o
cable
VISTA EN CORTE
DEL RIEL O CABLE


PALETIZADO
Cajas de banano
Zuncho
o fleje
Angular
de cartón
Paleta o
tarima

APPENDIX D, BASE INTERVIEW

REPOSA

REsearch Programme On Sustainability in Agriculture

Encuesta sobre el trabajo en la postcosecha de bananos, provincia Limon

A. Información general

Número de encuesta	BAN.....
Fecha	
Nombre de la finca	
Lugar	
Cantón	
Nombre	
Función	

Información general de la finca	
Independiente ò propia (cuál compañía)?	
Cuántas hectáreas tienen?	
Cuál es su producción anual (cajas/año)?	
Cuál porcentaje de la producción es deshecho ó reduzo	

B. Información del trabajo

B.1 General

Cuántos trabajadores tienen?.....
Cuántos de ellos son hombres?.....
Cuántas de ellos son mujeres?.....
Cuántos estan casuales?.....
Cuántas horas trabajan los trabajadores promedio por día?.....
Cuántos días por semana hay trabajo en la empacadora?.....
Cuántos días promedio por mes trabajan los trabajadores en la empacadora?.....
Cuánto tiempo promedio trabajan los trabajadores en esta finca?.....

Cómo obtienen su trabajadores?.....
.....
.....
Usan algunos criterios para seleccionar los trabajadores y estan estos relacionado con edad, experiencia, sexo ò tipo de trabajo? .....
.....

.....

.....

Cómo asignan las diferentes actividades (especialmente entre sexos) y cuáles son los criterios?.....

.....

.....

.....

Hacen los trabajadores siempre el mismo trabajo ò hay cambios?.....

.....

.....

Donde viven su empleados y como viajan ellos al trabajo (porcentajes)?			
Lugar de vivir	**%**	**Transportación**	**%**
Pueblo		**Bus regular**	
Campo		**Bus de la finca**	
Casas en la finca		**Propios medios de transporte**	
Otros		**Otros**	

B.2 Trabajo pro actividad

Cuál es su productividad más alta realizable?.....
Cuántas líneas de empacar tienen?.....
Cuántas cajas tienen que producir hoy?.....
Cuántos racimos tienen que cortar para esta?.....
Cuántas personas estan trabajando hoy?.....
Cuántos hombres y cuántas mujeres?.....

Cuántas personas trabajan en esta actividad, cuántos hombres y cuántas mujeres?			
Actividad	# personas	# hombres	# mujeres
1. Trabajando en el campo			
2. Acarrear los racimos a la empacadora			
3. Administrar los racimos que entran a la planta			
4. Quitar las bolsas plásticas			
5. Controlar el tamaño de la fruta			
6. Quitar las flores de los dedos			
7. Cortar las manos del pinzote y ponerlos en la pila			
8. Seleccionar			
9. Medir 18 a 19 kilos de bananos y fumigarlos			
10. Pegar los sellos de las marcas comerciales			
11.Empacar las manos en las cajas			
12. Controlar el peso de las cajas			
13. Cargar el camión			
14. Administrar las cajas			

15. Engrapar las cajas			
A. Comprobando			
B. Trabajando en la oficina			
.....			
.....			

Qué hacen los hombres cuando no hay corta?.....
.....
.....
Qué hacen las mujeres cuando no hay corta?.....
.....
.....

C. Otros

Hay un salario mínimo y cuál es?.....
Cómo pagan a su trabajadores (pro caja, pro hora)?.....
Hay diferencias en el pago de los empleados?.....

Dependen las diferencias eventuales de los siguientes factores (y cómo)?	
Edad	
Experiencia	
Sexo	
Tipo de trabajo	
Otros	

Tienen algún respaldo social (si responde sí, cuáles), por ejemplo relacionado con:

a) Fondos de retiros?.....
.....
.....
b) Cuidar ò enseñar a los niños?.....

.....
.....

c) provisión del alimento?.....
.....
.....
d) alojamiento*?.....
.....
.....
e) Otros, es decir .....
.....
.....

* Con d): Cuándo hay casas en la finca, cuánto tienen los trabajadores que pagar por eso?.....
.....

Appendix E, Calculations used for the data given in Table 8.1

The data given in the last column of Table 8.1 are calculated with an estimated 260 working days of 8 hours per year. The crop specific data used are the following:

Banana:

0,15 man-hours per box packed and a yearly production of 2.175 boxes/ha/ year as reported for the Atlantic Zone in 1996 (CORBANA, 1997).

Root and tuber crops:

To pack a box of 22,7 kg cassava or yam, respectively 0,58 and 0,07 man-hours are needed. Yam yield is 12 ton/ha/year, whereas cassava yields 15 ton per hectare per year, of which 60% is exported as first class product.

Palm heart:

To pack one kg palm heart (net canned) 0,35 man-hours are needed, whereas 0,032 man-hours are needed to process one fresh harvested palm heart (PEIpal). Mean average yield per hectare: 7000 palm hearts.

Pineapple:

PEIpinf and PEOpinf (as defined in paragraph 6.4) are respectively 2,72 and 3,83 man-hours/ ton pineapple. Average gross yield is 106 ton per hectare per year.

Macadamia:

0,28 man-hours are necessary to pack one kg almendra which is converted 0,057 man-hours per kg concha. Mean macadamia yield was estimated to be 3000 kg concha/ha/year.