Capitalization sheet

Production of essential oil of lemongrass

- Harvest of lemongrass stalks and leaves
- Distillation
- Phases separation
- Oil filtration
- Bottling, labelling and storing
- Results

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Capitalization Sheets produced within the framework of the Agro-ecological Intensification and Diversification of Peri-urban Agriculture Project in Siem Reap Province, Cambodia (IADA phase 1)

Production of essential oil of lemongrass

Method sheet N°6

The development of lemongrass essential oil production business is aimed for the local market and serves two main causes:

On the one hand, expand the scope of activities to diversify sources of income and thus ensure economic security for producers.

On the other hand, contribute to skills building capacity within the group of producers.

Lemongrass is commonly found throughout the tropical belt from Australia to Africa and is reknown for its medicinal and aromatic properties. It is therefore, as a local resource, and input sought for the production of repellents and cosmetic care in the province of Siem Reap, that this herb represents a real potential.

Description methods/tools

Lemongrass plant

Harvest of lemongrass

The species used for the production of essential oil are Cymbopogon nardus and Cymbopogon winterianus, which are sourced in the vicinity of the processing zone (Banteay Srey).

There are 5 main steps in processing:

⇒ Step 1: Harvest of Lemongrass stalks and leaves

⇒ Step 2: Distillation

⇒ Step 3: Phases separation

⇒ Step 4: Filtration of the oil

⇒ Step 5: Bottling, Labeling, and Storage

A team of 19 people in total is employed in the production of essential oil, but only the employees constituted in pairs-relay are alternately responsible for the process (steps 2 to 5).

Step 1 : Harvest of lemongrass stalks and leaves

The harvest can be done as soon as the plant is more than 31cm tall and the stems have a diameter of at least 1cm. The cut is made at the base of the stem using a sickle or other sharp tools. It takes an average of 2 hours to harvest 200kg with a sickle.

Analysis elements

> Care should be taken when handling leaves as they can be extremely sharp.

> It is important to harvest the lemongrass at maturity (6-8 months) to ensure the production of a quality oil rich in aromatic compounds.

Analysis elements

> The quantity of firewood is to be adjusted according to the type of wood and its water content. The dryer the wood, the better the fuel.

Step 2.1: selection

Step 2.1: weighing

Step 2.2 : filling of the distillation tank

Step 2.2: tanks' connection

Step 2.2: distillate collection

Table of proportion of each ingredient

Ingredient	Quantity	Source
Fresh lemongrass	200kg	Banteay Srey
Water	200L for fresh humid lemongrass and 250L for dehydrated one (water content in the plant is low)	Groundwell, can also be sourced from river or clean pond
Firewood	1/3 m^3	Banteay Srey producers

Step 2 : Distillation

On receipt of harvest, lemongrass must be sorted, and weighed before distilling the oil. In parallel the firewood was ordered and/ or delivered. The transformation zone is naturally ventilated and open (with mesh walls and sheet metal roof) because of the heat released by the still and the presence of the open fireplace for combustion.The durations are indicated for a production cycle, ie 200kg of fresh lemongrass.

Step	Method/Material	Time
⇒ Step 2.1: Selection of raw material and weighing	Remove damaged parts (dead leaves) and all herbs other than lemongrass to keep only the material to be distilled. What is kept is then weighed on a scale, according to the quantities required	1h
⇒ Step 2.2: Extraction	Firstly, prepare the fire to heat the distillation tank and fill this tank with water according to the proportions indicated. For this stage of the process it takes 1:30h on average. Secondly, place the lemongrass in the distillation tank and fill the cooling tank with water. Finally, connect the two tanks, making sure the joints are airtight. Between the moment we start to distillate and we collect the first drop of distillate it takes approximately 1:30h. It takes between 3h30 and 4h to collect all the oil	6h30 to 7h00

Analysis elements

> Ensure that the connection points between the gooseneck and the tank containing the material to be distilled on one side, and the cooling tank on the other side, are airtight in order to limit the escape of steam rich in aromatic compounds. To seal, a PTFE (polytétrafluoroéthylène) tape can be used.

> It is also important to regularly check the water level in the cooling tank to maintain a good performance.

> The hydrolate transferred in gericans gains to be valorized as inputs in the manufacture of other products.

> It is necessary to remove all the water from the oil to allow the good conservation of the latter.

Through heating, the water contained in the boiler (or distillation tank) turns into steam and, leads with it the volatile aromatic compounds contained in lemongrass. The steam is then cooled as it passes through the coil (cooling tank) and condensed into a distillate composed of water and oil which is collected in a bottle.

