

**Custo de produção de milho transgênico na primeira e segunda safra em diferentes regiões no Brasil**

**Production cost of transgenic corn in the first and second harvest in different regions in Brazil**

**Costo de producción de maíz transgénico en la primera y segunda cosecha en diferentes regiones de Brasil**

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**Matheus Vinicius Abadia Ventura**

ORCID: <https://orcid.org/0000-0001-9114-121X>

Instituto Federal Goiano campus Rio Verde, Brasil

E-mail: [matheusvinicius10@hotmail.com](mailto:matheusvinicius10@hotmail.com)

**Hellen Regina Fernandes Batista**

ORCID: <https://orcid.org/0000-0003-4815-4159>

Instituto Federal Goiano campus Rio Verde, Brasil

E-mail: [hellenf13@gmail.com](mailto:hellenf13@gmail.com)

**Marcio Moacir Bessa**

ORCID: <https://orcid.org/0000-0002-6267-775X>

Universidade Estadual Paulista, Brasil

E-mail: [marciomoacir@hotmail.com](mailto:marciomoacir@hotmail.com)

**Estevam Matheus Costa**

ORCID: <https://orcid.org/0000-0003-4137-1222>

Instituto Federal Goiano campus Rio Verde, Brasil

E-mail: [estevammcosta@yahoo.com.br](mailto:estevammcosta@yahoo.com.br)

**Leandro Spíndola Pereira**

ORCID: <https://orcid.org/0000-0003-0016-0330>

Instituto Federal Goiano campus Rio Verde, Brasil

E-mail: [leandrop629@gmail.com](mailto:leandrop629@gmail.com)

**Rafael Matias da Silva**

ORCID: <https://orcid.org/0000-0002-5072-0538>

Instituto Federal Goiano campus Ceres, Brasil

## Resumo

A cultura do milho é um dos importantes segmentos econômicos do agronegócio brasileiro. O aumento da produção de milho está relacionado com aumento da produtividade e na área cultivada. Além disso, ressalta-se a variação quanto à produtividade nos diferentes estados brasileiros, o que pode ser explicado pelo nível tecnológico da produção. Diante disso, objetivou-se avaliar os custos de produção de dezoito regiões produtoras para determinar o custo de produção na 1ª safra em três anos agrícolas e na 2ª safra em quatro anos agrícolas com milho transgênico, além de analisar a influência da produtividade no custo de produção. Foi realizada uma pesquisa exploratória com dados fornecidos pela Companhia Nacional de Abastecimento. Foram analisados dados estatísticos nos anos agrícolas de 2018, 2019 e 2020 em dezoito municípios brasileiros. A região de Chapadão do Sul - MS, em ambas as safras, obteve os menores custos de produção por saca de 60 Kg e por hectare foram em Balsas - MA e Santo Ângelo - RS. Os maiores custos de produção por saca e por hectare na 1ª safra foram nas cidades de Unaí - MG e Boa Vista - RR e os menores custo por hectare foram em Campo Mourão - PR e Sorriso - MT. Os maiores custos de produção por saca na 2ª safra foram em Rio Verde - GO e Ubiratã - PR e por hectare foram em Unaí - MG e Campo Mourão - PR.

**Palavras-chave:** Produtividade; Saca; Produção; Hectare; *Zea mays*.

## Abstract

Corn culture is one of the important economic segments of Brazilian agribusiness. The increase in corn production is related to increased productivity and in the cultivated area. In addition, the variation in productivity in the different Brazilian states is highlighted, which can be explained by the technological level of production. Therefore, the objective was to evaluate the production costs of eighteen producing regions to determine the cost of production in the first harvest in three agricultural years and in the second harvest in four agricultural years with transgenic corn, in addition to analyzing the influence of productivity on the cost of production. An exploratory research was carried out with data provided by the Companhia Nacional de Abastecimento. Statistical data were analyzed in the agricultural years of 2018, 2019 and 2020 in eighteen Brazilian municipalities. The region of Chapadão do Sul - MS, in both harvests, obtained the lowest production costs per bag of 60 Kg and per hectare were in Balsas - MA and Santo Ângelo - RS. The highest production costs per bag and per hectare in the 1st harvest were in the cities of Unaí - MG and Boa Vista - RR and the

lowest costs per hectare were in Campo Mourão - PR and Sorriso - MT. The highest production costs per bag in the 2nd harvest were in Rio Verde - GO and Ubiratã - PR and per hectare were in Unaí - MG and Campo Mourão - PR.

