Revista ARACÊ
ISSN: 2358-2472

EVALUATION OF LOSSES IN THE SUGARCANE HARVESTING PROCESS IN THE IVINHEMA VALLEY REGION

https://doi.org/10.56238/arev6n2-172

Submitted on: 09/22/2024 **Publication date:** 10/22/2024

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ABSTRACT
Brazil holds about 18% of all its arable territory to produce sugarcane, its raw material is of great economic importance in the country, with production of by-products with high added value, such as sugar, alcohol and ethanol. Some states of greater territorial extension are responsible for large-scale production, mainly in the Midwest, Southeast and North regions of the country, with the greatest highlight with 53% of all sugarcane cultivation being São Paulo, followed by Minas Gerais, Goiás and Mato Grosso do Sul. In view of this, with large-scale production, other challenges begin to arise, such as the need for crops within technological aspects that prevent the occurrence of losses in the production system, from the establishment of sugarcane fields and especially their harvesting and transportation, to the arrival of raw material within the industrial complex for transformation into by-products. The objective of this study was to analyze and quantify the percentage of losses between the harvesting and receiving process in the sugarcane raw material industry harvested fresh in the region of Vale do Ivinhema – Mato Grosso do Sul. As a methodology, the case study was used, which comprised three months of analysis. With the data analyzed, it was possible to verify that the highest percentage of losses occurs for the portion of producers who carry out their own crops, sending their raw material to the industry, generating around 44.02% in losses between the total harvested and received. In addition, harvests farther from the industrial complex showed greater losses of around 9.85% in mineral and vegetable impurities, showing that transportation may have influenced the time of receipt.

Keywords: Sugarcane Sector. Technology. Management in sight. Planning.

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Revista ARACÊ
ISSN: 2358-2472

INTRODUCTION

The activity of Brazilian agribusiness advances more and more in the production and commercialization of sugarcane, which serves as the main raw material in the country for the production of derivatives to serve humanity directly and indirectly, such as the production of essential products for humanity, such as: Sugar, ethanol, alcohol, vinasse, filter cake, molasses, among others, in addition to serving in derivatives for animal feed, the main options being the sugarcane bagasse residue and dry yeast.

According to data from Conab – National Supply Company, ethanol production in Brazil, in harvest data obtained in 2022, the Brazilian area destined for sugarcane cultivation was 8.4 million hectares, with a total production of 642.71 million tons, ensuring approximately 76.13 tons per hectare in productivity. Currently within a national *ranking*, the state of São Paulo corresponds to approximately 53% of this production, followed by Goiás, Minas Gerais and Mato Grosso do Sul. According to this total production, about 34% was destined to sugar production with 29.79 million tons, and the rest destined to record ethanol production.

In view of this, it is possible to verify that Brazil meets in great demand the production of this raw material in sugarcane biomass, to meet the needs of numerous sectors, some states are highlights in this production. However, despite the resident industries in the country, there is a need to search for greater technology, such as equipment, qualified labor, and other means that meet and ensure greater productivity MEERT et al., (2020).

Sugarcane productions currently meet a large production demand, generating billions of tons and liters of by-products, aiming for an increasing production. For this to be possible, there is a need to seek greater productivity and margin before companies, called large rural industries, which directly supply the domestic and foreign markets.

In general, the main factors that may interfere in this greater search for a higher production yield, especially within the ethanol production chain, are extrinsic factors, that is, environmental, such as: Temperature, operational yield of harvest, climate, type of soil and management, yeasts in fermentation, among others.

Revista ARACÊ
ISSN: 2358-2472

OBJECTIVES

GENERAL OBJECTIVE

To evaluate the amount of losses in the sugarcane harvesting process in the Ivinhema Valley region.

SPECIFIC OBJECTIVES

- Quantify the losses during harvest in the period 3 months in the Vale do Ivinhema region.
- Identify the main factors that cause these losses.
- Analyze actions that can minimize losses during harvest.

