Embrapa
Portal de Periódicos da Embrapa
International Journal of Maize & Sorghum
Formerly Revista Brasileira de Milho e Sorgo
ABMS

AGRONOMIC CHARACTERISTICS AND PROFITABILITY OF CORN HYBRIDS FOR SILAGE IN THE SEMI-ARID OF ALAGOAS

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ABSTRACT – The analysis of the agronomic characteristics of different genetic materials indicates the one that has the highest productivity. This research aimed to evaluate the agroeconomic characteristics of corn hybrids for silage in the Alagoas semiarid region. The experiment took place in the experimental field of the Federal Institute of Alagoas, Campus Piranhas, located in the municipality of Piranhas in the State of Alagoas, a semiarid portion of Northeast Brazil, in rainfed conditions, under a block design randomized, with eight treatments and four replications. The treatments were eight corn hybrids (K9555 VIP 3, R9080 PRO 2, K9822 VIP 3, K9606 VIP 3, K9510 Conventional, K8774 PRO 3, RB9006 PRO 2 and 2B587 PW). At the pasty/farinaceous grain stage, the following characteristics were evaluated: green and dry mass of leaves, stem, cob, tassel, and total (g plant^{-1}); green and dry mass productivity (t ha^{-1}) and percentage of dry mass (%). Gross income, net income, rate of return, and profitability index were determined for economic variables. The highest average value for dry mass productivity occurred in the hybrid R9080 PRO 2 with 11.04 t ha^{-1}, not differing from the others, except for 2B587 PW with 5.62 t ha^{-1}. The 2B587 PW is the least recommended for silage, and the K9555 VIP 3 and K9510 Conventional are the most recommended. The total production cost averaged R$ 5,863.51 ha^{-1}. Inputs had the highest average cost (53.62%), followed by harvesting operations (30.28%). All hybrids presented equal economic results, but the 2B587 PW hybrid is the least recommended because it has the same production costs but undesirable agronomic characteristics.
Keywords: *Zea mays* L., silage, productivity, rainfed.

Corn (*Zea mays* L.) is a crop used for the most diverse purposes, being one of the most important agricultural *commodities* in the world. The greatest demand is from the animal feed industry with 53% of the total, compared to 2% of human consumption (Abimilho, 2021). In the Brazilian semi-arid region, livestock farming, especially dairy farming is considered a relevant activity as it brings food security and makes up the income of farmers who are mostly family-based, because animal husbandry is more resistant to drought compared to other agricultural activities.

The Northeast was the fourth largest milk-producing region in 2021, with 1.8 billion liters, representing 7.2% of national production (Embrapa, 2022). One of the main challenges in increasing milk production in this region is obtaining food during the dry period. Ensiling corn plants is one way to keep livestock fed during this period.

The corn crop is one of the most used and preferred by producers in different countries for the ensiling process due to its numerous characteristics, such as its cultivation tradition, high productivity, high content of total digestible nutrients, and fermentative capacity. It can remain ensiled for long periods, maintaining its high nutritional value (Domingues et al., 2013).

In the Northeast region, there is a total area planted with corn for grains of 3,177.2 thousand ha, with the state of Alagoas contributing an area of 40.2 thousand ha. About its States, the corn planting area for grains expanded in all States in the 2021/2022 period, except Alagoas. The most significant increase in area was in Paraíba, with 20.6%, followed by Maranhão (20.1%). Productivity increased in all states except Pernambuco (12.4%) and Alagoas (62.7%), and production remained the same in Pernambuco (6.9%) and Alagoas (66.5%) (Conab, 2022).

The genetic material can be resistant to the main pests and diseases of the crop, reducing the costs of purchasing pesticides. It is compatible with herbicides that will facilitate the management of weeds. It is better adapted to edaphoclimatic conditions and, thus, better able to express all its genetic potential. Consequently, this leads to better control of invested capital, which is uncommon among small producers (Pinto et al., 2010; Klein et al., 2018).

The present work's objective was to evaluate the agronomic characteristics, production costs, and profitability of corn hybrids for silage in the semiarid region of Alagoas.

