

## Effect of Inf (cna - cnb) enzyme complex in the drying process and the coffee quality

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### ABSTRACT

The world demand for quality coffee is growing and the market is increasingly demanding for sustainable practices, leading coffee growers to search for new coffee processing processes always aiming for maximum quality. The objective of this work was to verify the benefits of using the LNF CNA - CNB enzyme complex in the postharvest process, in order to compare the results of drying time and the final beverage quality of the product. The research was carried out at Fazenda Iracema, municipality of Machado - Minas Gerais, with mechanically harvested coffees from the cultivar Mundo Novo, with 80% maturation, and the treatments were: natural and washed coffee, with and without application of enzymatic complex and drying in suspended, concrete and mixed courtyards (initially in the yard and finished in rotary dryers), the enzyme complex dosage was 1 ml CNB + 2.5 ml CNA per liter of water, applied to 60 liters of coffee. The experimental design was in randomized blocks, in a 2 x 2 x 3 factorial scheme (2- types of "washed or natural" processing; 2- with and without enzymatic application; 3 - "suspended, concrete and drying" drying forms), with 4 repetitions per treatment, totaling 48 experimental plots. The coffees were dried to 11.5% humidity and evaluated by the SCAA. It was concluded that the use of LNF (CNA - CNB) enzymatic complex in the coffee drying process did not influence the final drying time results, nor did it influence the coffee beverage aroma attributes. The drying forms directly influence the drying time.

**Key words:** Enzymes; post-harvest; specialty coffees.

## 1 INTRODUCTION

Currently, the demand for higher beverage quality coffees is growing with good appreciation compared to commodity coffees. The consumer market is increasingly demanding. A condition of good remuneration provides the coffee grower conditions for increasingly sustainable production, which is also increasingly demanded by consumers (Guimarães; Castro Júnior; Andrade, 2016).

Minas Gerais stands out with the largest coffee producing state in the country, having as its main factor of regional development, coffee agribusiness (Silva; Santos; Lima, 2001).

Brazil, for many years, was considered a major producer of commodity coffees, and not of quality, such scenario has been changing. The market is valuing and increasingly seeking better quality coffees. Due to this change, the seal of purity was created by the Brazilian coffee industry association, with the main objective of preventing fraud, but also in order to collaborate in the development of specialty coffee marketed in Brazil (Associação Brasileira da Indústria de Café - ABIC, 2014).

According to Zaidan et al. (2017), specialty coffees have characteristics that encompass physical and sensory properties, as well as incorporating factors that relate to technological

issues, environmental preservation and maintenance, and social responsibility. Nowadays, the use of enzymes is used in various sectors of the food industry, such as baking, wine and beer production, among others.

According to Abrahão et al. (2009) the production of quality coffees, in addition to genetic characteristics, it is also influenced by other factors that are fundamental importance, such as: altitude, topography, microclimate, among others. In addition to environmental factors, pre and post-harvest care drastically influence the final quality of the produced fruits.

Coffee drying, if improperly conducted, it can lead to product deterioration, causing it to lose its quality attributes obtained on the field, that is, resulting in poorer quality coffee and consequently lower commercial value (Borém, 2004).

The grains dehydration process can be done in yards, where the product is sprawled out in floors that can be of cement, brick, beaten ground or asphalt; it can also be performed in dryers, structures that force heated air to pass through the grain mass. There is also the drying association that is the method most used by producers nowadays, where it is made half dry in the yard and the end in the dryers (Santos; Chalfoun; Pimenta, 2009).

A recommended practice in the process of dehydrating beans is coffee in terraces or pre-dryers until the state of half-

dry (35 to 40%), with drying being continued in the mechanical dryer until it is stored in bins. The conventional terrace used in this dehydration process can be constructed of cement, bricks, asphalt and beaten or suspended floors, and the product must be dried and distributed in a thin layer (Silva, J.S; Nogueira; E.M Roberto; C.D., 2005).

Currently, one of the drying methods that has been highlighting is drying in suspended yards, wherein despite being longer and more expensive, it has provided better beverage quality coffees (Borém et al., 2008).