LITERATURE REVIEW

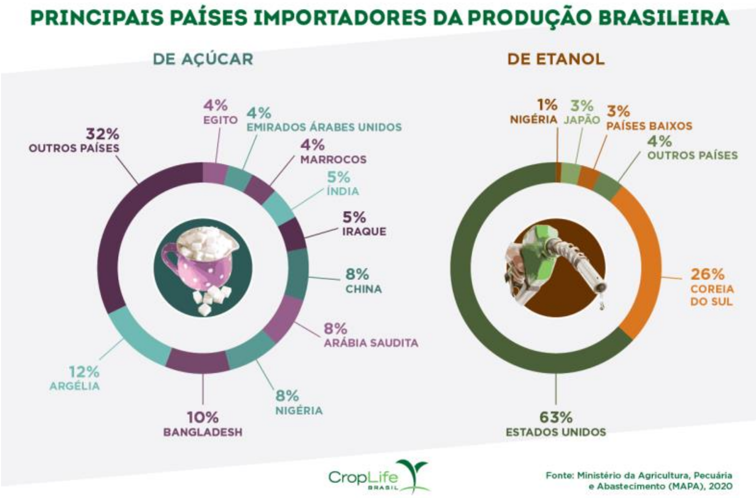
SUGARCANE IN BRAZIL

Sugarcane cultivation has supplied the country with its raw material and by-products for approximately 500 years, being responsible for 2% of the gross domestic product (GDP) for the production of sugar and ethanol compared to Brazilian exports, corresponding to approximately 13% of the entire Brazilian harvested area (CARMO et al., 2021). According to IBGE data (2022), Brazil produced an average of ~74 tons per hectare of biomass, totaling 724,428,135 million tons in 9.8 million hectares, with the state with the highest production being São Paulo, followed by Goiás, Minas Gerais and Mato Grosso do Sul in fourth place.

Mato Grosso do Sul, in the 2022 harvest, was responsible for the production of 40,758,940 million tons (~5.6% of all national production) cultivated in 631,534 hectares, with an average operating yield of 64 tons/hectare, with Nova Alvorada do Sul as the highest production municipality.

In view of this, the great representativeness of sugarcane cultivation in Brazil is observed, with the country being the largest producer of this biomass worldwide, with the state of São Paulo responsible for more than 53% of all this national production, followed by the countries India and China (YOGITHA, 2020). Being the country with the largest production, it is responsible and leader in the international market in the commercialization of commodities from its production, such as sugar and ethanol, mainly destined for many countries (Figure 1).

Figure 1 – Client countries of Brazil in the acquisition of Brazilian sugarcane commodities.



SOURCE: (Ministry of Agriculture, Livestock and Supply – MAPA, 2022).

With all its importance for the Brazilian market, sugarcane still goes through constant prospects in production area growth, according to CONAB data, the 2023/24 harvest tends to grow 10.9% compared to the previous cycle, supplying new records computed by the company, both yields obtained in the highest production per hectare and in the growth of planted area (CONAB, 2023).

Given all the significant importance of the production of sugarcane raw material in the country, the sector is going through great complexities in the production process, bringing with it a series of challenges, especially in some certain links of the production chain, such as planting, management and harvesting mainly. Some problems inherent to harvesting are considered one of the biggest bottlenecks, since it is the most important phase of all production, as they depend on generating quality, quantity available in raw material and production volume delivered within the industrial complexes for processing (MANHÃES et al., 2014).

SUGARCANE HARVEST

The sugarcane crop is classified as having a semi-perennial production cycle, and its planting is interspersed every five or six years, due to its drop in production mainly in the last cycles, measured through the volume produced in tons per hectare, and the level of sucrose of the raw material measured in the industry (ROSSETO, 2012).

In recent decades, the cultivation of crops at the corporate level, originating from the cultivation by large business groups such as alcohol, sugar and ethanol producing mills, has generated the need to intensify the sugarcane harvesting process, through its great increase in cultivation in some regions of the country, especially in the Southeast, Midwest and North regions. This practice minimized the reduction of burning and manual harvesting practices, automatically reducing labor conflicts, lack of renewal of the workforce, providing some other advantages such as standardization of the standards of the production chain, thus ensuring a uniform harvest, planned from its beginning and end. In addition, especially for regions where the topography allows, improvements in harvest yields were evidenced, making it possible to aim for a reduction in costs with the operation in the harvest, post-harvest and transportation of the raw material to the industrial complex for its treatment (LIMA, 2021).

The Midwest region demands high yields of this crop, especially its production occurring in large areas, being classified as a crop of great economic importance for the region in question. In view of this, the costs of the harvesting process can indicate up to 12.67% of the entire cost of the cultural treatments that occur annually since the establishment of the CARLI sugarcane field; MARTINS (2022). Therefore, all the savings and efficiency generated during this process may be able to generate greater operational results, indicating improvement in the positive results with your cultivation.

Still in this sense, Carli; Martins (2022) show that the part of the management in which it can be more burdensome production costs are allocated to the harvesting process, and can be significantly self-losing operational result at the end of the process, in cases of poor data management and planning for an efficient harvest.

ROSSETO (2012) highlighted some expenses that can be minimized with the correct management in the harvesting process of this material, especially for the operational harvest through the use of machines mentioned in this research, without burning, aiming at greater efficiency and economy from the harvest in the field, until its entry into the industrial complex for the transformation of the sugarcane raw material, in by-products.