Material and Methods

The experiment was conducted in the field dry land, in the experimental area of the Federal Institute of Alagoas (IFAL), located on the *Campus* of the municipality of Piranhas, State of Alagoas, Brazilian Semiarid (9º37'22.42" South, 37º46'1.51" West; 178 m altitude). According to the Köppen classification, Piranhas' climate is BSh, tropical, semi-arid, with a rainy season between April and July, average annual precipitation of 492.2 mm, relative humidity around 74.4%, and average air temperature varying between 23.5 ºC and 28.2 ºC (Santos et al., 2017a).

The average meteorological data of air temperature (ºC), relative air humidity (%), and accumulated rainfall (mm) were obtained throughout the experiment using the automatic meteorological station of the National Institute of Meteorology (Inmet, 2021), located in IFAL, *Campus* Piranhas. For air temperature, the average value during the experiment was 23.8 °C, relative humidity was 82%, and accumulated precipitation was 234.6 mm (Figure 1).

The experimental design used was randomized blocks, with eight treatments and four replications. Treatments consisted of eight corn hybrids (K9555 VIP 3, R9080 PRO 2, K9822 VIP 3, K9606 VIP 3, K9510 Conventional, K8774 PRO 3, RB9006 PRO 2 and 2B587 PW). All reported hybrids are suitable for grain and silage except K9822 VIP 3 and 2B587 PW, which are only for grain. Each plot consisted of four rows 3.5 meters long and spaced 0.70 m apart and 0.20 m apart between plants, making up a total area of 9.8 m^2. The two central lines, disregarding 0.20 m (one plant) from each end of the line, were considered as the useful plot area (4.34 m^2).

Soil was prepared with two crossed harrows

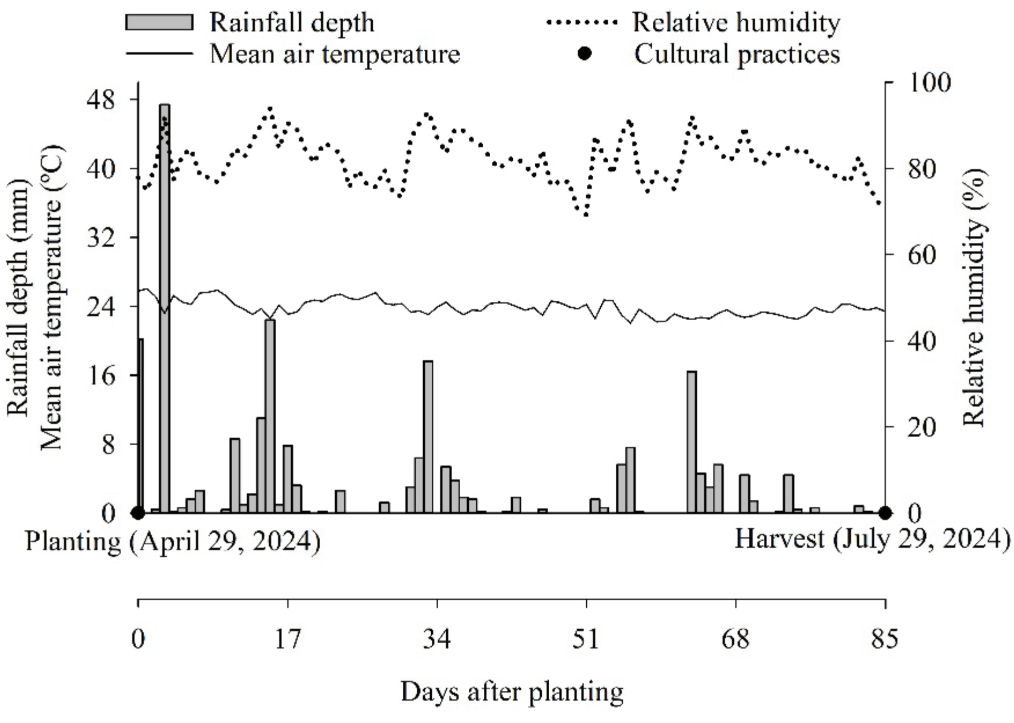

Figure 1. Average values of air temperature (°C), relative air humidity (%), and rainfall (mm), in addition to identifying the cultural practices carried out on corn hybrids produced in rainfed areas in the year 2021 at Ifal, Piranhas *Campus*.

at an average depth of 0.20 m. Then, the plots were demarcated, and furrows opened for manual sowing of the seeds of the eight corn hybrids with a spacing of 0.7m x 0.2m (71,429 thousand plants ha^{-1}), placing two seeds per hole. The seeds emerged five days after planting (DAP), and at 10 DAP, thinning was carried out, leaving only one plant per hole. Weed control was carried out at 15 and 30 DAP through manual weeding. Two insecticide applications with the active ingredient Deltamethrin (25 g L^{-1}) were carried out to control caterpillars (*Spodoptera frugiperda*), performed at 19 and 34 DAP.