**Key-words:** Pproductivity; Big sack; Production; Hectare; *Zea mays*.

## Resumen

El cultivo del maíz es uno de los segmentos económicos importantes de la agroindustria brasileña. El aumento en la producción de maíz está relacionado con una mayor productividad y en el área cultivada. Además, se destaca la variación en la productividad en los diferentes estados brasileños, lo que puede explicarse por el nivel tecnológico de producción. Por lo tanto, el objetivo era evaluar los costos de producción de dieciocho regiones productoras para determinar el costo de producción en la primera cosecha en tres años agrícolas y en la segunda cosecha en cuatro años agrícolas con maíz transgénico, además de analizar la influencia de la productividad en el costo de producción. producción se realizó una investigación exploratoria con datos proporcionados por la Companhia Nacional de Abastecimento. Los datos estadísticos se analizaron en los años agrícolas de 2018, 2019 y 2020 en dieciocho municipios brasileños. La región de Chapadão do Sul - MS, en ambas cosechas, obtuvo los costos de producción más bajos por bolsa de 60 Kg y por hectárea en Balsas - MA y Santo Ângelo - RS. Los costos de producción más altos por bolsa y por hectárea en la primera cosecha fueron en las ciudades de Unaí - MG y Boa Vista - RR y los costos más bajos por hectárea fueron en Campo Mourão - PR y Sorriso - MT. Los costos de producción más altos por bolsa en la segunda cosecha fueron en Río Verde - GO y Ubiratã - PR y por hectárea en Unaí - MG y Campo Mourão - PR.

**Palabras-chave:** Productividad; Bolsa; Producción; Hectárea; *Zea mays*.

## 1. Introduction

Corn (*Zea mays* L.) is a species that belongs to the Poaceae family, originating in Mexico, Central America. The production chain of corn, as well as that of soy, is one of the important economic segments of Brazilian agribusiness (Artuzo et al., 2018). It is one of the most important cereals grown and consumed in the world, due to its nutritional value, productive potential and chemical composition. Used as food and can be consumed different types of dry and green grains (Melo et al., 2018).

The corn planted area in the first harvest, in the 2019/20 season, is 4.22 million hectares, 2.8% greater than the area cultivated in the 2018/19 harvest, and the second crop is 13.46 million hectares, 4.5% greater than the area cultivated in the 2018/19 harvest. The average corn yield in the first crop, in the 2019/20 crop, is 5.989 Kg ha<sup>-1</sup>, 4.2% lower than the productivity in the 2018/19 crop and the second crop is 5.603 Kg ha<sup>-1</sup>, 1.4% lower than the average productivity in the 2018/19 harvest (Conab, 2020a).

According to Artuzo et al. (2018), the increase in corn production is related to the increase in productivity and the cultivated area. In addition, the variation in productivity in the different Brazilian states is emphasized, which can be explained by the technological level of production (Coelho et al., 2013), and in order to occur investments in technology, it will result in production costs, being necessary that the producer has, in his view, these costs in his production, with the maximum profit and the minimum cost coming from production related to technical and economic efficiency (Münch et al., 2014; Artuzo et al., 2018)

In view of the above, given the importance of corn for Brazilian agribusiness, the objective of this study was to evaluate the production costs of eighteen producing regions to determine the highest and lowest production costs in the first harvest in three agricultural years and in 2nd crop in four agricultural years with transgenic corn, in addition to analyzing the influence of productivity on production costs.

## 2. Material and Methods

In this study an exploratory research was carried out with descriptive data of the quantitative type (Pereira et al., 2018) provided from the Agricultural Information Portal at the Agricultural Observatory of the National Supply Company (Conab, 2020b). Statistical data were analyzed in the agricultural years of 2017, 2018, 2019 and 2020 of the corn crop (*Zea mays* L.) in eighteen Brazilian municipalities.