External transport is also capable of generating numerous costs added to each ton harvested, and if it is capable of generating higher costs, it may indicate a loss in operating results. Carli; Martins (2022), when analyzing analytical expenses of some of the main producing regions of the country (Southeast and North) with data from CONAB in the period 2008 to 2021, found about R$ 487.74, the cost of external transport per hectare of harvested crop. In addition, it identified that the main cost of sugarcane producing crops is still labor, even in mechanized aspects, accumulating about 18.26% in corporate crops, and

Revista ARACÊ
ISSN: 2358-2472

the second most cost is related to harvesting and transportation, with approximately 13% of all operation costs, evidencing the importance of policing these costs, especially in crops at the company level, where extensive areas are cultivated.

GRINDING

The raw material is conditioned by a process of cleaning and opening the cells, providing the extraction of a juice, after its removal the appearance of bagasse arises, which is the residue of the process, its moisture is reduced. After this procedure, the sugarcane is sent to conveyors, where the sugarcane is cut into small pieces, the equipment responsible for this process is the rotary knife, composed of an oscillating hammer motor and a defibrillator plate which pulverizes the sugarcane and opens the cells that contain sugar, facilitating its extraction process, it is recommended that at least 82% of the sugarcane cells be opened to achieve good extraction and efficiency in the mills (GOMES, 2016).

In this initial moment of receiving and cleaning the raw material from the crops, after its harvest, fresh sugarcane *in natura* may present a greater or lesser amount of impurities (minerals or vegetables, mainly classified in the industry) giving rise to data on losses with the harvesting and transportation process MEERT et al., (2020). In view of this, it is essential to monitor the volume harvested and received in the industry, in order to control in a management format the quantification of these losses and whether they exist, so that decisions can be made to improve the volume received daily, without affecting the production cycle of industrial by-products (MANHÃES et al., 2014).

According to Alcarde (2017), after this process, at the exit of the defibrillator, the height of the sugarcane mattress is standardized by the spreader, located at the discharge of the metal belt, to a high-speed metal belt that feeds the forced feed chute of the mill, in this way, the level of the sugarcane inside the chute is used to control the flow of sugarcane to the mill. With the beginning of the milling process, characterized by the extraction of the juice, this process is based on making the sugarcane pass between two rollers, with an established pressure, extracting the juice, also results in the generation of sugarcane bagasse at the end of the extraction, with a certain degree of humidity that allows its use as fuel in the boilers. The grinding process is characterized by seven suits in series, after the passage of the material through the first of this, the juice extraction occurs, where its proportion drops in relation to the amount of fiber, to around 2 to 2.5, leaving a residue that is difficult to extract. In this way, in the last two suits that the material will be subjected to, it is necessary to add a certain amount of water to the sugarcane layer. For industries that seek the production of sugar and ethanol, the first juice that passes through the first suit is sent to the production of sugar, as it is a better quality material, the rest is destined for use in distillery, for the production of ethanol. The efficiency of the extraction process by the mill can vary from 94 to 97.5% and the moisture of the final waste, the bagasse, is around 50% (ALCARDE, 2017).

After grinding and verifying the juice yield, it is also possible to evaluate the quality of the raw material received, with the generation of higher or lower yield, mainly impacted by the sucrose content available in the processed material (ALCARDE, 2017). Such information serves as an aid for decision-making in the field, in the verification of the characteristics of the raw material, aiming to maintain in the field varieties of sugarcane fields that best provide greater juice yield in the industry (MEERT et al., 2020).

RIBEIRO et al., (1999) emphasized the milling process, where the material must go through processes after this practice, for a better use of the raw material, such as: Liming, heating, decantation, concentration and cooling. Where during the heating stage, with the lime law material, flocculation aims to occur, favoring the decantation of colloidal impurities, in addition to protecting the equipment against corrosion.

OPERATIONAL YIELD AT HARVEST

Some states in the country have a 100% mechanized harvesting process, especially those with production of sugarcane raw material on a larger scale, where one of the main challenges at the moment is to seek to reduce operating costs with this process, some alternative processes since the establishment of sugarcane fields can contribute up to 50% to the reduction of costs (Chart 1) of raw material losses in its removal from the crop, until entering the industry Oliveira et al., (2019).

In addition, harvesting and transportation can significantly compromise the volume of productivity and the quality of the final production, especially during loading after cutting the raw material exceeding 24 hours, excess impurities, destruction of roots by machines going into transshipment trucks (OLIVEIRA et al., 2019).

Revista ARACÊ
ISSN: 2358-2472

Frame 1 - Components of the productive cost in sugarcane cultivation that are determinant in the measurement of Brazilian ethanol production.