Ten days before planting, a soil analysis was carried out at a depth of 0 to 0.20 m (Table 1). Following recommendations from Lopes et al. (2008), foundation fertilization was carried out with manual application of 42.86 kg ha^{-1} of N, 28.57 kg ha^{-1} of P_2O_5 and 34.28 kg ha^{-1} of K_2O, using as sources ammonium sulfate (20% N), simple superphosphate (18% P_2O_5) and potassium chloride (60% K_2O), respectively. In the top dressing, 42.86 kg ha^{-1} of N was manually applied at 18 and 33 DAP, the same amount on both days.

The harvest was carried out at the R5 phenological stage (farinaceous grains), corresponding to 85 DAP, when the plants had an average dry mass content between 35 and 40%. Non-destructive assessments were carried out of plant height (m), obtained by measuring the distance from the base of the stem close to the ground to the insertion point of the last leaf of the plant (flag leaf) with a measuring tape graduated in centimeters. Stem diameter (mm), measured at the base of the stem, 15 cm above the ground, with two measurements being taken and their arithmetic mean, with the aid of a digital caliper. Number of living, dead and total leaves, with those with 50% or more of green color being considered alive; and the leaf length (L) and width (W) were measured with a ruler and measuring tape graduated in centimeters, and the individual leaf area (LA) was estimated from the equation LA (cm^2) = L x W x 0.75 (Guimarães et al., 2002). Then, the total leaf area of the plant was obtained from the sum of all areas of each definitive leaf. Green mass productivity (t ha^{-1}) was estimated from the green mass of ten plants present in the useful area of each plot. Dry mass productivity (t ha^{-1}) was determined after drying three plants in a forced air circulation oven, with a temperature regulated at 65 ºC until a constant mass was reached. Three more plants from each plot were divided into leaves, stems, tassels and ears and weighed on an analytical balance to determine green mass. The same material was placed in a forced air circulation oven at 65 °C until it reached a constant weight to evaluate the dry mass.

The total production costs of one hectare for corn silage were calculated and analyzed using the methodology proposed by Conab (2010). During the experiment, the American dollar (US$) had an average value of R$5.17. At the harvest, the value of the dollar was R$5.20. The expenses considered in the analysis covered variable costs – crop funding expenses (machine rental, labor, seeds, fertilizers, pesticides, and others),

Table 1. Chemical and physical analyses of the soil in the corn experimental area (depth of 0 to 0.20 m), in the rainy season of 2021, in Piranhas, Western Alagoas.

pH	MO[(1)]	P	K^+	Ca^{2+}	Mg^{2+}	Na^+	Al^{3+}	H+Al
H_2O	%	mg dm^{-3}	----------------------------cmol$_c$ dm^{-3} ------------------------------					
5.60	1.28	72.00	0.38	7.50	5.20	0.27	0.00	3.20
Fe	**Cu**	**Zn**	**Mn**	**Coarse Sand**	**Thin sand**	**Total Sand**	**Silt**	**Clay**
-------------mg dm^{-3} -------------				----------------------------g kg^{-1} --------------------------				
233	2.81	7.95	94.46	600	212	812	3	185

(1) Organic matter.

administrative expenses, technical assistance, rural land tax (ITR), and financial expenses (interest on financing).

Administrative expenses and technical assistance corresponded, respectively, to 3 and 2% of the total crop costs. Considering the minimum ITR to be paid in an agricultural year (R$ 10.00), using Equation 1:

$$\text{ITR (R\\$ ha}^{-1}\text{)} = \text{ITR value (R\\$) x} \left(\frac{\text{Culture cycle (days)}}{\text{365 days}}\right) \quad (1)$$

The financing interest was levied on the resources necessary to finance the crop, computed from the respective periods of release or use, considering the credit that the farmer obtained with resources from official rural credit to finance the crop (rate of 2.75 % year^{-1}) (Mapa, 2021), calculated according to Equation 2:

$$\text{Financing Interest (R\\$ ha}^{-1}\text{)} = \text{Cost value (R\\$ ha}^{-1}\text{) x} \left(\frac{\text{Culture cycle (days)}}{\text{365 days}}\right) \text{x 2.75 \%} \quad (2)$$

The average value of bagged forage in the months following the harvest of the experiment was considered, multiplied by the green mass productivity of the corresponding plot to calculate the gross income (GI) of corn silage (any losses occurring during the harvesting processes were not recorded, harvesting, storage and removal of ensiled material).