The Brazilian municipalities analyzed in this study were Rio Verde - Goiás (GO), Chapadão do Sul - Mato Grosso do Sul (MS), Dourados - MS, Sorriso - Mato Grosso (MT), Campo Novo do Parecis - MT, Campo Verde - MT, Primavera do Leste - MT, Vilhena - Rondônia (RO), Barreiras - Bahia (BA), Ferries - Maranhão (MA), Uruçuí - Piauí (PI), Boa Vista - Roraima (RR), Unaí - Minas Gerais (MG), Campo Mourão - Paraná (PR), Ubiratã - PR, Londrina - PR, Passo Fundo - Rio Grande do Sul (RS) and Santo Ângelo - RS.

The costs of producing transgenic corn in the 1st crop in the 2017/18, 2018/19 and 2019/20 crop years and in the 2nd crop in the 2017, 2018, 2019 and 2020 crop years were

analyzed in the cities analyzed in Table 01. The yield (R\$/bag and R\$/ha) were calculated according to the average productivity (Kg/ha) of each corn producing municipality considering the harvests and agricultural years. The marketing unit is the bag, weighing 60 Kg.

**Table 1.** Municipalities producing transgenic corn in the 1st harvest in the 2017/18, 2018/19 and 2019/20 harvests and the 2nd harvest in the 2017, 2018, 2019 and 2020 harvests.

	1st harvest			2nd harvest			
	2017/18	2018/19	2019/20	2017	2018	2019	2020
Rio Verde - GO				X	X	X	X
Chapadão do Sul - MS	X	X		X	X	X	X
Dourados - MS						X	X
Sorriso - MT				X	X	X	X
Campo Novo do Parecis - MT				X	X	X	
Campo Verde - MT				X	X	X	X
Primavera do Leste - MT				X	X	X	X
Vilhena - RO				X	X	X	
Barreiras - BA	X	X	X				
Balsas - MA	X	X	X				
Uruçuí - PI			X				
Boa Vista - RR	X	X	X				
Unaí - MG	X	X	X	X	X	X	X
Campo Mourão - PR	X	X	X	X	X	X	X
Ubiratã - PR				X	X	X	X
Londrina - PR	X	X	X	X	X	X	X
Passo Fundo - RS	X	X	X				
Santo Ângelo - RS	X	X	X				

Source: The authors.

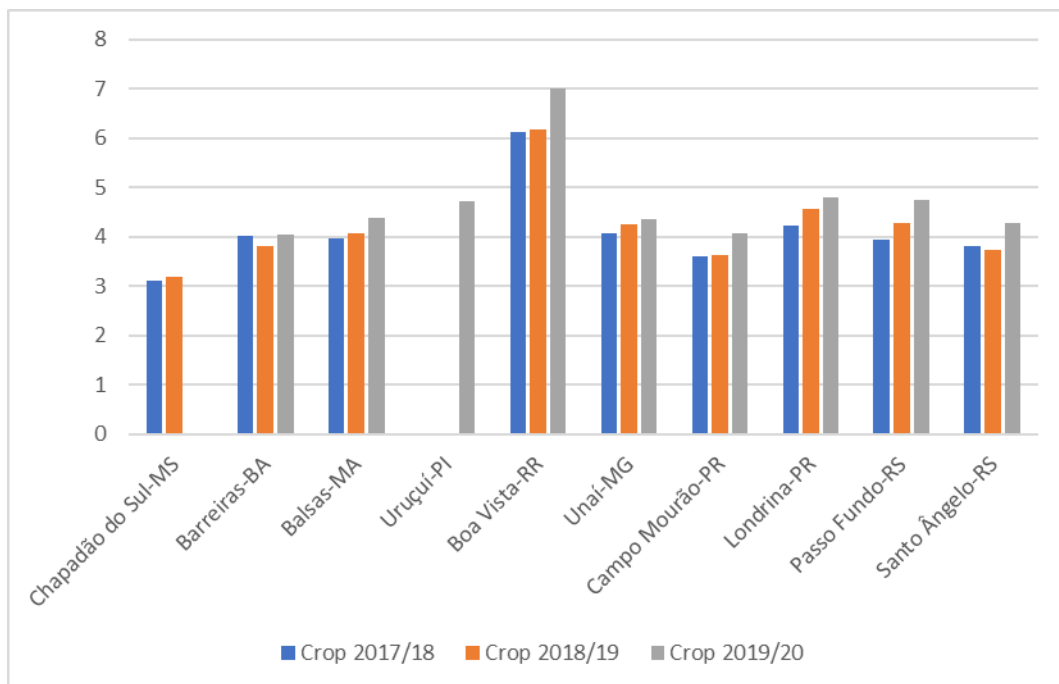
The transgenic corn in the 1st and 2nd harvest, the items that integrated production costs were: farm administrator, pesticides (insecticides, fungicide and herbicides), soil analysis, labor, fertilizers, genetically modified seeds, various services, tractors and harvesters, bank financing interest, technical assistance, special contribution to rural social security, administrative expenses, storage costs and external transport.