Cost component	US$/ha	US$/t
Planting	428	5,9
Plant cane treatment	34	0.5
Knuckles	394	5.4
Harvesting and transportation	853	11.8
Earth	592	8.1
Administration	87	12
Depreciation	88	1.2
Capital	134	1.8
Total	2.537	34

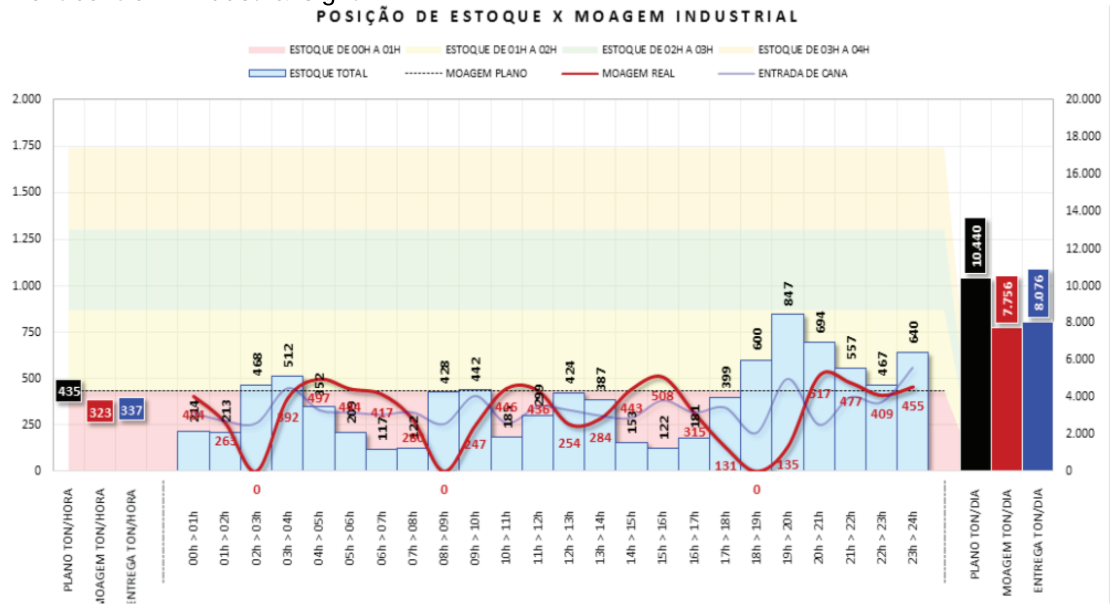
SOURCE: (CTBE, 2018).

The operational performance with mechanized cutting has advantages over the programming of the volume produced, without excess loads for transport and thus reducing losses, in some regions this is carried out through specialized trucks, with an average load of up to 45 tons composed of two or three trailers. These compute within the total cost of harvesting, including cutting, transshipment and transportation, the latter when counting the distance between the crop and the industry can further burden the activity (ALVES et al., 2022).

Some mills producing alcohol, sugar or ethanol have prior planning for their production and decision-making within their daily operational flow in obtaining by-products from sugarcane, mainly due to their great need for high volumes to be worked daily, being guided by production panels, which may indicate the need for greater or lesser receipt of raw material, the measure of the by-product being produced in relation to the quantity and quality of the raw material being processed (Figure 2).

Revista ARACÊ
ISSN: 2358-2472

Figure 2 - Composition of harvested sugarcane stocks x industrial crushing with monitoring via system and management control in industrial sight.



SOURCE: (ALVES et al., 2022).

The crushing storage plan can be paramount within the daily, weekly and biweekly planning of the industrial complex, thus programming the volume to be harvested in the crops. Thus, it is possible to carry out inventory planning, avoiding production stops in the manufacturing process ALVES et al., (2022).

One of the main objectives of mechanized harvesting, in addition to greater organization of the entire daily production flow, is directly linked to lower operating costs, through the volume harvested and the number of operations required, thus avoiding significant losses throughout the production of the raw material (OLIVEIRA et al., 2019).

LOSSES IN THE HARVESTING PROCESS

One of the most important processes in the sugarcane production cycle is its harvesting process, mainly because its yield depends on a series of factors inherent to the process, and because of the responsibility for the volume of production of raw material, to be delivered to industrial complexes on a daily basis (MANHÃS et al., 2014). According to Oliveira et al., (2019) many challenges are encountered at this final moment of the annual production cycle, mainly due to the issue of operational yield in harvest volume, which can be compromised in the way the operation occurs.

Revista ARACÊ
ISSN: 2358-2472

In this sense, the process arising from a mechanized harvest can offer solutions, which aim at greater programming of the volume to be harvested, and operational yield mainly, allowing greater strategic planning in the field and at the industrial level to receive the raw material in sufficient quantities for daily, weekly, biweekly, and monthly work (ALVES et al., 2022).

In the aspect of modernization in technology, the sugarcane harvest started to provide returns with the programming of the volume of raw material harvested, and with this improvements within the industrial sector, however, improvements in operations management for this process were needed, in order to manage the resources demanded in order to reduce the operational costs of harvesting, mainly involving the reduction of harvest losses, savings that can be generated in this process, and other activities inherent to the harvesting operation as a whole (ALVES et al., 2022).

