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Analysis of the agroindustry processing of wet and dry arabic coffee, in the western region of Honduras

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ABSTRACT

This research arose from the academy, with the purpose of making scientific contributions to the country's coffee sector, and determining the yield of processed coffee by studying yields, in two compact ecological milling centers in Honduras, in Matazano, Pinabetal, Talgua Lempira and El Pinal, San Juan de Opoa,,Copán. In addition, to know the volume and/or measure when receiving cherry or grape coffee, and in order to produce coffee that has a moisture percentage between (11 - 12) %. Obtaining the following results for a dry parchment coffee, samples from a standard plant < 900 masl 19% yield, Composition of the High Grown coffee bean "900-1200 masl" with 21% and Composition of the Stricty High Grown coffee bean > 1200 masl, averaging for all altitudinal floors of 21% CPS, yields for producer gold yield averages of 18% for standard plant, High Grown coffee 18% and Strictly High Grown coffee 19%. Respectively for gold exportable according to cupping laboratory analysis 15% average weight in the three different altitudinal floors. Likewise, the samples of the different altitudinal floors were sensory evaluated, with the purpose of determining the quality of the coffee, finding scores of 82.5% in the standard central coffee, 84.5% in High Grown coffee and 89.5% Stricty High Grown coffee, likewise in accordance with a systematization process found in the compact ecological process, the document characterized wet and dry processing throughout the coffee supply chain. Finally, in the measurement of the yields of the green bean, it was determined by analysis of variance and Duncan's separation test that there are significant differences between the three types of altitudinal floors (masl) evaluated, and each evaluated height has different yields of dry where a directly proportional relationship between height and coffee weight yield is denoted.

Keywords: *coffee; altitudinal floors; processed; dry parchment; sensory analysis.*

Análisis del procesamiento agroindustrial de café árabe húmedo y seco, en la región occidental de Honduras

RESUMEN

Esta investigación surgió de la academia, con el propósito de hacer aportes científicos al sector cafetalero del país, y determinar el rendimiento del café procesado mediante el estudio de los rendimientos, en dos centros compactos de molienda ecológica en Honduras, en Matazano, Pinabetal, Talgua Lempira y El Pinal, San Juan de Opoa, Copán. Además, conocer el volumen y/o medida al recibir café de cereza o uva, y para producir café que tenga un porcentaje de humedad entre (11 - 12) %. Obteniendo los siguientes resultados para un café de pergamino seco, muestras de una planta estándar < 900 msnm 19% de rendimiento, Composición del grano de café High Grown "900-1200 msnm" con 21% y Composición del grano de café Stricty High Grown > 1200 msnm, promediando para todos los pisos altitudinales de 21% CPS, rendimientos para productores de oro promedio de 18% para planta estándar, café High Grown 18% y café Strictly High Grown 19%. Respectivamente para el oro exportable según análisis de laboratorio de catación 15% de peso promedio en los tres pisos altitudinales diferentes. Asimismo, se evaluaron sensorialmente las muestras de los diferentes pisos altitudinales, con el propósito de determinar la calidad del café, encontrando puntajes de 82,5% en el café central estándar, 84,5% en café High Grown y 89,5% Stricty High Grown coffee, así mismo de acuerdo con un proceso de sistematización encontrado en el proceso ecológico compacto, el documento caracteriza el procesamiento húmedo y seco a lo largo de toda la cadena de suministro del café. Finalmente, en la medición de los rendimientos del grano verde, se determinó mediante análisis de varianza y prueba de separación de Duncan que existen diferencias significativas entre los tres tipos de pisos altitudinales (msnm) evaluados, y cada altura evaluada tiene diferentes rendimientos de seco donde se denota una relación directamente proporcional entre la altura y el rendimiento en peso del café.

Palabras clave: *café; pisos altitudinales; procesado; pergamino seco; análisis sensorial.*

1. INTRODUCTION

Our country "Honduras" has a unique climatic variety, so the varieties of coffee grown in its microclimates allow the creation of Gourmet coffee with great flavor and texture, so socio-economic development depends more on the quality than the quantity of the coffee. Production, due to the great potential in organoleptic and sensory characteristics that the aromatic possesses, in the different coffee bean-producing zones or regions, the high quality of Honduran coffee is mainly due to its geographical location, to the different ecosystems of the country that allow the production and transformation of the crop in almost the entire territory and to the perseverance, dedication and capacity of Honduran coffee growers. Around 120,000 Honduran families are dedicated to the cultivation of coffee, currently the cultivated area of coffee in Honduras for the 2020-2021 harvest was 295,000 Ha. With a production of 7,660,696.08 quintals of gold coffee; that is, the production of gold coffee for (Instituto Hondureño del Cafe, 2021)export of that harvest is equivalent to 348,213.46 tons of gold coffee. These lands are located in 15 of the 18 departments of Honduras where coffee is produced, except in the departments of Valle, Gracias a Dios and Islas de La Bahía. 90% of the coffee produced is processed by the wet process known as "other mild" and it is intended for export; the remaining 10% is processed by the dry method and consists of green, dry, vain and poorly managed fruits, which are destined for national consumption. (IHCAFE, Jicatuyo Project, October 2002). A high percentage of world coffee production is obtained in tropical and subtropical zones, mostly emerging countries. In many cases, the export of coffee constitutes an important part of the income of Honduran families, and its production is a great generator of employment. "The vast majority of the coffee produced in Honduras comes from the mountainous regions of 210 of the 298 municipalities, generating more than one million jobs that produce about 38% of the Agricultural GDP.(IHCAFE, 2018)

Coffee production not only depends on a large number of people (25 million in the world) but also many producing countries. There are areas, such as the great lakes of Africa (Burundi, Rwanda, Uganda...) that, despite not being one of the main countries in world coffee export volume, its economy depends on 80% of its export. Colombia is the world's leading exporter of mild coffee and has worldwide representation through Juan Valdez stores, having one of the largest varieties of specialty coffees, depending on the growing region, the flavor, color, and aroma of the coffee vary; many of these coffees are

