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Effectiveness of Weed Control on Two Varieties of Corn (Zea Mays L.) in West Aceh Regency

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Abstract

This research aims to find out which weed control techniques are most effective in suppressing weed growth on corn plants, to find out the interaction of manual, mechanical, and chemical weed control on corn plants, to find out the influence of weed control techniques on the production and growth of corn plants. This research be carried out in West Aceh Regency on corn farming land in the Pante Ceureumen District. The time allocation is from April to June 2014. The research was conducted using a randomized block design with a factorial pattern with two factors being studied. The first factor is the weed control technique (T): no control, manual control, using husk charcoal, chemical, atrazine + mesotrion 1.35 ml each 9 m² and the second factor is the variety (V): Bisi-2 and Bisi-18. Based on the treatment of 12 plots with 3 repetitions times until there are 36 experimental units. Each treatment plot measures 300 cm x 300 cm with a planting distance of 75 cm x 25 cm so that the number of sample plants in each plot is 48 plants and the number of sample plants in each plot is 8 plants. The distance between plots is 50 cm and the distance between replications is 100 cm. The results obtained from observations are analyzed using the F test. If the results obtained from the variance are significantly different at the 5% level. The result of the research that has been carried out is that the most effective control technique in suppressing weed growth in corn plants is found at T5 (chemistry, topramezone + atrazine 1.35 ml each 9 m², at 21, 40, and 56 HST), followed by T2 (culture technique using rice husk charcoal), T4 (Chemical, nicosulfuron + atrazine 1.35 ml each 9 m², at 21, 40, and 56 HST) and T1 (manual, at 21, 40, and 56 HST) have the same position, then T3 (chemistry, atrazine + mesotrione 1.35ml each 9 m², at 21, 40 and 56 HST), and the last position in weed control techniques is WC (without control).

Keywords: *Effectiveness, Corn, Weed Control, Varieties.*

1. Introduction

Corn (Zea mays L.) is one of the agricultural commodities from the cereal group which is the main source of raw materials in making livestock feed and is rich in carbohydrates and protein, this makes corn plants have high economic value because of its diverse benefits [1].

According to Padang [2] weeds are all plants that grow in places that are not desired by farmers where their presence can be detrimental to cultivated plants. The reduction in production due to the presence of weeds on land cultivated by corn farmers can reach 16 - 56%. The decrease in corn production is because corn plants are very sensitive to weed competition.

Weeds are plant species that are associated with cultivated plants and adapt to human-made habitats. Weeds are known in the agricultural science zone because they compete with cultivated plants in these artificial habitats. Weeds are mostly from the herbaceous group, but there are also some shrubs and trees (Acacia sp., Opuntia sp) which are very aggressive types of weeds [3].

Weed classification is based on several aspects, including leaf morphology. From the morphology, weeds can be divided into several groups, namely grasses, sedges, and broadleaf weeds. Grasses have ribbon-shaped leaves consisting of leaf sheaths and blades. Included in the Poacea or Gramineae family. Sedges have leaves shaped like grass but triangular. Included in the Cyperaceae family, while broadleaf weeds have various leaf shapes, but are not narrow like grasses. Examples of broadleaf weeds are Amaranthus spinosus and Portulaca oleracea [4]. Weeds in corn plantations without tillage are controlled with herbicides. Before the corn is planted, herbicides are sprayed to kill weeds growing in the planting area. After the corn grows, weeds still need to be controlled to protect the plants. Control can be done by hand weeding, using mechanical tools, and spraying herbicides. The formulation or trade name of herbicides available on

the market is quite diverse. The selection and use of herbicides depends on the type of weeds in the plantation. Excessive use of herbicides will damage the environment. To suppress or eliminate the negative impacts of herbicide use on the environment, its use needs to be limited by combining it with other control methods [5].
According to Moenandir [3], weed control is an action to stop the continued growth of weeds. Weed control is carried out because weeds as plants will compete with plants around them, namely cultivated plants. Farmers want maximum growth and yield of cultivated plants. The growth of cultivated plants will be maximized if interference from the presence of weeds is reduced or even eliminated. Weed control or generally referred to as anticipating the presence of weeds around cultivated plants can be done chemically (with herbicides) and non-chemically (without herbicides or non-herbicides).
Effective and efficient weed control, especially in the use of chemicals, can reduce the possibility of phytotoxicity in cultivated plants [6]. Phytotoxicity is tissue damage that occurs in cultivated plants caused by the use of chemicals in ineffective and inefficient weed control [7].
Chemical weed control using herbicides can be an alternative because it is known to be effective in controlling weeds in a relatively short time and can control weeds in large planting areas [8]. Herbicides containing active ingredients glyphosate, paraquat, and 2,4-D are widely used by farmers, so many formulations use these active ingredients. Glyphosate sprayed on leaves is effective in controlling annual grasses and annual broadleaf weeds, annual grasses, and broadleaf weeds. Glyphosate compounds are very mobile, translocated to all parts of the plant when applied to leaves, and rapidly decompose in the soil. Symptoms of poisoning develop slowly and appear 1-3 weeks after application [9].