The increase in demand for coffee is attributed to the growth in the offer of differentiated products, of better quality and with certifications that attract consumers. The adjustments made by the producers to meet the new consumption requirements, made possible or arising in the specialty coffee market in the country (Boaventura et al., 2018).

The coffee growers, improving their processes and seeking better remuneration, are using biotechnologies focused on the post-harvest coffee process. The use of LNF (CNA - CNB) enzyme complex promotes acceleration in the drying process and consequently minimizes the risk of unwanted fermentation by reducing the time it is exposed to conditions that may be propitious, and consequently may maintain final coffee quality (Guimarães; Castro Júnior; Andrade, 2016).

Enzymes are proteins obtained through the use of modern biotechnology. Coffee fruits usually already contain enzymes which act as natural catalysts in coffee grains, but the addition of enzymes promotes an increased concentration, which results in accelerated desmucilage and later faster drying and better final product quality (Borém, 2008).

The Specialty Coffee Association of America (SCAA) was founded by a group of people in the USA coffee industry concerned about losing consumers. Specialty coffee is a product that has a high quality level, and is therefore the result of strict quality control. SCAA has established a complete and consistent methodology for coffee evaluation, introducing the so-called objective evaluation that is, qualifying the coffee through a decimal scale ranging from 0 to 100 points. In this sensory evaluation, ten different coffee attributes are verified; they individually vary from zero to ten points, based on scientific concepts (Specialty Coffee Association of America - SCAA, 2015).

To be considered specialty coffee, it is pertinent to have a score greater than or equal to 80 in relation to sensory analysis, according to the standards established by the Specialty Coffee Association of America. It is considered gourmet coffee, high quality coffees that have a mild flavor and aroma due to roasting and grain selection (ABIC, 2017).

Beverage quality is related to qualitative characteristics or quality assessment attributes such as: clean beverage, taste, acidity, sweetness, body expressed from the accumulation of chemical constituents in the grain (Bytof et al., 2007).

The objective in this research was to evaluate the use of LNF (CNA - CNB) enzyme complex in the post-harvest process of arabica coffee fruits and the effects on drying time and final beverage quality according to methodology SCAA methodology (2017).

## 2 MATERIAL AND METHODS

The survey was carried out at the Iracema Farm, municipality of Machado, Southern Minas Gerais, geographic coordinates latitude 21°37'55" South, longitude 45°51'40" West and altitude 900 m, tropical altitude climate.

The selected coffee land was site 01, cultivar Mundo Novo 502/9 with spacing 3.80 m x 0.80 m, 3.290 plants/ha<sup>-1</sup>, implanted in the year 2004/05. The coffee fruits were harvested mechanically, when they reached 80% of maturation.

The experimental design was in randomized blocks, in a 2 x 2 x 3 factorial scheme (2- types of processing "washed or natural"; 2- with and without enzyme application; 3 - "suspended, concrete and dryer" drying forms), with 4 replications per treatment, totaling 48 experimental plots.

The harvested coffee was transported to the processing unit and processed to install the treatments:

- 01 - Natural coffee with enzyme complex application and drying via suspended yard;
- 02 - Natural coffee without enzyme complex addition and drying via suspended yard;
- 03 - Coffee washed with enzyme complex application and drying via suspended yard;
- 04 - Coffee washed without enzyme complex addition and drying via suspended yard;
- 05 - Natural coffee with enzyme complex application and drying via concrete yard;
- 06 - Natural coffee without enzyme complex addition and drying via concrete yard;
- 07 - Coffee washed with enzyme complex application and drying via concrete yard;
- 08 - Coffee washed without enzyme complex addition and drying via concrete yard;
- 09 - Natural coffee with enzyme complex application, drying in concrete yard and finished in the dryer;
- 10 - Natural coffee without enzyme complex addition, drying in concrete and finished in the dryer;
- 11- Coffee washed with enzyme complex application, drying in a concrete yard and finished in the dryer;
- 12 - Coffee washed without enzyme complex addition, drying in a concrete yard and finished in the dryer.