Also in this sense, Meert et al., (2020) also called the types of losses quantitative and qualitative, the first being that it is plant losses, such as the presence of foreign materials within the biomass harvested from sugarcane, such as the presence of wood tips, chips, whole canes and the like, affecting the yield obtained in the crop and the net received within the industry, while the second format is configured as losses in the reduction of the quality of the juice, mainly by reducing the apparent sucrose content found in the harvested material.

On a large scale, two different types of losses are classified in a macro way, but Morais et al., (2015) further detail this process, since they can be dependent on the variety of the sugarcane field, size and thickness of the stalks, plant architecture, crop uniformity, among others, affecting the quantitative and qualitative yield.

METHODOLOGY

The present work is initially composed of a case study War; Lunetta (2023) whose main objective of the analysis in question is to analyze the correlation of yield losses and volume of the sugarcane raw material harvested and received in the industry, through the analyses obtained during three months of the 2023 harvest. The data comes from an industry in the region, which will have its name confidential in this work.

It was possible to collect information obtained from a previous harvest of a mill located in the city of Ivinhema – Mato Grosso do Sul, operating in the region of Vale do Ivinhema, involving 6 cities (Ivinhema, Deodápolis, Angélica, Novo Horizonte do Sul, Naviraí and Nova Andradina), preserving the name of the industry, in the present work it was called: Sugar and Alcohol Mill. In this way, it is possible to analyze the data obtained, and assimilate with those found in the literature, to identify whether or not there is significant efficiency in the operational yield of raw material losses during the harvesting process.

The data were collected for three months, through the search for information about the period of the year, such as the volume harvested in the field, transported and received in the industry according to the work fronts, and after verifying the net yield of the raw material, all data were provided by the company through visual management reports used by the company, for better management of their productive data, in order to contribute to the research. The period of information collected comprises between the months of June and August of the year 2023.

The research is methodologically based on a qualitative analysis, because it contains an analysis of a process, which according to Flick (2004) is a type of analysis whose purpose is to ascertain a case study, phenomenon, among other works whose objective is to generate deeper analyses on the subject, and possible explanations. The quantitative methodology was also used, due to the need for a visual analysis using graphs, tables, and other data for the interpretation of the results. Ludke (1988) defines this type of method as a practical basis for further bibliographic exploration, and foundations for academic work. It was necessary to use an exploratory methodology, in bibliographic character, which is characterized by Godoy (1995) as a systemic search of literary character for possible analyses and contributions in the case, through the use of periodic materials, documentaries, books, articles, theses, dissertations, among others that proved to be pertinent to the theme, through searches in reliable sites: ScieLo and Google Scholar. The research was made possible through a search using keywords, the main object of research being: Harvest yield in sugarcane, losses in the harvest of sugarcane, extrinsic factors in the harvest of sugarcane.

The files found went through a selection process, where those pertinent to the proposed theme were considered, within the year of publication less than ten years, considering periodical files, books, documentaries, articles, theses, among others. Through this, it was possible to combine the analyzed materials, interpretations and new considerations and conclusions on the proposed theme, as well as to identify whether or not there are direct or indirect correlations in the quantification of losses in net yield of the

Revista ARACÊ
ISSN: 2358-2472

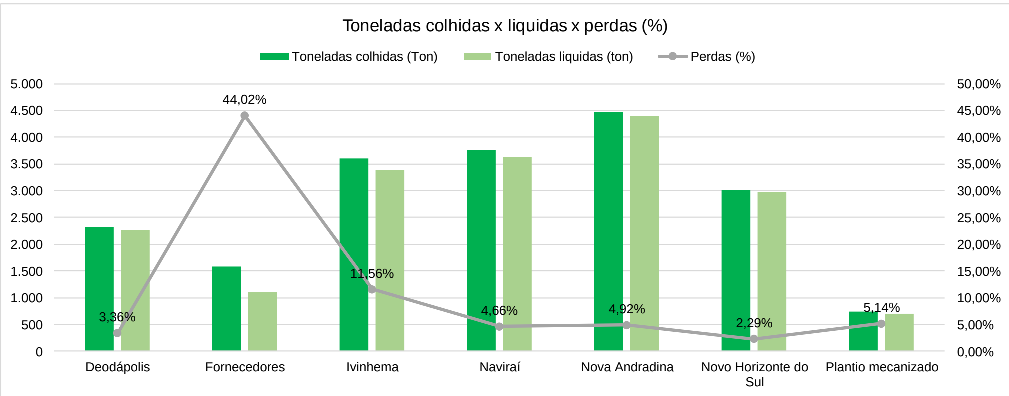
sugarcane raw material obtained in the field. The analysis of the results, and formulation of the present research comprised between July 2023 and July 2024.

RESULTS AND DISCUSSIONS

By analyzing the database of the company mentioned as "Sugar and Alcohol Mill" so named in the research, during three months of the harvesting process in the region of Vale do Ivinhema – Mato Grosso do Sul, it was possible to verify some results used in the present proposed research.