2. Research Method

This research was conducted on corn farming land in Pante Ceureumen District, West Aceh Regency for four months starting from the implementation of preparation in making research proposals, and field surveys, then continued with data analysis to writing a thesis. Time allocation from March to June 2024.
The tools used in this study were rulers, meters, millimeter paper, calipers, cameras, chlorophyll meters, 50 cm x 50 cm squares (frames), analytical scales, ovens, hoes, plastic bags, paper bags, calculators, digital refractometers, books for weed identification "Nation Plant Monitoring Scheme Species Identification Guide", "Hand Book on - Weed Identification" and stationery.
The materials used in this study consisted of weed species found in corn cultivation locations, corn seeds of BISI-2 and BISI-18 varieties, rice husk charcoal, herbicides with active ingredients atrazine and mesotrione at a dose of 1.5 - 3 l / ha or 1.35 - 2.7 ml per 9 m2, nicosulfuron and atrazine at a dose of 1.5 - 2.25 l / ha or 1.35 - 2.025 ml per 9 m2, and topramezon and atrazine at a dose of 1.5 l / ha or 1.35 ml per 9 m2. The study was conducted using a randomized block design (RAK) factorial pattern with two factors studied. The first factor is the weed control technique (T) and the second factor is the variety (V) Factor 1:
T0 = without weed control
T1 = Manual, at 21, 40 and 56 HST
T2 = technical culture using rice husk charcoal at the beginning of the study with a thickness of 5 cm
T3 = chemical, atrazine + mesotrione 1.35 ml per 9 m2, at 21, 40 and 56 HST
T4 = chemical, nicosulfuron+ atrazine 1.35 ml per 9 m2, at 21, 40 and 56 HST
T5 = chemical, topramezone + atrazine 1.35 ml per 9 m2, at 21, 40 and 56 HST
Factor 2:
V1 = BISI-18
V2 = BISI-2

The number of research plots was 12 plots with 3 replications so there were 36 experimental units. Each treatment plot was 300 cm x 300 cm in size with a planting distance of 75 cm x 25 cm so the number of sample plants per plot was 48 plants and the number of sample plants per plot was 8 plants. The distance between plots was 50 cm and the distance between replications was 100 cm. The arrangement of treatment combinations is presented in the following table:

Table 1. Arrangement of experimental treatment combinations

Varieties (V)	Weed Control Techniques (T)					
	T0	T1	T2	T3	T4	T5
V1	$T_0 V_1$	$T_1 V_1$	$T_2 V_1$	$T_3 V_1$	$T_4 V_1$	$T_5 V_1$
V2	$T_0 V_2$	$T_1 V_2$	$T_2 V_2$	$T_3 V_2$	$T_4 V_2$	$T_5 V_2$

The statistical analysis used was analysis of variance with a randomized group design model as follows:

$$\mathbf{Y_{ijk} = \mu + \beta i + Tj + V_k + (PN)_{jk} + \varepsilon_{ijk}}$$

Information:
Y_{ijk} = The results obtained from observations between types of corn varieties and weed control
μ = General average
βi = The effect of block repetition on the th level - i
T_j = The effect of weed control on the level of - j
V_K = The influence of corn variety type on the level of - k
$(PN)_{jk}$ = The effect of interaction between corn varieties and weed control
ε_{ijk} = Trial error

The implementation of this research includes: land preparation, planting, fertilizing, weeding, pruning shoots and harvesting. The land used for the research was cleaned manually using a hoe then the soil was turned over so that the soil became loose. Furthermore, plots were made with a distance between plots of 50 cm and a distance between replications of 100 cm. The corn seeds used in this study were the Bisi 2 and Bisi 18 varieties. Corn planting was carried out using a tugal system with a depth of 3-4 cm. One corn seed was planted in one planting hole. The planting distance between rows was 50 cm and the distance between beds was 100 cm. If after planting the corn seeds did not grow or there were plants that did not grow well, replanting was carried out by moving the reserve plants that had been prepared outside the research plot.