The statistical data obtained by Conab (2020b) and analyzed were provided in Brazilian reais (R\$), but in this study, the authors used US dollars (US\$) as the currency unit used, obtained by converting the exchange rate: US\$ 1 = R\$ 5.22 (Ipea, 2020).

### 3. Results and Discussion

The production costs in US\$ in transgenic corn per bag of 60 Kg in the first harvest are described in Graph 01. Data were not provided in the 2017/18 and 2018/19 harvests in the municipality of Uruçuí - PI and in the 2019/20 harvest in the municipality of Chapadão do Sul - MS.

**Graph 01.** The production costs in US\$ in transgenic corn per bag of 60 Kg in the first harvest in producing regions in Brazil.



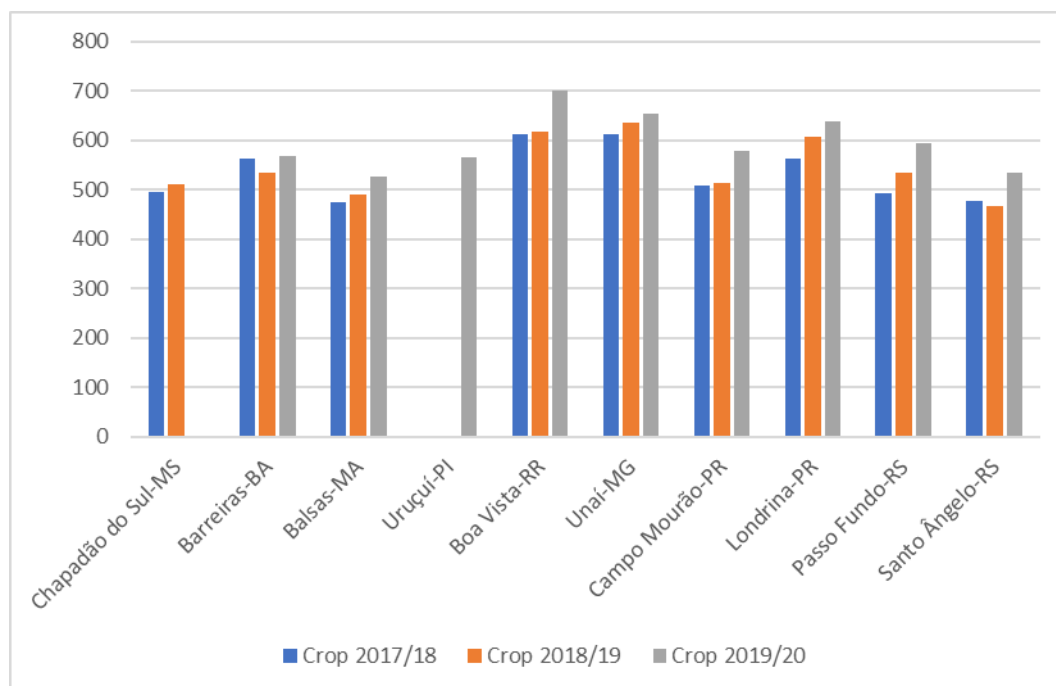
Source: Data were provided at Conab (2020b).

The lowest production costs per bag in the 2017/2018 and 2018/19 harvest was in the municipality of Chapadão do Sul - MS with US\$ 3.11 and US\$ 3.19, considering that in this municipality there was no information collection in the harvest of 2019/20. In the 2019/20 harvest, the municipalities of Barreiras - BA (US\$ 4.05) and Campo Mourão - PR (US\$ 4.07) had the lowest costs. It is worth mentioning that among the cities analyzed, Chapadão do Sul - MS has the highest productivity (9.600 Kg ha<sup>-1</sup>) among the cities analyzed, this being the factor that influences the cost reduction per bag. According to Artuzo et al. (2018), corn production is concentrated in the states of the Midwest and South regions and these are among those with the highest productivity (Conab, 2017)