For all treatments using enzymes the dosage was 1 ml CNB + 2.5 ml CNA per liter of water which was applied in 60 liters of coffee. Coffee drying process was as follows: the natural coffee that was processed in the concrete yards,

both passed through the washer as well as the one that did not pass, it occupies the same space of 4 m<sup>2</sup> and day by day were revolved every one hour until they reached 11.5% moisture, ending thus its sun-drying and environmental conditions. Already the natural coffee plots that were distributed in the suspended yards, followed the same methodology, it was distributed in an area of around 4 m<sup>2</sup> and ended its dryness also in the sun and environmental conditions. As for treatment 05 and 06, which are larger lots, they were previously distributed in a concrete yard and later taken to finalize drying in mechanical rotary dryers with a temperature around 40 °C in the mass.

After coffee drying when it reached 11.5% moisture, they were stored for a period of 15 days, which we call rest, later were benefited and sent to the score classification and beverage according to the methodology SCAA (2008).

The obtained results were submitted to the variance analysis and the averages comparison made by the Scott-Knott test, at 5% probability, using the SISVAR<sup>®</sup> software (Ferreira, 2014).

### 3 RESULTS AND DISCUSSION

It is possible to analyze according to the data presented in Table 1, that in relation to the drying time (hours) in different processes with and without the use of enzyme complex the treatments in their respective yards presented the following results:

Regarding to be washed or not, there was no statistical difference, as in comparison between the use or absence of enzymatic complex, but there was a statistical difference among the drying forms.

The treatments in the drying process in concrete yards stood out in relation to the coffees in which drying was performed in suspended yards.

According to Krug (1940) the coffee quality is determined by favorable or unfavorable fermentations and enzyme reactions may be responsible for obtaining good or bad beverage quality.

The coffee drying process is a step of great importance for coffee quality, which demands time and risks of unwanted fermentations.

Coffee beverage quality, which is characterized by its taste and aroma, it is influenced by several pre and post-harvest factors that guarantee the final expression of the product quality. Regarding post-harvest factors stand out: enzyme and microbial fermentations, drying processes, storage of processed coffee, blending and roasting of grains (Carvalho; Chagas; Souza, 1997).

It can be compared through the classification, score and final beverage attributes in this work, whether or not the enzyme activity really influences the final product.

After drying, rest and coffee benefit, the samples were sent to Q-graders for classification according to methodology SCAA (2008), wherein the score, aspects and beverage quality were evaluated.

According to the data in the Table 2, we can state that in terms of attributes all treatments obtained caramel scores, not differing from each other. These attributes were granted by the 03 Q-grader responsible for the evaluation of this work.

Evaluating all the attributes and results of the sensory analysis shown in the table below, we can compare the quotation by Toledo et al. (2016), when they say that the aroma and taste of coffee is formed by a wide variety of

**Table 1:** Results of coffee drying time submitted to different processing with and without the enzyme complex application.

| Processing | DRYING         |                |              |                |                |                |
|------------|----------------|----------------|--------------|----------------|----------------|----------------|
|            | Suspended yard |                | Concret yard |                | Yard and dryer |                |
|            | With enzyme    | Without enzyme | With enzyme  | Without enzyme | With enzyme    | Without enzyme |
| Natural    | 480 Aa         | 480 Aa         | 332 Ab       | 336 Ab         | 167 Ac         | 171Ac          |
| Washed     | 480 Aa         | 480 Aa         | 332 Ab       | 336 Ab         | 171 Ac         | 176Ac          |

\*Capital letters equal in the column and minor letters equal in the same line do not differ among themselves by the Scott-Knott test at 5% probability.

**Table 2:** Results of coffee sensory analysis according to the SCAA methodology - attributes, submitted to different processing with and without enzyme complex application.

| Processing | DRYING         |                |              |                |                |                |
|------------|----------------|----------------|--------------|----------------|----------------|----------------|
|            | Suspended yard |                | Concret yard |                | Yard and dryer |                |
|            | With enzyme    | Without enzyme | With enzyme  | Without enzyme | With enzyme    | Without enzyme |
| Natural    | Caramel        | Caramel        | Caramel      | Caramel        | Caramel        | Caramel        |
| Washed     | Caramel        | Caramel        | Caramel      | Caramel        | Caramel        | Caramel        |

volatile compounds, arising from the reactions that occur in the chemical constituents of raw grains during roasting, which may result in an excellent quality coffee.