The first fertilization at 7 HST was given urea fertilizer as much as 50 kg/ha and phonska fertilizer 200-300 kg/ha. The second fertilization at the age of 35 HST was given urea fertilizer of 100 kg/ha and phonska 100 kg/ha. Weed control was carried out according to the predetermined treatment techniques. Without control, after minimum soil processing, no weed control was carried out on the beds. Manual weed control, manual weed control was carried out by pulling weeds using hands at planting ages of 21, 40 and 56 HST. Control with technical culture, after minimum soil processing, rice husk charcoal was given on the surface of the beds. Chemical control, using herbicides containing active ingredients atrazine and mesotrione with a dose of 1.35 ml per 9 m2, nicosulfuron and atrazine with a dose of 1.35 ml per 9 m2, and topramezon and atrazine with a dose of 1.35 ml per 9 m2. Herbicide spraying was carried out at planting ages of 21, 40 and 56 HST. Harvesting was carried out when the corn plants were 100-120 days old after planting. Harvesting is done by cutting the cob from the stalk, then the corn is peeled while still attached to the stalk in order to reduce the water content. After peeling, the corn kernels are shelled using a corn sheller.

2.1. Observation Parameters

1. Plant height (cm); Height measurement is measured starting from the base of the stem which was previously given a black painted stake to the tip of the leaf at 10, 20, 30, 40, 50 and 60 HST;
2. Leaf length (cm); measured from the base to the tip of the leaf blade on one leaf above the cotyledon leaf (2-4 MST) and below the cob of age (60 HST);
3. Leaf width (cm); measured from the right edge to the left edge on one leaf above the cotyledon leaf (2-4 MST); leaves below the cob (6-10 HST);
4. Leaf greenness compared with a chlorophyll meter on the 7th leaf from the base which was carried out at 6 MST;
5. Number of leaves (blades); measured by counting leaves that are fully open with clearly visible ligule characteristics;
6. Stem diameter (cm); observed at 15-25 cm above the soil surface;
7. Leaf area index; calculated the total leaf area per plant per pot area. Leaf area was measured using block millimeter paper.
8. Dry weight of biomass (g/plant); ovened at 80 °C for 2 × 24 hours then weighed;
9. Weight per cob with husk and weight per cob without husk (g/cob); weighed using a digital scale;
10. Cob size [cob length and diameter (cm)]; measured using a meter and caliper;
11. Percentage reduction in dry production weight; calculated using the formula: Percentage reduction = Control weight − Treatment weight × 100
12. Observations were made to see the toxicity due to herbicide administration. Observations of herbicide toxicity were carried out on 4 corn plants in each experimental unit.

2.2. Weed dominance ratio (NJD)

NJD observations by comparing the density ratio, wet weight, and frequency ratio at the experimental unit location. NJD can be calculated using the formula:

$$NJD = KN+BBN+FN3$$

Note:

KN = density ratio of

BBN = wet weight ratio,

FN = frequency ratio

Density ratio (KN), wet weight ratio (BBN), and frequency ratio (FN) can be calculated using the equation:

$$KN = \frac{\text{KM certain weed species}}{\text{KM total weeds}} \times 100\ \%$$

$$BBN = \frac{\text{BBN certain weed species}}{\text{BBN total weeds}} \times 100\ \%$$

$$FN = \frac{\text{FN certain weed species}}{\text{FN total weeds}} \times 100\ \%$$

a. Dry stalk weight (dominant weeds) per plot

Observation of dry stalks of dominant weeds per plot is done by weighing the dry stalk weight (biomass) of dominant weeds.

b. Observation of total weed biomass

Observation of total weed biomass is done by calculating and adding up the dry biomass per species.

c. Phytotoxicity of corn herbicides

Observations are made to see poisoning due to herbicide administration. Observations are made at 2 and 4 DAP. The toxicity of herbicides begins with the following scoring system:

0 = No poisoning, 0-5% of the shape and color of young leaves are abnormal
1 = mild poisoning, 5-10% of the shape and color of young leaves are abnormal
2 = moderate poisoning, 11-20% of the shape and color of young leaves are abnormal
3 = severe poisoning, 20-50% of the shape and color of young leaves are abnormal
4 = very severe poisoning, more than 50% of the shape and color of young leaves are abnormal until they dry up and fall off until they die.