Net income (NI) was calculated using the difference between the GI and the total costs (TC) of obtaining the silage. The rate of return (RR) was determined based on the relationship between GI and TC, corresponding to the capital obtained for each real investment in corn cultivation. The profitability index (PI) consisted of the relationship between NI and GI, expressed as a percentage. Analysis of variance was carried out for the characteristics evaluated using the Sisvar application, version 5.6 . The Scott- Knott test ($P<0.05$) was used to group treatment means. (Ferreira, 2011).

Results and Discussion

Among the treatments studied, there was no statistical difference for stem diameter, which obtained a general average of 20.18 mm; leaf area, leaf area index, which achieved an average result of 2.27; and number of total leafs, which reached an average value of 13.64 leaves.

Two groups were formed for the plant height variable; the first was composed of the hybrid K9555 VIP 3, K9822 VIP 3, and K9510 Conventional, with a group average of 1.56 m (Table 2). These values were expected, since, according to KWS (2021), these hybrids can reach up to 2.6 m, and 2.4 m in height, respectively. The second group comprised the rest of the treatments, which presented an average value of 1.43 m. Superior results were found by Domingues et al. (2013) in Santo Antônio do Leverger-MT, where the accumulated precipitation during the experiment was 479 mm, working with 23 corn hybrids, which obtained plant height values in the range of 1.84 to 2.49 m. Klein et al. (2018), in Santa Maria-RS, with accumulated precipitation of 845.9 mm, also found higher values than this study, obtaining results for plant height of 1.81 to 2.70 m in four corn hybrids.

According to Pinto et al. (2010), plants with values below 2.20m are considered low-sized plants, which would classify all hybrids used in this work in this category. However, meteorological conditions may have influenced the development of the plants. Short plants are desirable because they avoid losses due to lodging and breakage, and the self-shading of the leaves. Furthermore, increasing the number of plants per unit area would be possible, that is, a greater population density. Therefore, shorter plants could increase the crop's productivity potential and facilitate mechanized cultivation and harvesting operations (Berilli et al., 2013; Gabriel et al., 2018). Furthermore, according to Klein et al. (2018), earlier corn hybrids with short plant height have a higher percentage of ears and grains, having more significant potential for silage production. All hybrids used in the work are early, except K9555 VIP 3, which has a medium cycle.

Two groups were formed regarding the number of living leaves, with the hybrids K9555 VIP 3 and K9510 Conventional obtaining an average value of 9.40 units (Table 2). Regarding the number of dead leaves, two groups were also formed, in which K9555 VIP 3 and K9510 Conventional presented an average value of 4.70 units. They present the lowest number of dead leaves and the highest results of number of living leaves; their values indicate that they have high stay green, that is, they remain green even after reaching an advanced stage of development, showing that the K9555 VIP 3 and K9510 Conventional have potential for making silage. According to Klein et al. (2018), a smaller number of dead leaves facilitates management during the ensiling process, making compacting the material simpler and better, enhancing lactic fermentation to maintain the nutritional value of the silage.

For the variable percentage of leaf dry mass, the hybrid that obtained the highest

Table 2. Average values of plant height (PH), number of living leaves (NLL), and number of dead leaves (NDL) of corn hybrids produced under rainfed conditions in Piranhas, Western Alagoas, 2021.