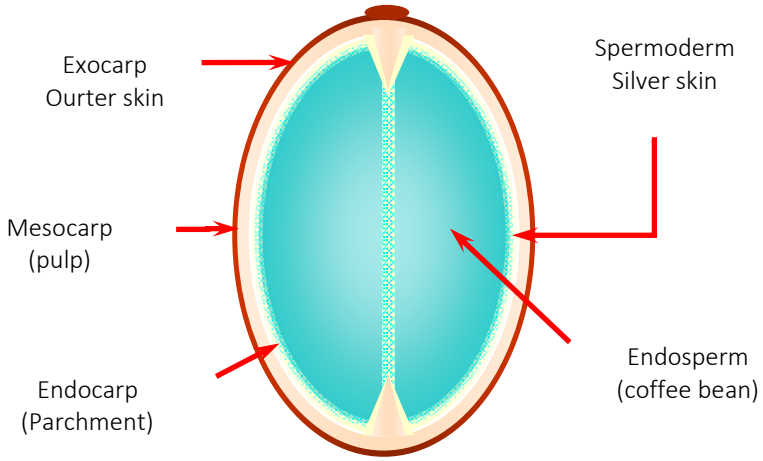
considered premium within the world market and can be quite expensive.

Coffee is the second merchandise traded in the world, after oil. An estimated 125 million people live from coffee cultivation, including 25 million small producers. Every year 400 billion cups of coffee are drunk. Therefore, there are many extremely important economic and social interests at stake. (Ignacio Sánchez Bazán, 2020).

There is almost unanimous consensus that coffee originated in its wild form known as Arabica in the highlands of Abyssinia (present-day Ethiopia) and a series of legends circulate regarding the discovery of its use as a drink. The most accepted refers to Kaldi, an Abyssinian shepherd who observed that his goats jumped around very excited and full of energy after eating the leaves and fruits of a certain bush. Kaldi took the fruits and branches of this bush to the abbot of a monastery who would have discovered the coffee drink by putting the cherries on the fire, which when roasted produced an exquisite aroma. (Gotteland, 2007)

1.1 The Coffee Fruit.

Figure 1. *Composition of the cherry or grape coffee bean.*



Source: adapted from (Torres, 2004).

The fruit is a berry that contains two seeds and when ripe it is red or yellow, it is known as a grape. It can also be said that it is a drupe that during its growth is light green in color and when ripe it is wine red; Its structure can be seen in Figure 1.

Epicarp: (fruit peel or pulp)

Mesocarp: (mucilage)

Endocarp: (parchment)

Endosperm: (seed)

Spermoderm : it is a silver film, which in turn is protected by the endocarp.

In the endosperm is the embryo, which is composed of two superimposed cotyledons and a growth axis called the hypocotyl. (Torres, 2004)

Coffee is made up of more than 1000 different chemical substances (6) including amino acids and other nitrogenous compounds, polysaccharides, sugars, triglycerides, linoleic acid, diterpenes (cafestol and kahweol), volatile (formic and acetic) and non-volatile (lactic, tartaric, pyruvic, citric), phenolic compounds (chlorogenic acid), caffeine, volatile substances (over 800 identified of which 60-80 contribute to coffee aroma), vitamins, minerals. (Gotteland, 2007). The attractiveness of coffee is linked to its aroma, flavor, the pleasure of tasting a "cup of coffee" consumed alone or with company, and the widespread concept that coffee is "stimulating" and "energizing" (Valenzuela 2010).

1.2 Coffee Beneficiary

The beneficiary is the process by which coffee is prepared for commercialization locally or for export, it includes a series of stages or activities for the stabilization of the qualities of the fruit. A good milling maintains the natural quality of the coffee, on the contrary, a poor milling deteriorates it. In the coffee world, coffee cherries are processed mainly in two ways: wet and dry. The wet method produces "mild" or "washed" coffees that are distinguished by high cup quality, being highly desired in consuming countries; this system is used in some separation stages. “Natural” coffees are produced through the dry method, which are of inferior quality and require a lot of energy to dry the fruit. (Coffee Farming Manual; IHCAFE 2002).

The wet route is made up of two phases: the “wet” phase and the dry one. The wet phase Includes the picking fruit, pulping, demucilagination, washing, classifying and drying the coffee at 12% humidity and is distinguished because at each stage of the process the fruit is classified and selected to obtain the best quality. The dry phase is the preparation of dry parchment coffee to gold for export; It consists of: storage, threshing, classification, tasting and packaging. (Torres, M. 2011)

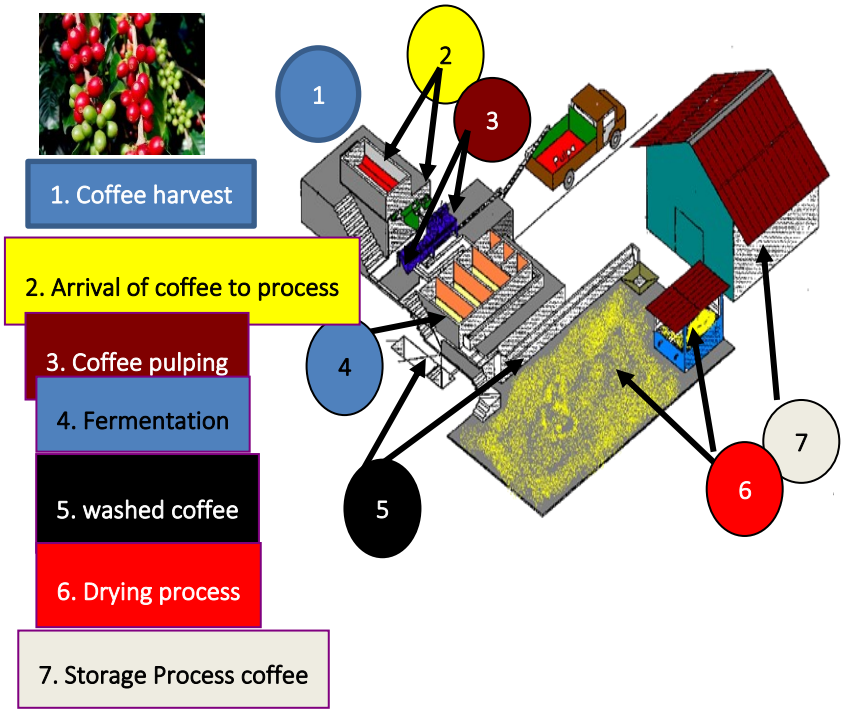
1.3 The drying process

In the 1990s, it was considered that drying was the bottleneck in the Western Region of Honduras. Drying capacity has been increasing in the region and, especially, in Santa Rosa de Copán; however, the bottleneck is not only in drying but also in the lack of working capital; the small coffee farmer cannot wait for the dry season when he needs to sell to