The highest production cost was in Boa Vista - RR, showing a significant difference in relation to the other production costs, with a cost of US\$ 6.13 in the 2017/18 crop, US\$ 6.18 in the 2018/19 crop and US\$ 7.01 in the 2019/20 harvest. Likewise, the production costs of Boa Vista - RR are affected due to the low productivity (6.000 Kg ha<sup>-1</sup>) of the region in relation to the others, which is the opposite of what happens in Chapadão do Sul - MS, increasing the your costs per hectare. In view of this, such a difference in productivity in different Brazilian states, which can be explained by the technological level of production (Coelho, Cruz & Pereira, 2013), requiring investments in the production process to obtain higher productivity to reduce costs in production (Heumesser et al., 2012).

The production costs in US\$ in transgenic corn per hectare in the first harvest are described in Graph 02. No data were provided for the 2017/18 and 2018/19 harvests in the municipality of Uruçuí - PI and in the 2019/20 harvest in the municipality of Chapadão do Sul - MS.

**Graph 02.** Production costs in US\$ in transgenic corn per hectare in the first harvest in producing regions in Brazil.



Source: Data were provided at Conab (2020b).

The lowest production costs per hectare were in the municipalities of Balsas - MA, with US\$ 474.18 in the 2017/18 harvest, US\$ 489.17 in the 2018/19 harvest and US\$ 525.59 in the 2019/20 crop and Santo Ângelo, with US\$ 477.58 in the 2017/18 harvest, US\$ 468.13

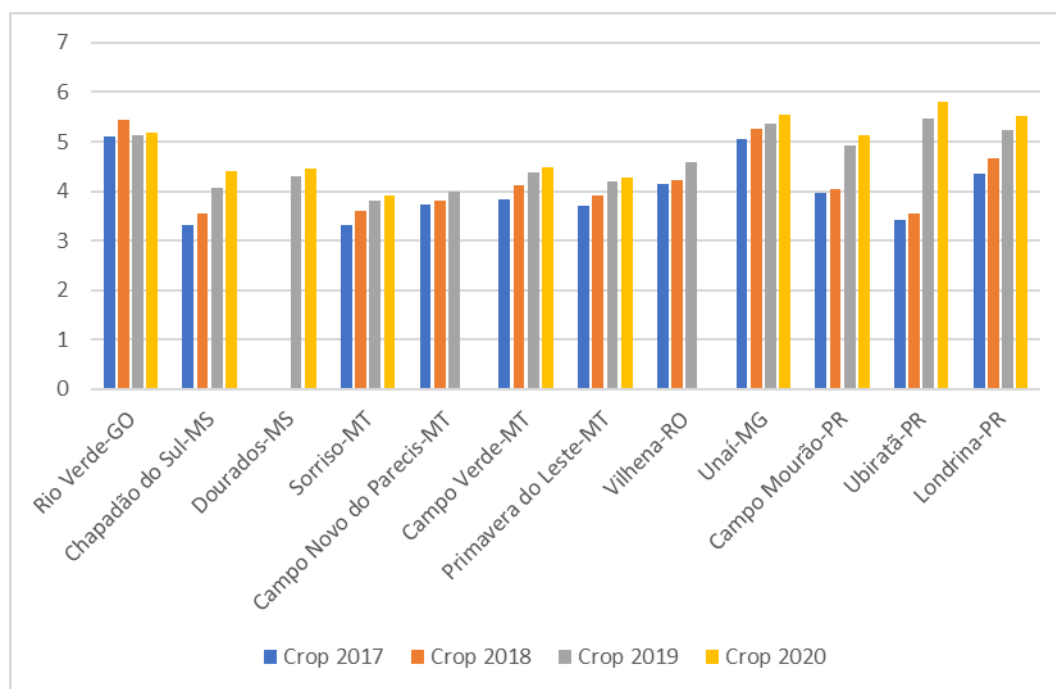
in the 2018/19 harvest and US\$ 535.15 in the 2019/20 harvest. It is worth mentioning that the municipalities are located in different regions with adverse weather and characteristics. With productivity data provided by Conab (2020b), it is noted that the low production costs in this region are directly related to productivity, such observation was reported by Franchini et al. (2011), who claim that increases in productivity for all economic crops involved in the production system can reduce production costs.

