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Productivity Evaluation of Five Soybean Cultivars in different Locations in Tocantins State

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***Abstract*—** *Soybean (Glycine Max) is characterized as an oleaginous plant, belonging to the Fabaceae family. Considered one of the main cultivars produced in Brazil, soybean has a high protein content for human and animal nutrition. It is a product widely used as biofuel and cooking oil, in addition to having a very important economic value for the economy in Brazil. in addition to having a very important economic value for the economy in Brazil. As main results obtained, it was noticed that the cultivars BMX Domínio IPRO, BMX Olimpo IPRO and SOY Muralha IPRO presented better performance in relation to their cultivation in the cerrado region of Tocantins, in the cities of Santa Rosa, Caseara and Aparecida do Rio Negro. The main objective of this article was to evaluate the productivity of five soybean cultivars (BMX Domínio IPRO, BMX Extrema IPRO, BMX Olimpo IPRO, DM 82I78RSF IPRO and Soy Muralha IPRO), in the cities of Santa Rosa, Caseara, Cariri do Tocantins, Campos Lindos and Aparecida do Rio Negro. The method used in the research was based on quali-quantitative, supported by bibliographical and exploratory research.*

I. INTRODUCTION

Soybeans (Glycine Max) are characterized as an oilseed, belonging to the Fabaceae family. That is, it is part of the same family as other grains such as lentils, peas, and beans, and for this reason it is also called cowpea or soy bean. It originated in China and Japan (MENDES, 2019).

Although Brazil is a producer and exporter of this cultivar, its introduction in the country was from the early twentieth century, with the arrival of Japanese immigrants, more precisely in 1914, in the region of Rio Grande do Sul, for having the climate similar to the producing regions of the United States (first and main country to invest in the soybean trade) (BRASIL, 2023).

Considered as one of the main cultivars produced in Brazil, soy has a high protein content for human and animal nutrition. Widely used in the industrial branch (biofuel and cooking oil), this grain has had great visibility for agribusiness in the country, placing the Brazilian economy in a prominent position worldwide (TONATTO, 2020).

During the 2018 and 2019 harvests, Brazil reached the position of second largest producer of soybeans in the world, while the United States occupied the first position, already in the 2019/2020 harvests achieved the first place in its production capacity. With the total of 124 million tons of grain, representing the percentage of 35% of soybeans produced worldwide (TONATTO, 2020).

The production of soybeans in the country has adapted well to the cerrado biome, holding the productive capacity of more than 50% in relation to the rest of the country, focusing on the states of Maranhão, Tocantins, Bahia, Mato Grosso, Mato Grosso do Sul and Goiás. The care and cultivation of soybeans starts since its planting, with soil management and the use of adequate fertilizers so that the

plant develops as expected and the time when it was planted (DIAS et al., 2021).

In the state of Tocantins, soybean planting started from the end of the 1980s to the 1990s, adapting well to the climate and soil of the region. Because the state is bordered by producing regions, its location contributes to the transportation and distribution of soybeans in a more practical way. The cities of Gurupi, Campos Lindos, Goiatins, Pedro Afonso are considered the main ones that most produce soybeans in the state (DIAS et al., 2021).

The main objective of this article was to evaluate the productivity related to five soybean cultivars (BMX Domínio IPRO, BMX Extrema IPRO, BMX Olimpo IPRO, DM 82I78RSF IPRO and Soy Muralha IPRO), in the cities of Santa Rosa, Caseara, Cariri do Tocantins, Campos Lindos and Aparecida do Rio Negro. The method used in the research was based on the quali-quantitative, with support in bibliographic and exploratory research.

II. METHODOLOGY

The method used in the research was based on the quali-quantitative, with support in bibliographic and exploratory research. The analyses were carried out in the state of Tocantins, in the cities of Santa Rosa, Caseara, Cariri do Tocantins, Campos Lindos, and Aparecida do Rio Negro, between the 5th, 8th, 12th, and 14th of March of this year, during daylight hours.

The treatments were made from the following cultivars: BMX Domínio IPRO, BMX Extrema IPRO, BMX Olimpo IPRO, DM 82I78RSF IPRO and Soy Muralha IPRO.

III. RESULTS AND DISCUSSION

The tables below show the results for the Soybean treatments, in which the main species were evaluated (BMX Domínio IPRO, BMX Extrema IPRO, BMX Olimpo IPRO, DM 82I78RSF IPRO and Soy Muralha IPRO). From the indicators it can be seen that some treatments responded positively regarding the three reproductions, which can also be verified in the averages in each of them.

Table 1: List of indicators for evaluating the treatments in the city of Santa Rosa do Tocantins

SANTA ROSA DO TOCANTINS	TREATMENT	REP. 1	REP. 2	REP. 3	MEDIUM
	BMX Dominio IPRO	80,5	77	72,83	77
	DM 82I78RSF IPRO	85	67,58	76,25	76
	SOY Muralha IPRO	77,08	74	70,75	74
	BMX Extrema IPRO	71,17	77	72,58	74
	BMX Olimpo IPRO	71,17	69	74,17	71

Table 2: List of indicators for evaluating the treatments in the city of Caseara-TO

CASEARA - TO	TREATMENT	REP. 1	REP. 2	REP. 3	MEDIUM
	BMX Dominio IPRO	67,33	54,5	68	63
	DM 82I78RSF IPRO	51,08	56,79	60,96	56
	SOY Muralha IPRO	60,83	71,67	72,75	68
	BMX Extrema IPRO	59,46	51,5	68,58	60
	BMX Olimpo IPRO	61,58	71,96	78,08	71