meet the costs of harvesting and family support, Due to the lack of drying capacity in the region, the installation of Guardiola-type dryers is being encouraged, and the IHCAFE (Honduran Coffee Institute) Beneficiary Program and other organizations in the region linked to production and transformation are promoting the implementation of other drying methods such as drawer-type dryers, the dome-type solar dryer, etc., since there can be no bargaining power when 70% of coffee damage is due to lack of immediate drying (Reyes, C. 2004).

The Western Region is a producer of SHG, not all coffee families live in the mountains where the farms are located, most of the coffee communities are in lower areas where it is feasible to dry the coffee in patios. Therefore, coffee farmers should be encouraged to dry their coffee and market it dry parchment at 12% humidity, preferably joining companies and offering quality volumes to the market, so they can face the costs of technology and implement ecological benefits and dryers. You cannot talk about coffee drying without talking about the air, since this is the main responsible for the process and the less humidity it has, the more efficient it will be. When it is "raining" it can be said that the relative humidity of the air is 100%, at this point it is said that the air is saturated, and on a dry and sunny day, in our Region it can be said that the relative humidity is 100%. 50%, since we have been able to observe that the efficiency of the air also depends on the temperature, since the hotter the air is, in the absence of water on which it can cause evaporation, the drier it will be and, therefore, the greater its drying efficiency. The air can be heated by the sun or by a heat source such as an oven; being in the heat source the difference between drying in patios and mechanical drying. In Honduras, coffee processing is generally carried out by mechanical methods, (Mejía, 2021)indicates in his work that the rotary dryer uses 91.95% of the biomass energy, the vertical dryer uses 90.31% and the static dryer 90.68%, concluding that rotary drying has a higher energy consumption. of biomass and reduces emissions CO2 ions/kg in dry parchment coffee, this method is also preferred by cuppers, as it preserves the sensory qualities of the coffee and contributes to reducing the environmental impact

Figure 2. *Traditional coffee processing center with fermentation*



1.4 Wet processing of coffee

1.4.1 Dry Phase:

After the post-harvest wet phase, the dry phase is carried out, which includes activities aimed at preparing the grain for export. This activity is carried out in Honduras by small producers in patios at the farm level and in drying guardiola by private export companies specialized in this activity.

1.4.2 The preparation of golden coffee:

In the world coffee market, only quality coffee is required, even so, a limited number of coffee beans that are not equal to the majority are accepted, and they are known as defects or imperfections that are responsible for "damage to the quality of the coffee". cup".

This process is called "preparation" of the coffee, the market being increasingly demanding for the cup to be healthy or free of defects. Sanitation is a very important parameter in the preparation and depends on the handling that has been given to the coffee from the harvest to the moment of packaging it.

If all the stages have been carried out correctly, then the preparation is relatively easy; Otherwise, the activity is almost impossible to carry out and requires specialized and

expensive equipment to carry it out, affecting the conversion of dry parchment coffee to gold. It is a mistake to think that a type of coffee with a damaged cup can be passed to a lower classification type, that is, the damage is the same for the STD, HG or SHG type.

1.4.3 Storage

When the coffee has obtained the appropriate drying (11.5-12% humidity), it is stored in the cellars until it is time to thresh it and prepare the grain for export. Care must be taken that in these cellars the humidity of the environment is between 65-70% and the temperature 20 and 25 ºC. It should always be considered that the storage place should be cool and ventilated and stack the bags on wooden pallets using 70% of the space to store the coffee and the other 30% for mobilization. The separation between pallets and walls and between pallets must be at least one meter. You should not store coffee together with other products that give off pungent odors such as fuels and agrochemicals, among others.

1.4.4 Threshing

The objective of threshing is to separate the green or gold coffee from the parchment or husk. When the parchment grain has been stored for some time, it is recommended to preheat the drying equipment (up to two hours) prior to threshing, in order to achieve the highest efficiency in the threshing equipment. There are machines that perform the threshing and polishing of the grain simultaneously, although there are also those that perform these tasks separately.

1.4.5 Classification

The objective of the classification is to present a more homogeneous product in terms of weight, size and physical aspects of the grain. This can be done in different ways: banding, mechanical, electronic and manual classification.

1.4.6 Densimetric classification

The selection and cleaning required by the preparation begins the moment it enters the tasters. These carry out a classification by density, eliminating grains that do not have the weight of a normal grain, such as broken, green and vain grains. The structure of these machines is vertical, which have a fan at the bottom. These are fed at the top, dropping coffee onto the air source that is blown upwards. In this way, the less dense grains are eliminated, dragged by the air current to which they are subjected, separating the light grains from the heavier ones. The latter are the ones with the best quality and weight,

and leave through the "arms" at the bottom, where they are picked up by an elevator or conveyor and taken to the pneumatic sorters.

1.4.7 Electronic graders

The electronic machines are in charge of selecting all the grain that does not fit into the color pattern (normal green) that has been predetermined. The coffee beans that enter the interior of the machine are separated by a conduit where the electronic analyzers are located, being separated by air impulse or by a special device, if they were recognized as defective by the machine.(Carlos Roberto Pineda Mejía, 2001)

1.4.8 Chosen bands

Since the machines do not make a 100% perfect selection, you must use direct labor to select the coffee. This is done in the sorting bands, where the coffee is spread and as the band runs, it can be easily picked to separate the defective beans.