The highest production costs per hectare were in the municipalities of Boa Vista - RR and Unaí - MG. In the municipality of Boa Vista - RR, costs were US\$ 613.14 in the 2017/18 harvest, US\$ 618.27 in the 2018/19 harvest and US\$ 700.81 in the 2019/20 harvest and Unaí - MG, the costs were US\$ 611.32 for the 2017/18 harvest, US\$ 636.72 for the 2018/19 harvest and US\$ 653.72 for the 2019/20 harvest. A more descriptive and regional analysis is necessary so that the administrator can have a good view and use it as a tool in decision making. In order to reduce costs, administrators need to increase efficiency related to pest and disease control, potential and rational use of fertilizers, adoption of precision agriculture and other assistive technologies in the production system (Kaneko et al., 2012; Rotili et al., 2015)

The production costs in US\$ in transgenic corn per bag of 60 Kg in the second harvest are described in Graph 03. No data were provided for the 2017/18 and 2018/19 harvests in the municipality of Dourados - MS and in the 2019/20 harvest in the municipality of Campo Novo do Parecis - MT and Vilhena - RO.



**Graph 03.** The production costs in US\$ of transgenic corn per bag of 60 Kg in the second harvest in producing regions in Brazil.



Source: Data were provided at Conab (2020b).

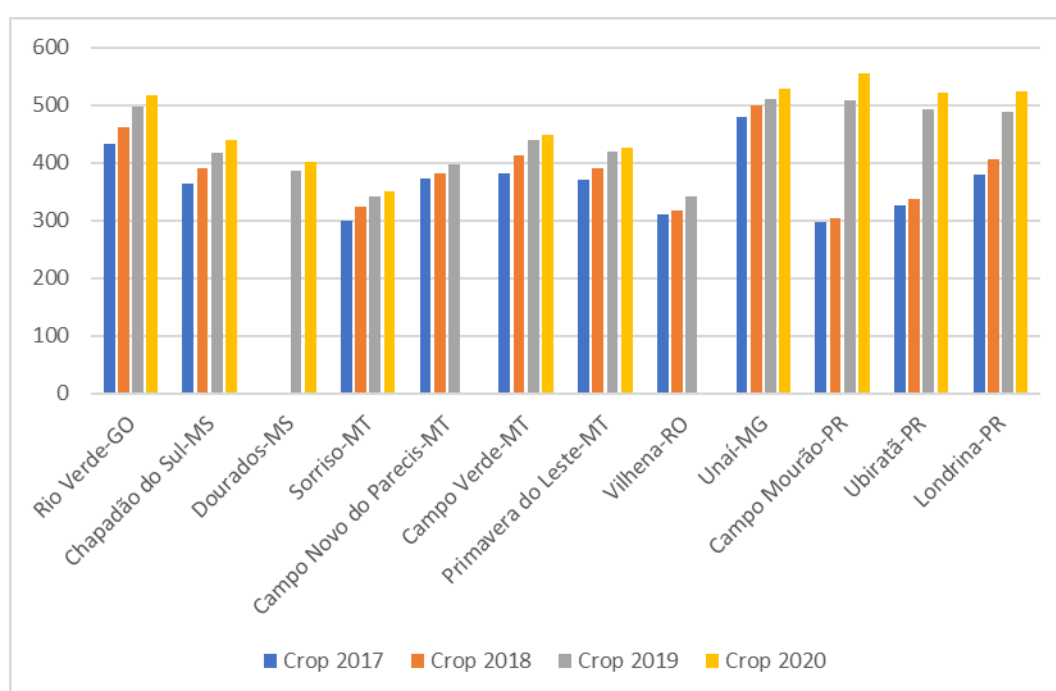
In the 2nd harvest, the lowest corn production costs per bag in the 2017 and 2018 harvest were in the municipalities of Chapadão do Sul - MS, with costs of US\$ 3.31 and US\$ 3.55 respectively, and Sorriso - MT, with costs of US\$ 3.32 and US\$ 3.60. In the 2019 and 2020 harvest, the municipality of Sorriso - MT, maintained at a cost of US\$ 3.80 and US\$ 3.90 respectively, accompanying the municipality of Campo Novo do Parecis - MT, with a cost of US\$ 3.98 in the 2019 harvest and Primavera do Leste - MT, with a cost of US\$ 4.27 in the 2020 harvest. It is important to describe regional descriptive studies in relation to production costs, aiming to obtain a tool for the producer in decision-making, as in the work of Richetti et al. (2017), in the city of Chapadão do Sul - MS.