2.3. Data Analysis

The data obtained from the observation results were analyzed using the F test. If the results obtained in the analysis of variance were significantly different at the 5% level, then further testing was carried out using DMRT (Duncan's Multiple Range Test) at the 5% level. Statistical data analysis using SAS V9.12 software

3. Result And Discussions

The results of the analysis of variance of growth, the results of two varieties of corn (Zea mays L) due to weed control can be seen in Table 2.

Table 2. Recapitulation of the results of the analysis of variance of growth, the results of two varieties of corn due to weed control gulma.

Treatment	Weed Control (T)	Variety (V)	T*V	KK (%)
Plant Height 10 HST	tn	tn	tn	10,93
20 HST	tn	tn	tn	16,67
30 HST	tn	tn	tn	14,38
40 HST	tn	tn	tn	12,20
50 HST	*	tn	tn	11,14
60 HST	*	tn	tn	6,89
Leaf length 2-4 MST	tn	tn	tn	17,98
60 HST	*	tn	tn	6,13
Leaf width 2-4 MST	tn	tn	tn	20,74
60 HST	*	**	tn	5,87
Green leaves	tn	tn	tn	6,22
Leaf area	**	**	**	0
Number of leaf blades 10 HST	tn	*	tn	9,22
20 HST	tn	**	tn	4,56
30 HST	tn	tn	tn	3,98
40 HST	tn	tn	tn	3,60
50 HST	tn	tn	tn	3,29
60 HST	tn	tn	tn	4,20
Stem diameter 10 HST	tn	tn	*	15,67
20 HST	tn	*	tn	21,42
30 HST	tn	*	tn	22,48
40 HST	tn	*	tn	11,66
50 HST	**	**	tn	8,80
60 HST	tn	**	tn	10,79
Cob diameter	tn	*	tn	5,09
Length of the cob	*	*	tn	3,23
Weight of wet corn cob with husk	*	*	*	6,45
Wet cob weight without husks	*	**	*	3,02
Weight of dry corn cob with husk	tn	*	tn	8,22
Weight of dry corn without husk	*	**	*	5,97
Dry weight of dominant weeds	*	tn	tn	70,46
Total weed weight	*	tn	tn	76,32

Description:
tn = not significantly different,
* = significantly different,
** = very significantly different,
KK = Diversity Coefficient

The results of the analysis of variance of plant height at 10, 20, 30, 40, 50, and 60 days after planting are shown in Table 3.

Table 3. Average height of corn plants at 10, 20, 30, 40, 50, and 60 HST

Treatment	Plant Height					
	10 HST	20 HST	30 HST	40 HST	50 HST	60 HST
Weed Control						
T0 (No control)	13,64a	46,77a	87,21	139,51a	192,65b	229,79b
T_1 (Manual)	13,37a	48,56a	92,27a	156,15a	226,42a	258,06a
T_2 (Rice husk charcoal)	13,98a	48,85a	91,56a	155,79a	230,15a	260,71a

T_3 (atrazin, mesotrion 1,35 ml)	14,35a	48,58a	92,31a	151,19a	206,94ab	252,77a
T4 (nikosulfuron, atrazine 1,35 ml)	13,27a	48,91a	87,44a	143,79a	209,02ab	240,35ab
T_5 (topramezon, atrazine 1,35 ml)	13,83a	50,85a	102,16a	157,59a	234,88a	258,66a
Varieties						
V_1 (bisi – 18)	13,57a	46,37a	89,52a	147,59a	214,69a	248,20a
V_2 (bisi – 2)	13,92a	50,48a	94,80a	153,74a	218,65a	251,93a

Description: The average number followed by the same letter in the same column shows no significant difference, DMRT (-) shows no interaction in Anova with a significance of 5%.

Based on the results of the analysis of variance of plant height at the ages of 10, 20, 30, 40, HST, it shows that plant height at the age of 10 HST is not significantly different from corn varieties and weed control techniques, and there is no interaction between varieties and weed control techniques. This occurs because both factors have not yet influenced the initial growth of corn plants.