The load placed on the belts and the speed with which they work will depend on how demanding the preparation is. Subsequently, the coffee goes to the mixers and packers. (Torres, 2004)

1. 5 What types of coffee exist in Honduras?

1.5.1 Strict Height.

Composed of washed coffee beans from a new harvest, extremely well processed and prepared. Produced generally in high zone; fresh smell, homogeneous size and color, excellent to very good cup quality, pound of damage, very good acidity, good body, intense aroma. It must be free of damage or undesirable flavors. Values between 7 and 8 points for each item (fragrance/aroma, acidity, flavor, body and aftertaste). The total ranges from 85-89 points.

1.5.2 Height (HG).

Composed of washed coffee beans from a new harvest, extremely well processed and prepared. Generally produced in the middle zone, fresh smell, homogeneous size and color, good cup quality, free from damage, good acidity, good body, pronounced and pleasant aroma. It must be free of damage or undesirable flavors. Values between 6.5 and 7 points for each item (fragrance/aroma, acidity, flavor, body and aftertaste). The total ranges between 82 and 85 points.

1.5.3 Standard Panel (STD).

Composed of washed coffee beans from a well-prepared new crop, generally produced in the lower area, fresh smell, homogeneous color, fair cup quality, free of damage, low acidity, medium to low body, light aroma. It must be free of damage or undesirable flavors.

Values between 5.5 and 6 points for each item (fragrance/aroma, acidity, flavor, body, and aftertaste). The total ranges between 77 and 80 points. (Coffee Farming Manual, IHCAFE) (Pineda, 2001)

1.6 Cup sensory analysis

The sensory evaluation of the quality in the cup of all the coffee samples was carried out following the tasting protocol of the Specialty Coffee Association of America (SCAA) by certified tasters in the country. The sensory characteristics evaluated were aroma/fragrance, flavor, aftertaste, sweetness, acidity, body, uniformity, balance, clean cup, and taster score. The organoleptic attributes were rated using an ordinal scale from 0 to 10 points and the sample in general was evaluated as the sum of the individual score of each attribute on a scale from 0 to 100 points (Juárez 2021).

2. METHODOLOGY

Once the independent producer and the Talgua Limited Agroforestry Cooperative "COPRATAL", Coffee Cooperative, were selected; that facilitated their facilities to carry out the *in situ study* of Yield Evaluation in the Process of Wet Milling of coffee in compact equipment of the Jota Gallo brand, in the sectors of Matazano Talgua , Lempira and El Pinal San Juan de Opoa , Copán. We proceeded to establish the sampling dates, taking into account the climatic conditions prevailing in the months of December, January and February; where cold fronts were one of the biggest drawbacks to carry out the sampling period. One of the factors that was studied was the height above sea level at which the farm is located, how it affects the weight yield in this sense, three (3) altitudinal floors were identified. For the construction of the description of the process, it was done by observing the process line, following the corresponding order of the transformation that the coffee bean entails.

Weight per fruit stage / Total sample weight (5 Lbs.)

2.1 Evaluation of the characteristics of washed parchment coffee.

Sampling was carried out in different periods of demucilagination until obtaining

averages of ten pounds (10), from this sample two pounds (2) were obtained by the quartering method, to carry out the following analysis:

Well washed and healthy grain.

peeled grain

Bitten grain.

Pulp in the grain.

Weight per state of washed parchment / Total weight of washed parchment (2 Lbs)

To determine the material balance, we proceeded as follows:

Two samples were taken from the different altitudinal floors such as low, high, strict high with the objective of determining the different compositions of the coffee bean.

The different units were weighed after pulping, such as:

Parchment weight washed

pulp weight

Weight of floats or hangovers

By means of material balance we proceeded to determine the weights of the mucilage. After drying the samples until reaching a dry parchment coffee, the loss of water or humidity of the grain was determined by weight difference.

2.2 The procedure was as follows

a. Pulping: the fruit is pulped the same day it is cut, within a maximum of six hours, after the fruit has been separated from the plant, in this way we preserve the quality; It is important that the pulper(s) are well calibrated.
b. Washed or Wet Parchment Grain: Stage in which the washed grains They maintain surface water (50 % humidity), the different types of demucilaginated grains were evaluated, such as those that are in good condition and those that are damaged. Two pounds were weighed and then the selection of the pill is carried out, weighing the totality of each one of them and they are noted in the attached tables in the preliminary project.
c. Oreo Parchment Grain: Stage in which the grains have lost their surface moisture. find between (40 to 45%) humidity and the endosperm or gold grain is totally humid, the time to reach this stage also depends on several factors such as: climate, drying system, volumes, etc. To determine the percentage of humidity at the time of airing, it was done in the study place through the use of a hydrometer or a humidity tester.

It is important to have the measuring instruments in the different milling centers to develop a more efficient work.

d. Dry Parchment Grain: stage in which the grains have almost completely lost their moisture and are between 11 and 12% moisture, as in the previous stages, the time to reach the optimum moisture point will depend on multiple factors; The clarification is made that a hydrometer and/or humidity tester was used , in the results it is important to note that it is the only scientific way to determine the humidity percentage.

e. Gold Producer: Although the coffee marketing system in Honduras is in parchment and not in gold, but this factor is important because it is applied at the time of price calculation; Five (5) pounds of first-class dry parchment coffee and one (1) pound of dry hangover were sent to the IHCAFE processing program with the objective of obtaining the factors of producer gold and exportable gold, with their respective rejection, which we will add to the hangovers in gold.

2.3 Materials and equipment:

1. Producer profit.
2. The production of 500 Kg. of coffee cherries, cut of the day.
3. 1 scale or Roman with capacity from one (1) to ten (10) quintals.
4. Nylon or polyethylene bags.
5. Rakes/Brooms/20 Liter plastic buckets.
6. Scale in ounces or in grams.
7. Global Positioning System (GPS).
8. Photographic camera.
9. 5 Lbs bags .
10. 1 Lb bags.
11. Yard.