Hybrids	PH (m)	NLL (plant leaves $^{-1}$)	NDL (plant leaves $^{-1}$)
K9555 VIP 3	1.59 a	9.56 a	4.64 b
R9080 PRO 2	1.44 b	5.65 b	7.76 a
K9822 VIP 3	1.56 a	6.34 b	7.33 a
K9606 VIP 3	1.46 b	6.75 b	6.75 a
K9510 Conventional	1.53 a	9.25 a	4.75b
K8774 PRO 3	1.41 b	6.96 b	6.74 a
RB9006 PRO 2	1.47 b	6.32 b	6.88 a
2B587 PW	1.37 b	6.87 b	6.58 a

Means followed by the same letter in the column belong to the same homogeneous group, according to the Scott- Knott test at the 5% probability level.

result was 2B587 PW (44.06%), not differing statistically from the other treatments, but rather from the average of group “b” (32.60%) according to Scott- Knott (Table 3). For the variable percentage of stem dry mass, the average (26.84%) of group “a” differs from the average (20.27%) of group “b”, according to the Scott- Knott test (Table 3). Neumann et al. (2017), evaluating six hybrids for silage production, found superior results for leaves compared to stems, which found average values in the percentage of dry mass of leaves of 26.03% and of stems with 20.16%. Likewise, Oliveira et al. (2013), evaluating maize genotypes at the R5 growth stage, obtained higher values for the participation of dry mass in leaves (27%) than in stalks (21.2%).

According to Mendes et al. (2015), the desirable characteristic in plants intended for silage production is to reduce the share of leaves, stalks, and cob bracts and increase the share of grains. The results obtained are interesting since corn leaves are components that have low fiber content and good energy value (Pereira et al., 2012), unlike stalks, which, according to Neumann et al. (2009), a high amount of this component can reduce the nutritional value of the silage because this part of the plant has higher fiber content and low digestibility, reducing the quality of the silage.

There was a significant difference among the hybrids regarding the variable percentage of ear dry mass. R9080 PRO 2 presented the highest result, but there was no statistical difference among the other hybrids. The 2B587 PW treatment presented the lowest result (24.20%), differing from the other hybrids (Table 3). The average value found for this work was 42.34%, with accumulated precipitation of 234.6 mm (Figure 1). Mendes et al. (2015) found results superior to those of this work in two planting seasons, obtaining an average value of bracts plus cob plus grains of 55.30% in October planting and 52.80% in November in Guarapuava-PR, with accumulated precipitation of approximately 765 mm during the experiment. According to Silva et al. (2014), corn is very demanding of water, especially during flowering and grain formation. The low precipitation value in this work, 234.6 mm (Figure 1), may have caused the lower percentage participation in the dry mass of the cob.

Low values of the dry mass of the cob, such as those presented by the 2B587 PW treatment, are not desirable, as the corn grains are located in the cob, an essential part of silage production. More excellent grain production affects the fermentative process of silage conservation, as it ensures a more significant amount of substrate available for fermentation by beneficial microorganisms, such as homofermentative lactic acid bacteria (Jobim & Nussio, 2013). This situation makes fermentation more efficient, as it promotes the rapid formation of lactic acid, which consequently causes a rapid lowering of pH, leading to better material conservation through the inhibition of scavenging microorganisms (Neumann et al., 2017). Therefore, the ideal is a genetic material with low fibrous fractions and more significant grains forming high-quality silage, guaranteeing good animal digestibility and nutrition.

There was no significant difference in green mass productivity, reaching an average value of 25.37 t ha^{-1}. This low productivity is a consequence of the low development of plant

Table 3. Average values of percentage participation of leaf dry mass (%LDM), stalk (%LDS), and ear (%LDE) of corn hybrids produced under rainfed conditions in Piranhas, Western Alagoas, 2021.

Hybrids	%LDM	%LDS	%LDE
K9555 VIP 3	32.80 b	19.05 b	46.56 a
R9080 PRO 2	30.11 b	18.51 b	49.59 a
K9822 VIP 3	34.08 b	23.01 b	41.21 a
K9606 VIP 3	31.51 b	19.92 b	47.24 a
K9510 Conventional	29.82 b	21.29 b	47.60 a
K8774 PRO 3	35.41 b	24.56 a	38.44 a
RB9006 PRO 2	34.46 b	19.83 b	43.87 a
2B587 PW	44.06 a	29.11 a	24.20 b

Means followed by the same letter in the column belong to the same homogeneous group, according to the Scott- Knott test at the 5% probability level.

components, which, as already shown, occurred due to the climatic conditions of the experiment. The small productivity of green mass meant that net income became low compared to other jobs.