The results of the analysis of variance in Table 3 show that plant height at the ages of 50 and 60 HST shows that plant height is significantly different from weed control techniques but not significantly different from plant varieties, and there is no interaction between varieties and weed control techniques. This shows that providing weed control is a very important cultivation action, because weeds can be quite high competitors for plants so that they have a negative impact on reducing crop yields. According to (Fuadi and Wicaksono [10]), if weed control is not carried out, there will be pressure due to competition for nutrients, water and sunlight between weeds and corn plants, which can reduce production. Providing organic materials such as rice husks as mulch can reduce weed growth and increase the growth of the main plant. [11].

The results of the analysis of variance showed that the length of corn plant leaves did not differ significantly between varieties and weed control techniques at the age of 10 HST, and there was no interaction between the two factors. Meanwhile, the results of the analysis of variance at the age of 60 HST showed that the length of the leaves differed significantly to the weed control technique and did not differ significantly to the varieties, and there was no interaction between the two factors. The results of the average leaf length can be seen in Table 4.

Table 4. Average length of corn plant leaves at 2-4 MST and 60 HST

Treatment	Leaf length (cm)	
	2-4 MST	60 HST
T0 (No control)	22,67a	84,12c
T1 (Manual)	22,16a	91,44ab
T2 (Rice husk charcoal)	23,41a	95,46a
T3 (atrazin,mesotrion 1,35 ml)	22,83a	91,25ab
T4 (nikosulfuron,atrazine 1,35 ml)	23,64a	87,00bc
T5 (topramezon,atrazine 1,35 ml)	22,48a	89,16abc
V1(Bisi-18)	23,31a	89,48a
V2(Bisi-2)	22,42a	89,99a

Description: The average number followed by the same letter in the same column shows no significant difference, DMRT (-) shows no interaction in Anova with a significance of 5%.

From Table 4 it can be seen that the type of variety and the provision of weed control at the age of 2-4 MST are not significantly different in corn plants. This indicates that both factors still give the same results on leaf length so that there is no difference between the two factors.

Based on the results of the analysis of variance of leaf width at the age of 10 HST, it showed that the leaf width was not significantly different in the varieties and weed control techniques, and there was no interaction between the two factors. Meanwhile, the results of the analysis of variance of leaf width at the age of 60 HST showed that the leaf width was very significantly different for corn plant varieties but significantly different for weed control techniques, and there was no interaction between varieties and weed control techniques. The average leaf width in corn plants can be seen in Table 5.

Table 5. Average leaf width on corn plants aged 2-4 WAP and 60 HST

Treatment	Leaf length (cm)	
	2-4 MST	60 HST
T0 (No control)	1,60a	8,10b
T1 (Manual)	1,56a	8,26ab
T2 (Rice husk charcoal)	1,75a	8,74a
T3 (atrazin,mesotrion 1,35 ml)	1,34a	8,09b
T4 (nikosulfuron,atrazine 1,35 ml)	1,62a	7,82b
T5 (topramezon,atrazine 1,35 ml)	1,52a	8,02b

V1(Bisi-18)	1,57a	7,87b
V2(Bisi-2)	1,56a	8,48a

Description: The average number followed by the same letter in the same column shows no significant difference, DMRT (-) shows no interaction in ANOVA with a significance of 5%.

Based on the results of the analysis of variance, it shows that the variety and weed control techniques give results that have no significant effect on chlorophyll levels in corn plants, and there is no interaction between the variety and weed control techniques. Meanwhile, the results of the analysis of variance of leaf area show that leaf area has a very significant effect on the variety and weed control techniques, and there is an interaction between the variety and weed control techniques. The average results of chlorophyll and leaf area in corn plants can be seen in the following table.

Table 6. Average chlorophyll and leaf area in corn plants

Treatment	Greenish leaves (cci)	Leaf area (cm)
V1(Bisi-18)	48,39a	511,1b
V2(Bisi-2)	47,64a	514,0a
T0 (No control)	45,21b	453,0f
T1 (Manual)	49,92a	467,7e
T2 (Rice husk charcoal)	48,66ab	558,1b
T3 (atrazin,mesotrion 1,35 ml)	48,06ab	469,8d
T4 (nikosulfuron,atrazine 1,35 ml)	47,43ab	567,6a
T5 (topramezon,atrazine 1,35 ml)	48,81ab	517,8c

Description: The average number followed by the same letter in the same column shows no significant difference, DMRT (-) shows no interaction in ANOVA with a significance of 5%.