2.4 Procedure for collecting information:

The information was collected in several farms, close to the three different ecological centers of wet milling where the study was carried out. The procedure that was used in the data collection to determine the yields was made with grape coffee or cherry cut of the day, in the case of the Los Nogales farm, likewise with the benefit centers of the Talgua Lempira sector. with coffee cut of the day, in this case the affiliated producers buy

the milling service and there are few who sell the coffee to the cooperative, for these reasons the sampled coffee was done at random since all the data of the processing process were taken. benefited, then the evaluation was completed with a visit to the farms of the producers to learn about the management and agronomic aspects that define the quality of the grain.

2.5 Sensory Analysis

The samples in dry parchment units were sent to the IHCAFE cupping laboratory, located in La Fe Ilama, Santa Bárbara, to determine the sensory characteristics of cup quality according to the altitudinal floor.

2.6 Statistical Analysis

After obtaining ours, they were identified from the place with their respective height, and they were classified in a range of three altitudinal levels to apply the statistical analysis with the help of the SPSS 21.0 software. where univariate analysis of variance and Duncan's mean separation test were applied to the yield of washed parchment coffee, aired parchment coffee and dry parchment coffee.

3. ANALYSIS OF RESULTS

The results obtained in this evaluation of cutting or harvesting of cherry or grape coffee, were made through twelve (12) repetitions carried out in the study places. Next, the results obtained in the analyzes carried out in the three areas where the research work on wet milling yields, evaluation of cutting or harvesting was carried out, are presented.

Evaluation of coffee at different heights above sea level "masl"

Another of the factors that was studied was the height above sea level at which the farm is located, in this sense three (3) altitudinal floors were identified.

1. Between 600 and 899 meters above sea level, known as lowlands.
2. Between 900 and 1200 meters above sea level, known as high altitude zones.
3. > 1,201 meters above sea level, known as strict altitude zones.

It is considered that coffee is produced at altitudes ranging between 900-1500 meters above sea level, however, depending on the area and variety used, it can thrive at lower altitudes, such is the case of the areas influenced by Lake Yojoa where there are commercial coffee plantations at 700 masl and in which excellent levels of productivity are obtained. At very high altitudes (greater than 1600 masl) the plants can present problems of dwarfism, chlorosis and poor formation. An analysis was carried out

according to the height above sea level and the different commercialization units, in this sense three (3) altitudinal floors and the characteristics of each of these types of coffee were identified.

Method used in the investigation to determine the weights of all the commercialization units with a sample of 500 kg of grape or cherry coffee. In this first evaluation, regression analysis graphs were elaborated, the simple linear model in this process, the purpose is to obtain an empirical equation of reasonable prediction and that provides a model that is not available. The most useful tool is the least squares estimation tool for the simple linear model, in this case there is only one prediction variable.

Variables evaluate masl. against production in a 500 kg sample, analyzing the following:

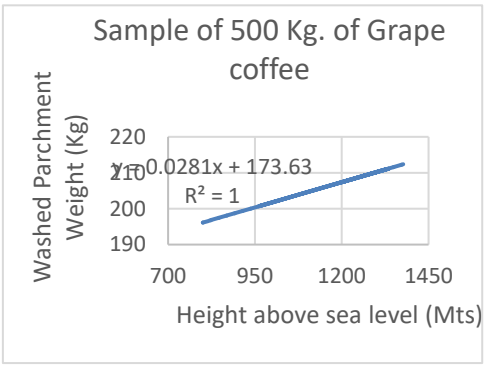


Figure 3. Washed parchment coffee

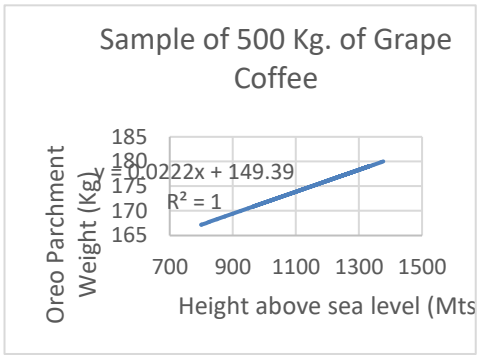


Figure 4. Oreated parchment coffee

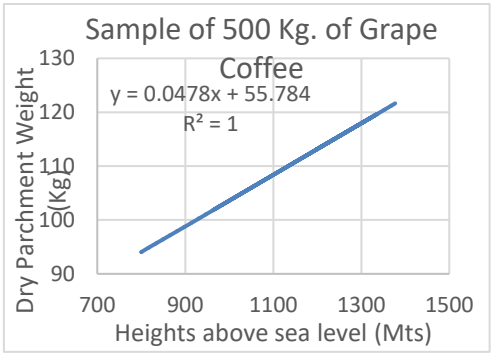


Figure 5. Dry parchment coffee Figure

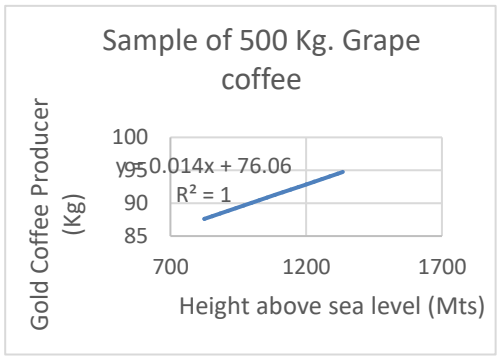


Figure 6. Producer gold coffee

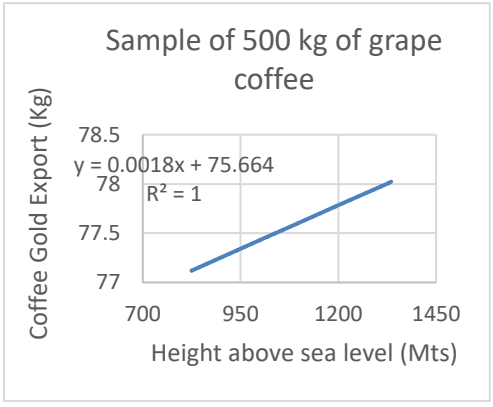


Figure 7. Coffee gold export

3.1 Results of the linear regressions according to the analyzed production unit:

1. Washed parchment coffee evaluation (y = 0.0281x + 173.63)
2. Evaluation of airy parchment coffee (y = 0.0222x + 149.39)
3. Dry parchment coffee evaluation (y = 0.0478x + 55.784)
4. Gold coffee producer evaluation (y = 0.014x + 76.06)
5. Exportable gold coffee evaluation (y = 0.0018x + 75.664)