The highest corn production costs per bag were observed in the municipalities of Unai - MG in the four harvests: 2017, 2018, 2019 and 2020 with costs of US\$ 5.05, US\$ 5.26, US\$ 5.37 and US\$ 5.55 respectively, together with Rio Verde - GO in the 2017 and 2018 harvests, with costs of US \$ 5.10 and US \$ 5.44 and Ubiratã - PR, in the 2019 and 2020 harvests with costs of US\$ 5.47 and US\$ 5.80. To reduce costs per bag, it is necessary to increase productivity. According to Cruz and Matiello (2005) to guarantee high productivity, it is important that production costs are used well and used in the best possible way and that

producers should be guided by research results and not by the commercial negotiations of sellers (Duarte et al, 2016).

The production costs in US\$ in transgenic corn per hectare in the 2nd harvest are described in Graph 04. No data were provided for the 2017/18 and 2018/19 harvests in the municipality of Dourados - MS and for the 2019/20 harvest in the municipality of Campo Novo do Parecis - MT and Vilhena - RO.

**Graph 04.** Production costs in US\$ in transgenic hectare corn in the 2nd harvest in producing regions in Brazil.



Source: Data were provided at Conab (2020b).

The lowest transgenic corn production costs in the 2017 harvest were in the municipalities of Campo Mourão - PR with US\$ 296.99 and Sorriso - MT with US\$ 298.82. In the 2018 harvest they were in the municipalities of Campo Mourão with US\$ 303.67 and Vilhena - RO with US\$ 316.87. In the 2019 harvest were in the municipalities of Sorriso - MT, with US\$ 341.87 and Vilhena - RO with US\$ 342.85. In the 2020 harvest, they were in the municipalities of Sorriso - MT with US\$ 350.39 and Dourados - MS with US\$ 401.95. When analyzing the data, we noticed an oscillation in costs due to harvests and agricultural years. But investment in the production process, such as transgenic seeds with high production potential and the acquisition of modern agricultural machines, increases

productivity and impacts production revenue and reduces the cost per bag and hectare (Artuzo et al., 2018).

The highest costs of production of transgenic corn in the 2017 and 2018 harvests were in the municipalities of Unaí - MG, with costs of US\$ 479.68 and US\$ 499.55 and Rio Verde - GO, with costs of US \$ 433.48 and \$ 462.94. In the 2019 and 2020 harvests, the municipalities with the highest costs were Unaí - MG, with costs of US\$ 510.07 and US\$ 527.72 and Campo Mourão - PR, with costs of US\$ 508.51 and US\$ 556.39. The oscillation of higher costs in relation to lower production costs is quite significant, and this variation occurred due to the technological contribution and the costs of agricultural production that precedes planting until post-harvest, such as labor, soil preparation, acquisition of seeds, fertilizers, pesticides and fuels (Duarte et al., 2011; Andrade et al., 2012).

#### 4. Conclusions

The region of Chapadão do Sul - MS in both harvests, had the lowest production costs per bag of 60 Kg. Likewise, in both harvests, the lowest costs per hectare in Balsas - MA and Santo Ângelo - RS.

The highest production costs per bag of 60 Kg and per hectare in the 1st harvest were in the cities of Unaí - MG and Boa Vista - RR and the lowest costs per hectare were in Campo Mourão - PR and Sorriso - MT.

The highest production costs per bag in the 2nd harvest were in Rio Verde - GO and Ubiratã - PR and per hectare were in Unaí - MG and Campo Mourão - PR.

It is noted that the production costs were influenced by the productivity of the analyzed regions, with this, areas with higher productivity obtained lower costs and vice versa.

It is recommended the importance of more descriptive and regional studies to analyze production costs in order to make decisions and determine the viability of the production unit.

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**Porcentagem de contribuição de cada autor no manuscrito**

Matheus Vinicius Abadia Ventura – 40%

Hellen Regina Fernandes Batista – 20%

Marcio Moacir Bessa – 10%

Estevam Matheus Costa – 10%

Leandro Spíndola Pereira – 10%

Rafael Matias da Silva – 10%