The results of the analysis of variance on the number of leaves of corn plants at 10, 20, 30, 40, 50 and 60 days after planting can be seen in the appendix. The following are the average results of the number of leaves on corn plants.

Table 7. Average number of leaves on corn plants

Treatment	Number of leaf blades					
	10 HST	20 HST	30 HST	40 HST	50 HST	60 HST
V1(Bisi-18)	1,89b	3,75b	4,91a	5,89a	6,89a	7,83a
V2(Bisi-2)	2,03a	3,96a	5,01a	6,01a	6,90a	7,84a
T0 (No control)	2,00a	3,83a	4,98a	5,92a	6,85a	7,77a
T1 (Manual)	2,00a	3,94a	4,96a	5,77a	6,77a	7,77a
T2 (Rice husk charcoal)	1,87a	3,83a	4,94a	5,98a	6,98a	7,79a
T3 (atrazin,mesotrion 1,35 ml)	2,02a	3,81a	4,92a	5,98a	6,81a	7,81a
T4 (nikosulfuron,atrazine 1,35 ml)	1,96a	3,89a	4,98a	6,02a	6,94a	7,83a
T5 (topramezon,atrazine 1,35 ml)	1,92a	3,83a	5,00a	6,04a	7,04a	8,04a

Description: The average number followed by the same letter in the same column shows no significant difference, DMRT (-) shows no interaction in Anova with a significance of 5%.

The results of the analysis of variance of the number of leaves at the age of 10 and 20 HST show that it has a significant effect at the age of 10 HST and a very significant effect at the age of 20 HST on the variety and has no significant effect on weed control, and there is no interaction between the variety and weed control techniques. The results of Table 8 show that V2 is superior to V1. Variety plays an important role in crop production, because achieving high yields is greatly influenced by genetics and the environment. The potential for high yields is influenced by the interaction between genetic factors and environmental management. If environmental management is not carried out properly, the potential for high yields from the variety cannot be achieved [12].
The results of the analysis of variance on stem diameter 10, 20, 30, 40, 50, and 60 days after planting in corn plants can be seen in the appendix. The following are the average results of stem diameter in corn plants.

Table 8. Average stem diameter of corn plants

Treatment	Stem diameter (mm)					
	10 HST	20 HST	30 HST	40 HST	50 HST	60 HST
V1(Bisi-18)	2,37a	4,81b	12,63b	16,68b	18,10b	16,45b
V2(Bisi-2)	2,51a	5,94a	15,78a	19,07a	20,14a	19,02a
T0 (No control)	2,48ab	5,14a	13,24a	16,21b	16,79c	16,34b
T1 (Manual)	2,39ab	4,94a	13,79a	19,04a	21,59a	18,37ab
T2 (Arang sekam)	2,01b	4,92a	14,14a	19,47a	20,06ab	19,14a
T3 (atrazin,mesotrion 1,35 ml)	2,56a	5,65a	14,91a	17,17ab	18,60bc	17,76ab
T4 (nikosulfuron,atrazine 1,35 ml)	2,46ab	5,18a	13,13a	17,07ab	18,24bc	16,79ab
T5 (topramezone, atrazine 1.35 ml)	2.74a	6.42a	16.02a	18.31ab	19.46b	18.00ab

Note: The average number followed by the same letter in the same column shows no significant difference, DMRT (-) shows no interaction in Anova with a significance of 5%.

Based on the results of the analysis of variance of stem diameter at 10 HST, it shows that stem diameter has no significant effect on variety treatment and weed control techniques, but there is an interaction between variety and weed control techniques. Higher interaction with the V2T5 treatment, for other interactions did not show significant differences. Interaction can occur because each variety has different genetic characteristics, and some weed controls are able to inhibit growth so that the interaction of both is able to increase the diameter of the corn plant stem.

Based on the results of the analysis of variance of ear diameter, it shows that ear diameter has a significant effect on variety but does not have a significant effect on weed control techniques, and there is no interaction between variety and weed control techniques. Meanwhile, the results of the analysis of variance of ear length show that ear length has a significant effect on variety and weed control techniques, and there is no interaction between variety and weed control techniques. The results of the ear diameter and ear length ratio in corn plants can be seen in the following table.