The percentage of losses between the volume of raw material harvested while still in the field and its net quantity received in the industrial complex allowed us to see from 2.29% to 44.02%, in relation to what was harvested and received at the mill, showing the highest percentage of losses occurred for the portion of suppliers (Graph 1).

Graph 1 – Tons harvested, net and percentage of losses.



SOURCE: (Author, 2024)

According to field research involving the analyzed database, suppliers are a class of producers who carry out their own planting and make the crop available to the Plant to be responsible for the harvest, in addition, it is evidenced that this refers to the longest distance traveled until the raw material reaches the industry (Table 1).

Table 1 – Number of total loads analyzed in the database and average distance traveled from the municipality/locality to the sugar and alcohol mill.

Line Labels	No. of total loads	Distance km (average)
Deodápolis	3.096	32
Fornecedores	820	56
Ivinhema	9.740	25
Naviraí	3.810	40
Nova Andradina	5.349	33

Novo Horizonte do Sul	6.674	36
Mechanized plantation	163	13

SOURCE: (Author, 2024)

In this sense, according to Oliveira et al., (2019) one of the biggest factors that can significantly increase the volume of losses is in the mechanized harvesting of raw sugarcane, such as the presence of foreign materials such as: pieces of wood (stumps), chips, tip cane, whole cane, splinters, peaked grinding wheel, among others. In outsourced plantations, that is, that all planting and crop management are carried out by the region's own producers, in the case named in the survey as suppliers portion in which 44.02% was identified in losses volume harvested x received, some essential aspects in the crop management carried out by the Plant itself in its own crops may go unnoticed, Since most of these producers are cattle ranchers or farmers in the region that holds some leased areas or intended for the production of sugarcane, in order to contribute to property costs in its commercialization, even so, most of these do not require labor, machinery and even consultancies or professionals responsible for the correct management of this crop, thus generating a raw material of medium to low quality, impacting on a greater volume of losses at the time of its harvest.

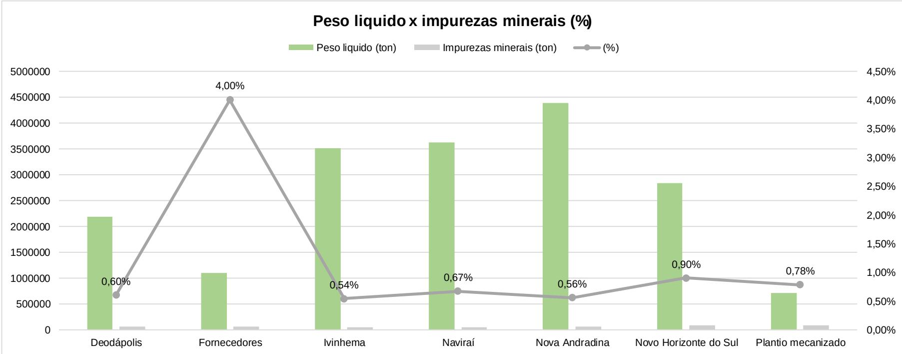
Also in this sense, according to Manhãs et al., (2014) in areas with difficult topographies, the harvest of the material can be compromised qualitatively, that is, it loses its quality as the number of harvests advances due to damage caused to the ratoons at this time, impacting their uprooting from the sugarcane, also compromising the next harvests to be carried out.

Also in graph 1, we observe that for mechanized planting there were 5.15% in losses between the volume harvested x delivered, while for this portion the average distance traveled by the loads was 13 km (table 1). With this, it is possible to observe the shortest distance traveled, but still a slight percentage in losses. Alves et al., (2022) point out that there are two main types of losses during the entire mechanized process, from the establishment of the crop to its harvest, with visible losses and invisible losses. The first is considered easy to identify because they can be visualized and even estimated in the field through the amount of raw material harvested in the form of whole sugarcane, stalk, piece of sugarcane and remains of raw material left in the field after the passage of the harvesting machine, while the second form in invisible losses are difficult to identify while still in the field, being seen in the industry during its production process, with the amount of raw material misplaced in its broth format, small splinters and sawdust, mainly.

It is possible to notify some regions in which they obtained lower losses in total production and receipt in the industry, showing that the operational aspects both in harvest and transportation are in accordance with normality, as in the case of Novo Horizonte do Sul and Deodápolis, with 2.29% and 3.36%, respectively in losses. In this sense, although the municipalities are located at average distances of 36 and 32 km, respectively, the distance did not contribute to further impact the increase in losses, showing that the transportation during the analyzed period was adequate.

According to the present research, most of the losses that occurred in the crop with the lower production volume received by the industry, have some actions that can still be taken in the field, such as the maintenance of the knives of the harvesters' base cutter, sugarcane variety, topography of the terrain and the like ALVES et al., (2022). These factors directly impact the generation of losses in the form of plant and mineral impurities (Graphs 2 and 3).