3.1.1 Therefore, solving the linear regressions we have the following result.

The results obtained in the application of this statistical analysis with the objective of using an equation that was found with the average number of repetitions of the investigation. To determine the amount of exporting gold coffee in a sample of 500 kg of cherry or grape coffee, according to the height above sea level where the farm is located, we will use the following equation Yi = 75.66 + 0.0018 X i . Yi is the variable with the name of gold exporter, to find it we substitute Xi which is the variable height above sea level, to which we will multiply the constant factor 0.00177 and add a constant value of 75.66, to know the amount of kilograms of exporting gold coffee.

Example: Farm located at 1320 masl

Yi = 75.66 + 0.00177(1320) Yi = 78.04 Kg.

A farm at 1320 meters above sea level, 78 kg of export gold coffee is obtained, 12% moisture content of the grain, in 500 kg of processed grape or cherry coffee.

Gold Producer: Although the coffee marketing system in Honduras is in parchment in the case of producers and not in gold, this factor is important because it is applied at the time of price calculation; Five (5) pounds of first-class dry parchment coffee and one (1) pound of dry hangover were sent to the IHCAFE processing program with the objective of obtaining the factors of producer gold and exportable gold, with their respective rejection, which we will add to the hangovers in gold (grain that is destined for internal consumption or exported according to sample). This analysis was made with each one of the altitudinal floors in the different places where the study was carried out, the objective is to know the composition of a coffee bean.

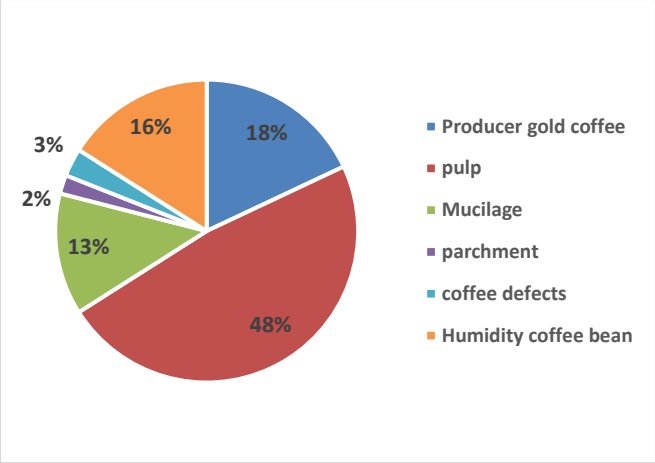


Figure 8. Composition of the coffee bean Standard plant < 900 masl.

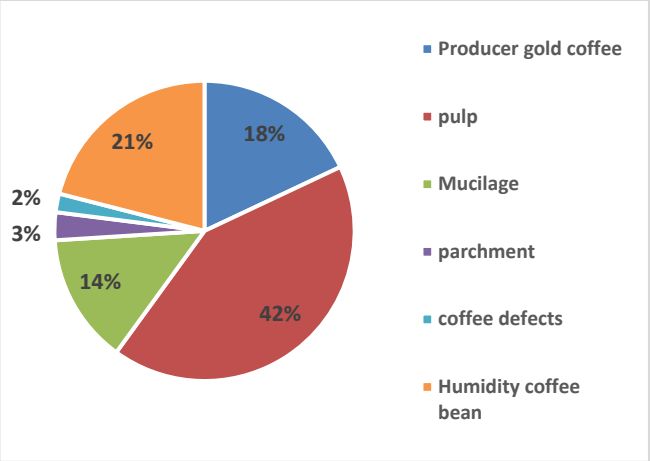


Figure 9. Composition of the High coffee bean Grown 900-1200 masl.

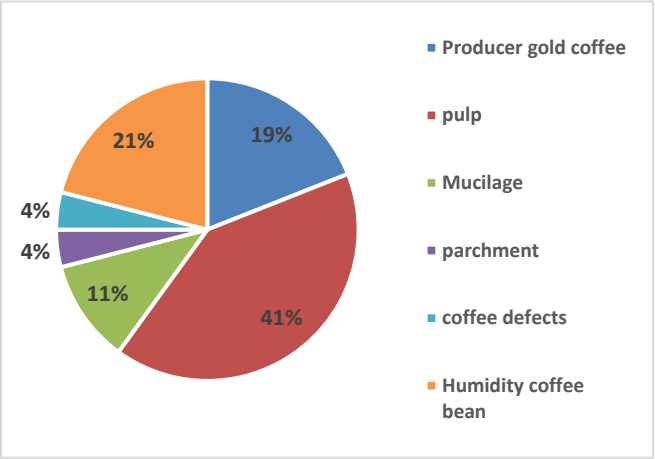


Figure 10. Composition of the Strictly High coffee bean Grown > 1200 masl

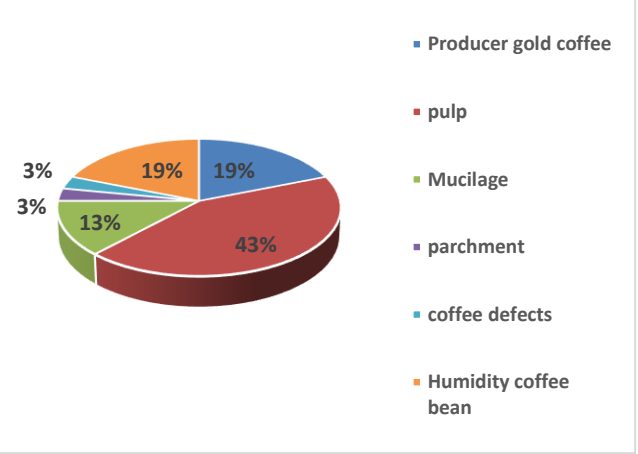


Figure 11. Composition of the coffee bean gold producing unit of all samples.