The relationship between dry and green mass had no significant difference, reaching an average value of 29.92% and showing that all hybrids were at a suitable harvest point for silage. For Jobim & Nussio (2013), the material must have between 28 and 40% dry mass, these values being adequate for good fermentation of the forage in the silo.

Two groups were formed for dry mass productivity. The group of the hybrid 2B587 PW formed had the lowest value (5.62 t ha $^{-1}$) (Table 4). The 2B587 PW treatment had a lower percentage of the cob (bract, cob, and grains) and a higher percentage of leaves plus stalk, which caused lower dry mass productivity. The same occurred in the work of Klein et al. (2018), whose lower participation of grains in silage was observed in the hybrid AS 1656 PRO 3, relating this result to the higher percentages of leaves and stalks in the ensiled material. According to Neumann et al. (2017), the hybrids with the highest grain share had the highest dry mass productivity.

Gross income reached an average value of R$ 9,518.56 ha^{-1}; considering the value of the dollar at harvest time, which was R$ 5.20, the value of gross income would be US$ 1,830.49 ha^{-1}, the net income of US$702.89 ha^{-1}, the rate of return of 1.62 and the profitability index of 38.40 %. Santos et al. (2017b), with a survey of silage prices in the State of São Paulo, obtained a return rate of 3.84 and a profitability index of 73.97% . For Minas Gerais, studies carried out by the same authors, the return rate was 4.03, and the profitability index was 75.18%. These results reflected the high productivity compared to this work (25.37 t ha^{-1}), 46.7 t ha^{-1} in São Paulo, and 52.3 t ha^{-1} for Minas Gerais. The differences between the Center-South and Northeast regions

Table 4. Average dry mass productivity (DMP) values of corn hybrids produced under rainfed conditions in Piranhas, Western Alagoas, 2021.

Hybrids	%LDM	%LDS	%LDE
K9555 VIP 3	32.80 b	19.05 b	46.56 a
R9080 PRO 2	30.11 b	18.51 b	49.59 a
K9822 VIP 3	34.08 b	23.01 b	41.21 a
K9606 VIP 3	31.51 b	19.92 b	47.24 a
K9510 Conventional	29.82 b	21.29 b	47.60 a
K8774 PRO 3	35.41 b	24.56 a	38.44 a
RB9006 PRO 2	34.46 b	19.83 b	43.87 a
2B587 PW	44.06 a	29.11 a	24.20 b

Means followed by the same letter in the column belong to the same homogeneous group, according to the Scott- Knott test at the 5% probability level.

are significant in technological and climate issues.

Expenses and profits are the same for silage production from any of the hybrids used in this work. Even presenting equal economic values, the hybrid 2B587 PW, as discussed in the agronomic variables, presented a more significant share of leaves with stalks than ears. In other words, it would produce silage with the same cost value but with lower nutritional value than the others, which is undesirable when feeding animals. More detailed research could be carried out in the future to identify the qualitative variables of each hybrid for silage, informing which would be better in terms of nutritional value (kcal/kg), crude protein, digestibility, weight gain, and feed conversion, among others. This way, even if the cost is the same, it would be possible to differentiate hybrids based on their nutritional benefits.

The average total cost for producing one hectare of corn for silage corresponded to R$5,863.51 ha^{-1} (Table 5). Similar results were found by Santos et al. (2017b) in surveying corn silage production costs in the 2015/2016 harvest, obtaining total costs of R$ 4,558.03 ha^{-1} in the State of São Paulo and R$ 4,868.53 ha^{-1} in Minas Gerais. Likewise, Souza et al. (2018), surveying costs for the economic viability of corn silage in the municipality of Igarapé - MA, found values close to those of this research, with a total cost of R$6,388.83 ha^{-1}. Among the production cost variables, the ones that contributed most to this research were inputs (seeds, fertilizers, pesticides, silage bags, and cable ties), with 53.63% referring to the cost of farming (Table 5). Santos et al. (2017b) also had the most critical process costs related to inputs, representing 57.0%. Likewise, Rabelo et al. (2017), in a case study in Montes Claros-MG and carrying out an analysis of corn silage production costs, indicated that inputs represented the most significant expenses, with 68.36%.These results demonstrate that the correct choice of seed to be used is essential, as each hybrid has a different nutritional need, thus affecting the amount of fertilizer purchased. In this work, fertilizers represented 26.72% of crop costs (Table 5). According to Souza et al. (2018), expenditure on inputs and fertilizers was high due to the fact that it was hybrid corn, following the fertilization recommendation for the cultivar proposed by the supplying company. Furthermore, the technology used in seeds to protect against pests and facilitate the use of pesticides such as glyphosate will also affect input costs, reducing expenses.