Graph 2 – Percentage of mineral losses in relation to the net weight of raw material received in the industry.

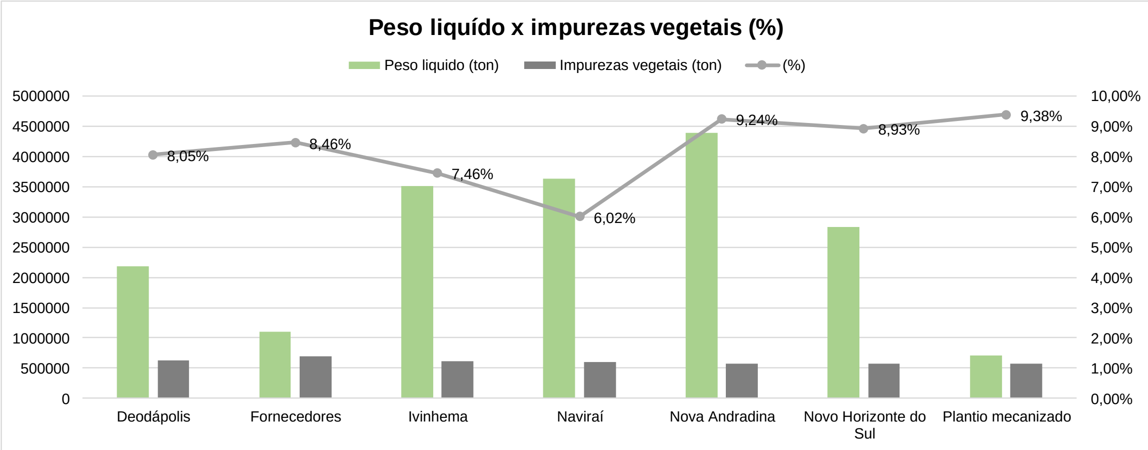


SOURCE: (Author, 2024)

Vegetable impurities are green leaves, straws and pointers mainly, they come from the crop with the harvest of the green raw material, and it is important that the machine does a separation and disposal process, aiming to leave the minimum of this impurity within the loads that will be destined for the industry. Mineral impurities are classified as stones, soil (earth) that can be harvested together with the sugarcane at the time of its cutting, but which are not desired within the raw material, generating losses that can be even significant within the production process (MANHÃS et al., 2014).

Revista ARACÊ
ISSN: 2358-2472

Graph 3 – Percentage of plant losses in relation to the net weight of the raw material received in the industry.



SOURCE: (Author, 2024)

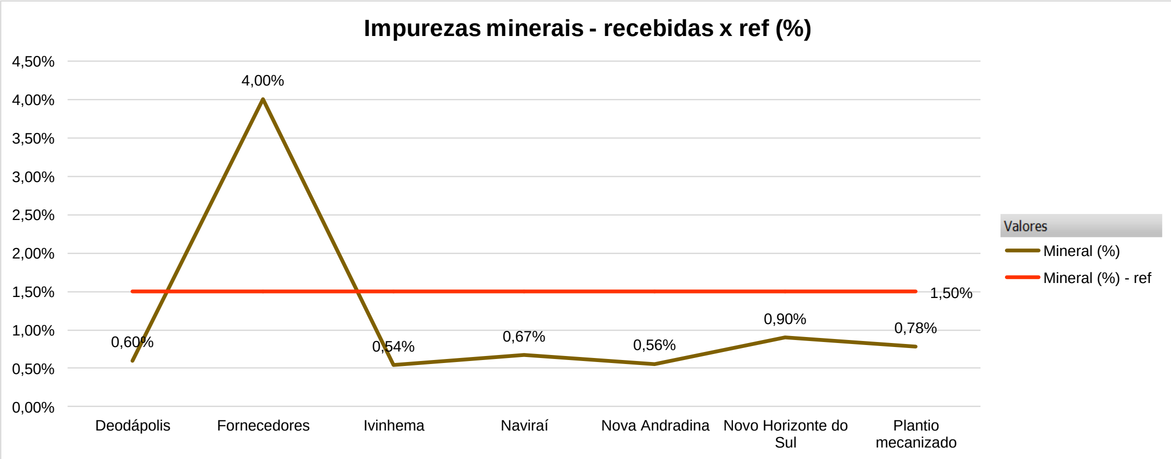
According to Oliveira et al., (2019) losses with the entire mechanized process can reach up to 15%, between forms of mineral and vegetable impurities. In the research, about 0.78% and 9.38% of minerals and vegetables were evidenced (graphs 2 and 3), respectively, totaling 10.16% in total losses, below the acceptable for this type of mechanized procedure. Thus, it is possible to emphasize that the sugar and alcohol mill used in this research has excellent controls in relation to losses for the production of raw material while the process is carried out all mechanized, showing that this practice can deliver better results in operating yields.