Evaluation with the objective of establishing the composition for a coffee bean grown at altitudes lower than 900 masl (Figure 8), heights that oscillate between 900 to 1200 masl (Figure 9) and greater than 1200 masl (Figure 10) analysis was done with the samples sent to the IHCAFE tasting laboratory. In the first analysis of the composition of the coffee bean, it was analyzed up to the state of dry parchment coffee between 11-12% humidity for the three types of altitudinal floors evaluated in different zones according to the height above sea level where where the farm is located, and the producer gold factor was performed by analysis of the dry phase sample.

In (Figure 11) the composition of a coffee bean is presented until reaching a producing gold coffee, from its state in cherry or grape, it was determined that the percentage of

producing gold, on average for any altitudinal floor ranges between 19%, hangovers 3%, husk 3%, pulp 43%, weight loss due to "wet" water is 19%, mucilage or honey water 13%.

3.2 Exporting gold coffee:

Like the producer gold marketing unit, the gold exporter factor was an evaluation carried out by the IHCAFE tasting department. The dry parchment coffee is transformed into gold, green or raw coffee, since the parchment or husk and the silvery film or seminal integument have been removed. Through maquiladora we take the dry parchment coffee, and it is brought to gold coffee, which is the presentation as is exported; since, the coffee must pass two processes, the wet and the dry, to be exported

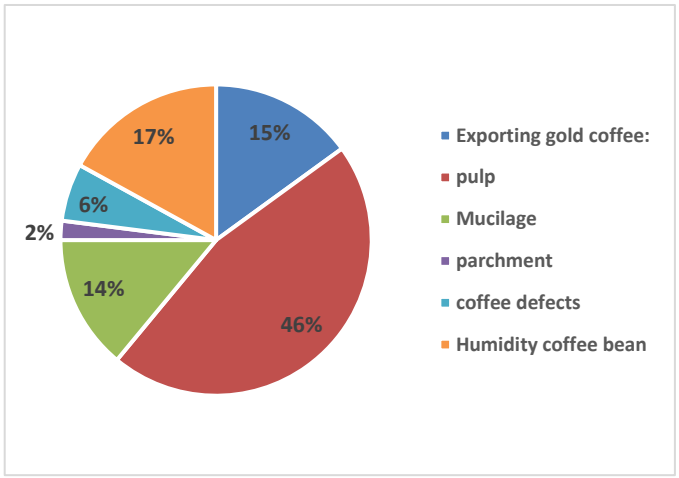


Figure 12. Composition of the coffee bean standard plant < 900 masl.

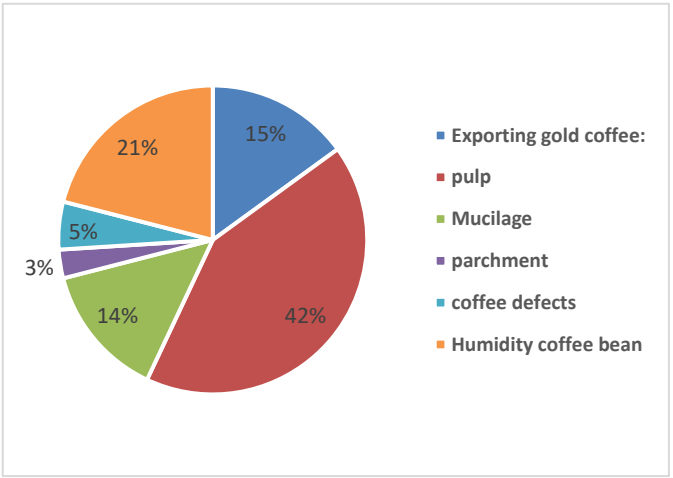


Figure 13. Composition of the High coffee bean Grown 900 -1200 masl.

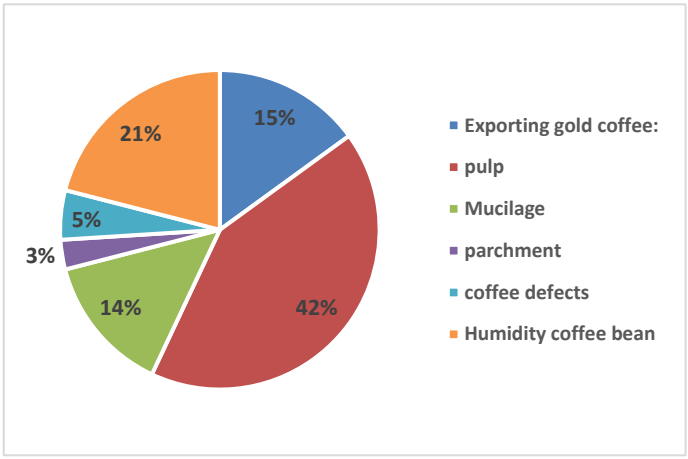


Figure 14. Composition of the coffee bean High Grown 900 -1200 masl

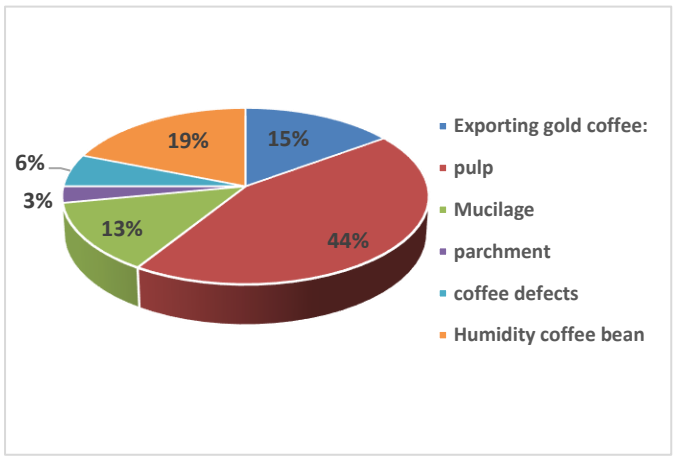


Figure 15. Composition of the coffee bean Exporting gold state.