Table 3: List of indicators for evaluating the treatments in the city of Cariri do Tocantins-TO

CARIRI DO TOCANTINS-TO	TREATMENT	REP. 1	REP. 2	REP. 3	MEDIUM
	BMX Dominio IPRO	55,08	55,42	67,92	59
	DM 82I78RSF IPRO	53,25	54,79	55,58	55
	SOY Muralha IPRO	54,54	55,67	54,08	55
	BMX Extrema IPRO	42,04	55,54	53,25	50
	BMX Olimpo IPRO	56,79	77,08	51,92	62

Table 4: Relationship of the evaluation indicators for the Treatments in the city of Campos Lindos-TO

CAMPOS LINDOS - TO	TREATMENT	REP. 1	REP. 2	REP. 3	MEDIUM
	BMX Dominio IPRO	70,42	69,79	71,92	71
	DM 82I78RSF IPRO	70,42	70,25	73,13	71
	SOY Muralha IPRO	75,5	81,17	78,29	78
	BMX Extrema IPRO	78,67	62,29	63,54	68
	BMX Olimpo IPRO	59,79	68,29	70,25	66

Table 5: List of indicators for evaluating the treatments in the city of Aparecida do Rio Negro-TO

ARECIDA DO RIO NEGRO- TO	TREATMENT	REP. 1	REP. 2	REP. 3	MEDIUM
	BMX Dominio IPRO	77,75	78	78	78
	DM 82I78RSF IPRO	68,42	64	60,5	64
	SOY Muralha IPRO	65,42	71,75	74,25	70
	BMX Extrema IPRO	76,25	75,83	65,67	73
	BMX Olimpo IPRO	81,75	82,5	77,75	81

According to the results presented, it was observed that the Treatments had good indicators in the cities of Santa Rosa do Tocantins, Caseara, and Aparecida do Rio Negro. While the cities of Cariri and Campos Lindos did not obtain as positive results as the other cities.

Analyzing the productivity of BMX Olimpo IPRO, SOY Muralha IPRO and BMX Dominio IPRO, it can be

seen that while BMX Olimpo IPRO had the best performance in Aparecida do Rio Negro (average 81), in Campos Lindos SOY Muralha IPRO had the best results (average 78). In Cariri do Tocantins and Caseara, BMX Olimpo IPRO also came out with a good average (average 62 and 71 respectively).

In the cities where the evaluation result was not very satisfactory for SOY Muralha IPRO was in Cariri, with an average of 55. In Santa Rosa there was a satisfactory result for the cultivars DM 82I78RSF IPRO (with an average of 76), and BMX Dominio IPRO (with an average of 77), while BMX Olimpo IPRO had the worst performance for this region, revealing itself not to be a good cultivar in this location, in comparison with its evaluation in the other cities.

Regarding these results in the cities of Cariri and Campos Lindos, it is reiterated that several factors may have influenced them. As Tonatto (2020, p. 20) addresses: "Soybean productivity is affected by genetics, climate, soil, and other abiotic and biotic factors. Therefore, taking these issues into account, it is noted that the results for the state of Tocantins coincide, mainly due to the characteristics of the region, since it is a Cerrado biome, the climate and soil have a great influence on the results of soybean treatments.

Sharing in this discussion, Mendes (2019) points out that:

The soybean crop water requirement varies from 450 to 800 mm/cycle, depending on the cultivar (due to the difference in cycle of the materials), soil and climate conditions, in addition to the cultural management employed, with two periods considered critical for lack of water: germination and flowering/grain filling (MENDES, p. 7).

Once, together with the way the soil was managed, the conditions in which the soil is and if the climate is conducive to seed germination and absence of water, cause the indicators such as those of the study in thesis.

For Piccoli (2018), the increasing use of technologies considered modern and that think about the sustainability of the environment should contribute to the cultivation of soybeans. The author also reiterates that: the management of pests, weeds, soil fertilization, no-till farming, and the option for cultivars that are in accordance with the soil and climate conditions of each region of Brazil are decisive factors in the positive results of better soybean indexes.

Soy cultivars can be subdivided into three main types, Silva (2021) states that:

The cultivars, whether of the determinate, semideterminate or indeterminate type, have good yield potential. Indeterminate cultivars tend to have a longer reproductive process in which they positively tend to recover better from the effects of water stress, by water shortage or excess. They need greater care when it comes to defoliation and pest control during this period (SILVA, 2021, p. 16).

This classification of cultivars helps to understand the diversity of species and how they respond according to the regions in which they were produced. In Tocantins, for example, it is observed that the indeterminate ones usually prevail because of the water stress, in which there are periods with very dry rainfall and others in which it rains a lot.

IV. FINAL CONSIDERATIONS

Soybean is one of the most exported and produced products in Brazil, bringing great lucrative return for the Brazilian economy. The expansion of the agribusiness focused on soy in the Tocantins region, in several cities of the state brought more visibility and growth to the economy. Thus, the importance of having each day more studies that evaluate the productivity and grain quality of different cultivars of soybeans.

According to the results obtained, it was noticed that the cultivars BMX Domínio IPRO, BMX Olimpo IPRO and SOY Muralha IPRO showed better performance regarding their cultivation in the cerrado region of Tocantins, mainly in the cities of Santa Rosa, Caseara and Aparecida do Rio Negro. But, it was also found that the indicators varied greatly in relation to the other cultivars.

Therefore, this study contributes greatly to the areas of agronomy and economics, which aims to encourage further research to evaluate the productivity of cultivars that were used in this study, as well as other species that are grown in the state of Tocantins.

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