Table 9. Average cob diameter and cob length in corn plants

Treatment	Cob diameter (mm)	Length of cob (cm)
V1(Bisi-18)	47,41a	23,27b
V2(Bisi-2)	43,42b	24,48a
T0 (No control)	44,00a	22,23b
T1 (Manual)	44,60a	24,09ab
T2 (Husk charcoal)	47,07a	24,96a
T3 (atrazin,mesotrion 1,35 ml)	43,69a	24,90a
T4 (nikosulfuron,atrazine 1,35 ml)	45,56a	23,70ab
T5 (topramezon,atrazine 1,35 ml)	47,17a	24,12ab

Description: The average number followed by the same letter in the same column shows no significant difference, DMRT (-) shows no interaction in Anova with a significance of 5%.

In the table above, V1 is higher than V2. The diameter of the cob has a significant effect on the variety. Increasing the diameter of the cob will affect the production results with better seed quality. Increased production and seed weight are also thought to be related to the amount of photosynthate that is channeled to the cob.

Based on the results of the analysis of variance on BBT with husks and BBTT with husks, it shows that BBT with husks and BBTT with husks have a significant effect on the variety and weed control techniques, and there is an interaction between the variety and weed control techniques. The average value of the wet weight per cob with husks and the wet weight per cob without husks can be seen in Table 10.

The wet weight per cob with husks in Table 10 has quite a lot of variation. This can happen because each variety has different characteristics, one of which is genetic factors.

Table 10. Average wet weight per cob with husks and wet weight per cob without husks on corn plants

Treatment	Weight of wet corn cob with husk (g)	Weight of wet corn without husk (g)
V1(Bisi-18)	223,59a	197,55a
V2(Bisi-2)	186,20b	162,44b

T0 (No control)	185,39bc	161,50d
T1 (Manual)	197,53abc	175,53c
T2 (Husk charcoal)	229,33a	201,59a
T3 (atrazin,mesotrion 1,35 ml)	176,66c	153,41d
T4 (nikosulfuron,atrazine 1,35 ml)	213,39ab	189,19ab
T5 (topramezon,atrazine 1,35 ml)	213,25ab	186,50bc

Description: The average number followed by the same letter in the same column shows no significant difference, DMRT (-) shows no interaction in Anova with a significance of 5%.

Based on the results of the analysis of variance, the dry weight per cob with husks shows that the BKT of the cob has a significant effect on the variety but does not have a significant effect on sugar control, and there is no interaction between variety and weed control. While for the dry weight per cob without husks, it shows that the BKTT of the cob has a very significant effect on the variety and has a significant effect on weed control techniques, and there is an interaction between the variety and weed control techniques. The following is a table of the average dry weight per cob with husks and dry weight per cob without husks in corn plants.

In Table 11, it can be seen in the dry weight per cob with husks that the variety factor affects the yield of the cob, the bisi-18 variety (V1) is superior to the bisi-2 variety (V2). It can be seen that this difference can be influenced by two factors, namely genetic factors and plant environment.

Table 11. Average dry weight per cob with husks and dry weight per cob without husks on corn plants

Treatment	Weight of dry corn cob with husk (g)	Weight of dry corn without husk (g)
V1 (Bisi-18)	184,93a	166,10a
V2 (Bisi-2)	148,49b	130,35b
T0 (No control)	148,30bc	132,36cd
T1 (Manual)	162,13abc	142,88bcd
T2 (Husk charcoal)	187,24a	167,17a
T3 (atrazin,mesotrion 1,35 ml)	143,66c	126,28d
T4 (nikosulfuron,atrazine 1,35 ml)	172,54abc	153,94abc
T5 (topramezon,atrazine 1,35 ml)	178,51ab	157,94ab

In the research that has been done by involving different variety factors and weed recognition techniques, it shows that there is no decrease in dry production weight. On the contrary, there is an increase in dry production weight in corn plants. This shows that variety variations and weed control techniques can positively affect production results, increasing the efficiency of corn production. The following is a table of the percentage of dry production weight in corn plants.

Table 12. Percentage of decrease in dry production weight in corn plants

Treatment	Wet Weight	% Dry Weight Loss	Information
V1T1	146.13	-	-
V1T2	206.94	-60.81	Improvement
V1T3	117.06	29.07	
V1T4	179.07	-32.94	Improvement
V1T5	151.00	5.00	Improvement
V1T0	145.13	1.00	Control
V2T1	139.63	-	-
V2T2	127.41	12.22	-
V2T3	135.50	4.13	-
V2T4	128.82	10.81	-
V2T5	164.88	-25.25	Improvement
V2T0	119.60	20.03	Control

Specific factors influencing this increase could include the ability of bisi-18 and bisi-12 varieties to be more resistant to weeds or the ability to choose more effective control techniques in managing competition between corn plants and weeds. These results can also be the basis for recommending more effective weed control techniques and selecting superior corn varieties to increase production yields.