Another variable that stood out was the machinery for harvesting silage, representing 18.30%, and manual bagging of forage with 11.98%, totaling 30.28% of the crop's costs (Table 5). Likewise, Souza et al. (2018) and Santos et al. (2017b) observed that, in addition to inputs, the silage harvesting part was the second most representative value of costs. In the present study, the total price for harvesting with payment per machine hour amounted to R$ 1,015.31 ha^{-1} (Table 5). Similarly, Rabelo et al. (2017), who carried out the study with their machinery, reached a value of R$ 1,022.77 ha^{-1}, a value very close to this work.

Table 5. Components of total costs producing one hectare of corn hybrids produced under rainfed conditions in Piranhas, Western Alagoas, 2021.

Discrimination	Items.	Qty.	R$
I - Farming expenses			
1 - Machine rental			
Tractor with light harrow	h	2.00	320.00
Tractor with forage harvester	h	6.35	1,015.31
Tractor with seeder-fertilizer	h	1.00	160.00
2 – Labor			
Manual weeding	daily	3.00	150.00
Spraying (insecticide)	daily	2.00	100.00
Manual fertilization	daily	2.00	100.00
Forage bagging	daily	13.30	664.79
3 – Seeds			
Hybrid seeds (average)	Items.	71,429	500.75
4 – Fertilizers			
Ammonium sulfate (20% N) - 42.86 kg ha^{-1} of N (Foundation)	kg	214.29	351.44
Ammonium sulfate (20% N) - 85.72 kg ha^{-1} of N (Cover)	kg	428.58	702.87
Simple superphosphate (18% P_2O_5) - 28.57 kg ha^{-1} of P_2O_5	kg	158.73	279.36
Potassium chloride (60% K_2O) - 34.28 kg ha^{-1} of K_2O	kg	57.14	148.56
5 - Agricultural pesticides			
Decis 25 EC (insecticide)	L	0.85	46.65
6 – Others			
Soil analysis	Items.	1.00	63.00
Silage bag - 40 kg	Items.	634.57	824.94
Cable Tie	Items.	634.57	120.57
Subtotal (A)			5,548.24
II - Other expenses			
7 - Administrative expenses (3% of farming costs)			166.45
8 - Technical assistance (2% of crop costs)			110.96
9 - Rural land tax (R$ 10.00 $year^{-1}$)			2.33
Subtotal (B)			279.74
III - Financial expenses			
10 - Financing interest (2.75% $year^{-1}$)			35.53
Subtotal (C)			35.53
Average total cost (A + B + C = D)			5,863.51
K9555 VIP 3			5,893.75
R9080 PRO 2			6,101.89
K9822 VIP 3			6,151.07
K9606 VIP 3			5,814.24
K9510 Conventional			6,013.52
K8774 PRO 3			5,688.41
RB9006 PRO 2			5,493.74
2B587 PW			5,751.45

As machinery is one of the components for harvesting silage, the producer must consider what would be more effective, having his machine or paying per machine hour, which will, therefore, depend on the current value instead of the hourly cost—machine and the need for successive production. Manual bagging of forage, a widespread practice in the study region, was another part of the harvest that proved to be representative and made the percentage of labor participation high, with 17.31% referring to the average total cost (Table 5). Another highlight was the soil analysis, which presented only 1.07% of the average total cost (Table 5). Soil analysis proved an essential item and fertilizers significantly represent crop costs.

Conclusions

Among the materials tested, the hybrid 2B587 PW is the least recommended for silage, as it presented a higher percentage of fibrous parts, leaves plus stalk, and a lower percentage of ears. In addition, it also had the lowest dry mass productivity.

The K9555 VIP 3 and K9510 Conventional are the most recommended for silage as they are the tallest materials, have a more significant number of live leaves, and have fewer dead leaves.

The lack of rain affected the development and, consequently, the productivity of the corn hybrids studied.

Among all parts of the plant, the percentage of dry mass of the cob most affected dry mass productivity.

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