Among all these factors, the types of post-harvest processing have been studied, as some authors have reported differences in the sensory profile of coffees submitted via dry and wet. Natural coffees produced sweeter, full-bodied beverages, and blanched coffees resulted in beverages with more balanced acidity and strong aroma (Borém et al., 2008).

According to SCAA (2015), coffee is considered specialty when it reaches a score above 80 points in the sensory classification (proof cup), besides not presenting any primary defect (black, burnt, coconut, strange material, fungus damaged grains or severely damaged by insect), and can have a maximum of five secondary defects (partially black, partially burned, mariner, badly formed, green, shell, broken, peel or slightly damaged by insects).

The results in the Table 3 show that the treatment with washed coffee using enzyme complex and drying in a suspended yard, and the treatment with natural coffee using enzyme complex and drying in yard and dryer differed statistically from the others, being the best treatments.

Analyzing the different types of yards, the treatments wherein the coffees were dried in concrete yards, that resulted in the lowest grades and those in suspended and yard + dryer did not differ statistically from each other.

Evaluating between natural and washed processing, only a low performance was observed in the washed, when submitted to drying in concrete yard, the others did not differ statistically. The use of enzyme was superior when applied, except in the treatment washed and drying in concrete yard.

According to Borém (2008), natural coffees produced via dry have better quality, but still inferior those produced via wet, because the differences in the quality of the grain produced are related to the processing adopted and to the unwanted fermentation, which in most cases are related to the natural processing of these grains, besides the lack of care in the post-harvest fruits phase. The results obtained in this research differ in part, which may have been influenced by the use of enzyme complex.

But, according to this work, there is a controversy regarding this statement, because two of the treatments that obtained the worst beverage quality were precisely washed and dried in the concrete yard, in comparison with the others. However, in this work the washed coffees were inferior to the others, emphasizing that they were the treatments that dried in the concrete yard.

According to Pinto et. al. (2001), coffee grains that have the highest beverage quality are exactly the ones that contain the highest enzymes participation related to this aspect, that is, enzymes that maintain a higher grain sweetness index, corroborating to the results obtained wherein the grains enzyme application increased its concentration giving to these fruits a higher final beverage quality.

According to a study by Araújo et al. (2018) the types of yards influence the final processed coffee quality, which can be verified in natural and desmucilated coffee processed in concrete yards and polyethylene cloth, being statistically superior to those processed in other types of yards, wherein it is noteworthy that it was possible to obtain coffees with scores higher than 80 points, a score that was possible to observe in most treatments of this work, however, in the current work, in addition to the use of different drying forms, there was also the use of enzyme complex.

**Table 3:** Results of coffee sensory analysis according to SCAA methodology, submitted to different processes with and without enzyme complex application.

| Processng | DRYING         |                |              |                |                |                |
|-----------|----------------|----------------|--------------|----------------|----------------|----------------|
|           | Suspended yard |                | Concret yard |                | Yard and dryer |                |
|           | With enzyme    | Without enzyme | With enzyme  | Without enzyme | With enzyme    | Without enzyme |
| Natural   | 81.7Ba         | 81.6 Ba        | 81.9Ba       | 80.5Ba         | 82.0Aa         | 81.2Bb         |
| Washed    | 82.4Aa         | 80.7Bb         | 74.0Cc       | 74.8Cc         | 81.1Bb         | 80.3Bb         |

\* Capital letters equal in the column and minor letters equal in the same line do not differ among themselves by the Scott-Knott test at 5% probability.

## 4 CONCLUSION

It can be concluded that the use of LNF (CNA - CNB) enzyme complex with respect to the coffee drying process did not influence the final results of drying time, even as it also did not influence the coffee beverage aroma attributes. The drying forms influence directly the time of drying.

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