Evaluation with the objective of establishing the composition for a coffee bean grown at altitudes lower than 900 masl (Figure 12) and heights that oscillate between 900 to 1200 masl (Figure 13) and greater than 1200 masl (Figure 14) analysis was made in the Matazano and Pinabetal area, Talgua , Lempira.

In the first analysis of the composition of the coffee bean, it was analyzed up to the state of dry parchment coffee between 12% humidity for the three types of altitudinal floors evaluated in different zones according to the height above sea level where it is located. the farm, in the same way the final evaluation in the dry milling stage was determined with half of the evaluated universe. In (Figure 15) the composition of a coffee bean is presented until reaching an exporting gold coffee, from its state in cherry or grape, it was determined that the percentage of exporting gold, on average for any altitudinal floor ranges between 15%, hangovers 6%, pulp 44%, weight loss due to "wet" water is 19%, mucilage or honey water 13%, parchment or seed coat 3%.

4. STATISTIC ANALYSIS

Ours were identified from the place of origin with their respective height and classified in a range of three altitudinal levels to apply the statistical analysis, using the SPSS 21.0 program. applying the univariate analysis of variance and Duncan's separation of means test to the yield of dry parchment coffee, the three altitudinal levels or ranges that the samples were classified are:

a. Standard coffee less than 900 meters above sea level
b. HG between 900-1200 masl
c. SHG greater than 1200 masl

Table No. 1: Yield data per productive unit in kilograms:

Producer	grape coffee	washed coffee	oreado coffee	dry parchment coffee	masl	Range altitudinal
No.1 Producer	500	196.5	130	76	1005	H.G.
No.1 Producer	500	175	135	89	1005	H.G.
Producer No. 2	500	212	180	103	800	STD
Producer No. 2	500	196.5	130	76	815	STD
Producer No.3	500	165	135	89	1088	H.G.
Producer No. 2	500	212	180	103	825	STD
Producer No. 4	500	211	510	105.7	1330	SHG
Producer No. 2	500	211	185.86	106	918	H.G.
Producer No.5	500	214	192	108	965	H.G.
Producer No. 6	500	212.5	194	104.7	1335	SHG
Producer No. 7	500	198	170	105	1198	H.G.
Producer No.8	500	195	169	99	1340	SHG
Producer No 8	500	213	192	106	1377	SHG
Producer No. 2	500	219	180	118	800	STD
Producer No. 2	500	222	187	115	815	STD
Producer No. 2	500	198	180	113	825	STD
Producer No. 2	500	206	185	115	918	H.G.

Own source

4.1 Analysis of variance

Table No. 2 Analysis of variance

Dependent Variable: Dry Parchment Coffee					
source	Type III Sum of Squares	df	mean square	F	Next.
Corrected model	1723.970 [to]	2	861,985	15,283	.000
Intercept	171196.962	1	171196.962	3035.361	.000
height masl	1723,970	2	861,985	15,283	.000
Mistake	789,612	14	56,401		
Total	178851.580	17			
Corrected Total	2513,582	16			

Own source

According to the analysis of variance, it is denoted that there are significant differences between the three altitudinal levels evaluated in the yield in kg of dry parchment coffee ($P<0.05$), therefore the average yields of the three altitudinal levels are different.

4.2 Separation analysis of yield means in Parchment Coffee.

Table No. 3 Duncan's mean separation analysis for dry Parchment Coffee

Farm masl	No.			
		1	2	3
Less than 900 (STD)	6	89.33		
900 – 1200 (HG)	7		104.91	
greater than (1300)	4			115.25

Own source

In the yield analysis of Dry Pergamino Coffee at altitudinal levels, the averages are not homogeneous for the three ranges of heights, and the CPS yields are different for the three heights, where the highest coffee yield in kg is studied. in the highest range of height at 1200 masl according to Duncan's mean separation (Table No. 3). In the same way, at the lowest level of height, the performance in pounds was obtained. lowest in average coffee yield.

In this way we can denote that, if the yield of the dry parchment coffee bean is directly proportional to the height, we can say that the tallest bean has a better weight yield given the greater density of the coffee bean, therefore that the amount of by-products is inversely proportional to the height, so that at higher altitudes the percentage of by-products of the coffee weight decreases in relation to the total weight of the grain, given that the weight of the grain is greater.

In addition, when evaluating the average yields of the washed parchment coffee and aired parchment coffee samples, no significant differences were found between the means, that is, in both cases the samples are homogeneous in the three ranges of heights evaluated ($P > 0.05$) .

5. CONCLUSIONS

The results obtained allow us to determine that for a coffee bean harvested on farms at higher altitudes above sea level, it is directly proportional to its yields by weight of dry parchment coffee, throughout the process stage of the wet coffee benefit in Honduras; In the dry milling phase of the transformation process into gold coffee for export, the

low yield of the grain produced in lowland farms is due to the fact that it has less weight (lower density) and in the process of agro transformation the percentage of grain is higher that classifies the siphon and the sieve, which are added as resacas, which are traditionally processed in drying patios and then marketed as regular coffee.

The sensory characteristics of the evaluated samples, we found that the higher the masl, the better the rate qualities, of the studied samples, the standard central coffee obtained qualifications of 82.5% as a High Grown coffee due to good management on the Los Nogales farm , High Grown scored 84.5%, and Strictly High Grown scored 89.5% as a Strictly High Grown plus category coffee, as they were handled from receipt to reach. exporting gold or green coffee.

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