According to data observed in graphs 2 and 3, it is also possible to evidence a higher percentage in mineral and vegetable losses, 4.00% and 8.46%, respectively, for the raw material received by suppliers, totaling 12.46% in total losses, second only to the region that was planted in mechanized format with 10.16% and third the region of Novo Horizonte do Sul with 9.83% in total losses. In the same sense, the reasons for this result are in line with data pointed out by Manhãs et al., (2014) in relation to crop care, form of planting, topography and the like, which carried out by producers in the region may not meet the quality control criteria adopted by the Plant in question.

According to some authors, the average found for percentages in mineral and vegetable losses is 1.50 and 8.00%, respectively, which together can be acceptable within the maximum margin of up to 15% (OLIVEIRA et al., 2019). In order to better visualize, it is possible to highlight the percentages found in separate graphs (4 and 5) for each variable analyzed.

Revista ARACÊ
ISSN: 2358-2472

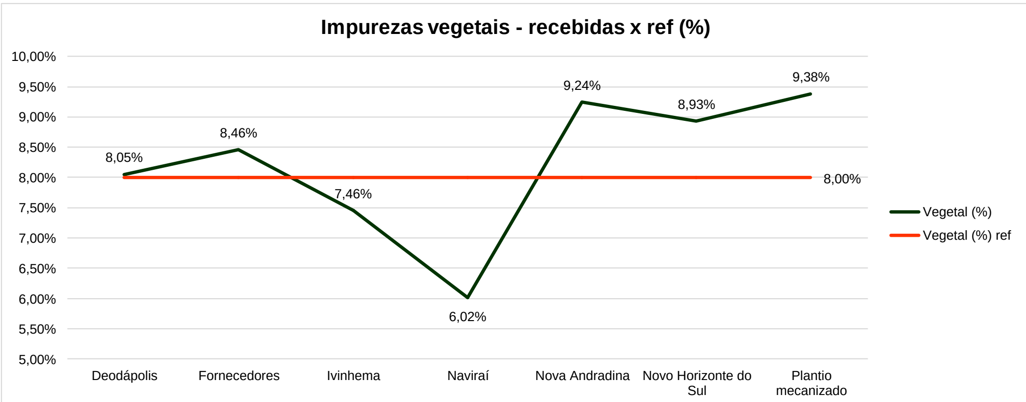
Graph 4 – Percentages of mineral impurities received, versus reference.



SOURCE: (Author, 2024).

Some factors must be taken into account at the time of harvest, avoiding contributing to the increase in the presence of both mineral and vegetable impurities in the harvested raw material. According to Pelloso et al., (2019) within mechanized harvesting, higher speeds can contribute to the increase of impurities, especially vegetables, with their greater presence in the harvested load, making it necessary to perform optimal maintenance, check the speed and current situation of the harvester, with adjustments if necessary in a timely manner.

Graph 5 – Percentages of plant impurities, versus reference.



SOURCE: (Author, 2024).

Despite an average distance of around 40km from the crop in the municipality of Naviraí to the industry, we can observe in graphs 4 and 5, a lower loss in mineral and vegetable impurities, 0.64% and 6.02%, respectively, totaling 6.69%, a lower percentage when compared to the others, showing that the format of harvesting and transportation of this locality is adequate. In addition, with regard to mineral impurities, it is also possible to

Revista ARACÊ
ISSN: 2358-2472

maintain as a hypothesis that the raw material from this locality may offer better juice yield, given the lower contamination with mineral impurities observed.

Through the measurements and analysis of the databases, and visual management from the sugar and alcohol mill, used in the research, it is possible to recommend some aspects to correct the generations of possible losses of raw material until its arrival in the industry, with the harvesting and transportation process, mainly to verify in the field the varieties of crops used and the form of crops carried out by suppliers, distance in kilometers from the crop to the industry, topography of the land, cultural management, speeds of the harvesting machines, up-to-date maintenance of these as well as the roll of knives responsible for cutting and the like.

FINAL CONSIDERATIONS

According to data analyzed in the survey, the entire process of mechanized cutting and transportation can be less costly to the company, especially in large size, which has prior planning for receiving raw materials in the industry, enabling improvements in the industry's operating results.

Also in this sense, in order to minimize losses, it is possible to make decisions that can still influence the field, aiming at a higher yield of the harvested raw material, such as checking the revision of harvesting machines, roller of cutting knives in good condition, topographies of the land, variety of sugarcane fields and the like.

The data analyzed for the entire mechanized production process, from the establishment of crops, management and harvesting, have the potential to generate lower losses in the production processes with less generation of impurities in mineral and vegetable losses, showing that the practice can contribute to a better operational yield, ensuring greater results for the industry.

Revista ARACÊ
ISSN: 2358-2472

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