Step 3 : Phases separation

Steps	Method/Material
⇒ Step 3.1: transfer of the oily phase in a bottle	The oily phase (upper phase) of the distillate collected in the bottle after distillation is transferred to another bottle and, the remaining aqueous phase is transferred to gericans. Note that the entire oily phase must be collected even if some water is taken at the same time during the transfer.
⇒ Step 3.2: separation by decanting	This oily phase gathered in the other bottle (and which may contain some water) is then decanted for 2 days in a separating funnel to separate the water from the oil. By gravitation the water (lower phase) is eliminated by opening the valve of the separating funnel. When the oil reaches the valve, close it. You must remove all the water and keep only the oil.

Step 3.2

Step 3.2

Step 4

Step 4: Oil filtration

The oil obtained after separation of the phases in step 3.2 is filtered to be cleared from impurities. Ideally a filter, of the coffee filter type (non treated one) is used. However depending on the logistical and financial possibilities, cotton (non treated too) disposed in very thin layers on a funnel can also be used. But, this second technique is not favoured because it causes a loss of oil that is irremediably absorbed by cotton.

Step 5: Bottling, labelling and storing

The oil obtained is stored in opaque glass bottles of 1.5L on the production area in a ventilated space and sheltered from the sun and then transported to the Association where it is bottled in 5, 10 or 20ml according to the need of the customers.

The choice of a bottling unit delocalized from the production area is linked on the one hand to the logistic conditions and on the other hand to the quality requirements. Indeed, the processing area is isolated from the center and access to containers is not easy in addition to requiring regular significant transportation time. Besides, bottling in individual unit requires a significant additional time and a clean bottling zone, covered and sheltered from the wind.

Steps	Method/Material	Time
⇒ Step 5.1: Bottling	The use of transparent and/ or plastic bottles is not recommended. The oil is therefore bottled in opaque glass containers using volumetric glass pipettes. It should be noted that both air and light are responsible for the deterioration of oil, and therefore special attention should be paid when sealing the bottle to ensure airtightness.	15 bottles of 10ml/ hour
⇒ Step 5.2: Labelling	The label containing the name of the product, its origin, the logo of the producers and the volume is then glued at the center of the bottle, making sure to expel the air bubbles with the fingertips.	
⇒ Step 5.3: Storing	Oil is stored in a dark and cool place (25°C).	-

Step 5.1: Bottling

Step 5.2: Labelling

Analysis elements

> It is paramount, not to use treated filters, to avoid contamination of the oil.

> Exposure to light and air can cause oxydation of the oil and alter its medicinal and organoleptic properties. This is why transparent bottles should be avoided.

> Plastic can also alter the quality of the oil. We will therefore prefer the use of glass throughout the process.

> Members should clean the equipment after each use and wash their hands before production and after using the toilet.

> There is competition on the local market with synthetic oils which should be taken into account in the analysis of economic risks.

> Bottling time is long because of the difficult handling of the precision tools by the Green Farmer staff.

To remember...

An oil with much sought-after properties, used in the manufacture of repellents and cosmetics in Siem Reap.

A several-day production process, which requires careful attention at the stages of harvest (ripeness), distillation (joint sealing and water level of the cooling tank), separation (non treated filters and no waterleft in oil) and storage (airtightness, opacity and freshness).

Seasonal variation in the quantities of water used as input for production depends of the water content of the lemongrass.

A high cost of production due to a low yield, which needs to be economically weighed in the face of competition from synthetic oils.

Results

	Lemongrass essential oil (for 1kg of product)
Key elements of demand	
Quantity sold	NB: The minimum quantity sold for this price is 1kg
Price	114 usd/kg
Quality requirements	100% natural EO, produced according to agroecological producers' specifications
Technical results	
Yield (%)	0,16% (320g of essential oil for 200kg of fresh lemongrass)
Volume produced/cycle	320g of oil produced (200kg of fresh lemongrass)
Economic results	
Cost of production	108,36 usd/kg
	Production costs vary according to input prices. The cost of production is calculated without taking into account the costs of investment in machinery and premises, because they are covered by the project and are therefore not counted as depreciation. Moreover, the cost of bottles and label is not considered in production cost as they are provided by customers
Profit	5,64 usd/kg
Volume sold/period	Irregular : about 1kg per month (product has just been launched)

Input prices: Fresh lemongrass = 0,125 usd/kg, Firewood = 7,5 usd/m³ ; Electricity= 0,25 usd/kW ; Hygiene and cleaning material = 1,5 usd/production cycle ; Labor cost = 5usd/person

Glass bottle price = 82,5usd for 220 bottles of 5ml ; Sticker price = 5,5usd for 220 bottles (about 1kg of oil)

NB: water is sourced from a well directly on the processing area

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