Based on the results of all the data above, it is known that the phytotoxicity value shows a number of 0, which means that the use of the herbicide used does not have a negative effect or there are no symptoms of corn plant poisoning. This is due to several factors, namely the use of the right herbicide dose and in accordance with recommendations so that it is quite effective in controlling weeds without causing phototoxicity, the use of herbicides that have high selectivity to kill weeds, the corn varieties used have high genetic tolerance to the applied herbicides, optimal and appropriate environmental conditions when applying herbicides, proper management and methods in applying herbicides and safe herbicide formulations, and so on.

The results of population and growth observations of weeds before the experiment were found 17 types of weeds, namely Patikan kebo (Euphorbia hirta), Rumput belulang (Eleusine indica), Maman Lanang (Cleome ruditos perma), Rumput Teki (Cyperus rotundus), Putri malu (Mimosa pudica), Kolonjono (Brachiaria mutica), Rumput Mutiara (Oldenlandia corymbosa), Tutup Hijau (Jussiaea linifolia), Rumput Lumbung (Echinochloa colona L), Wings biru (Torenia Crustacea), Meniran (Phylantus uninaria), Rumput abidi (Leersia virginica), Keladi tikus (Typhonium blunei), Babadotan (Ageratum conyzoides L), Patik emas (Euphorbia heteprophylla), Rumput Kepiting besar (Digitaria sanguinalis), Rumput abadi (Muhlenbergia Schreberi).

Weeds are plants that grow in unwanted places and interfere with the growth of the main plant. Weeds can be a threat because they can compete with the main plant for nutrients, water, and sunlight. Weeds found around corn plants can reduce yields and seed quality, and can interfere with the process of plant cultivation such as fertilization and harvesting which can be detrimental to farmers in terms of reducing product quality. Therefore, weed control needs to involve various techniques and there needs to be effective weed management without damaging the main plant and the environment [13].

From the results of the observations that have been carried out, it was found that there were 21 types of weeds growing in the corn planting area. However, there was a difference in the weed population in the initial observation and the final observation after the research was carried out. The following is a table of the difference in weed population before and after the research.

Table 15. Weed Population

No	Weed Population	Initial Population	Last population
1	Make sure the water buffalo (Euphorbia hirta)	✓	
2	Eleusine indica (Eleusine indica)	✓	✓
3	Maman Lanang (Cleome is a perma ruditos)	✓	-
4	Nutgrass (Cyperus rotundus)	✓	✓
5	Mimosa pudica (Sensitive plant)	✓	✓
6	Brachiaria mutica (Brachiaria mutica)	✓	-
7	Pearl Grass (Oldenlandia corymbose)	✓	✓
8	Green Cap (Jussiaea linifolia)	✓	✓
9	Barn Grass (Echinochloa colona L)	✓	✓
10	Blue wing (Torenia Crustacea)	✓	-
11	Meniran (Phylantus uninaria)	✓	✓
12	Abidi grass (Leersia virginica)	✓	-
13	Mouse taro (Typhonium blunei)	✓	✓
14	Babadotan (Ageratum conyzoides L)	✓	-
15	Golden hawk (Euphorbia heteprophylla)	✓	-
16	Large crab grass (Digitaria sanguinalis)	✓	-
17	Everlasting grass (Muhlenbergia Schreberi)	✓	✓
18	Malagasy (Mitracarpus hirtus)	-	✓
19	Water grass (Catabrosa aquatica)	-	✓
20	Baby Jump Up (Mecadornia procumbens)	-	✓
21	Hairy cowpea (Igna lutela)	-	✓

In the table above, it can be seen that there are several weed populations and types of weeds that were found again after the research ended, as well as the discovery of types of weeds that were only present at the end of the observation but were not found at the beginning of the observation. The types of weeds found during the last observation were Malagasy (Mitracarpus hirtus), Water grass (Catabrosa aquatica, Baby Jump Up (Mecadornia procumbens) and Hairy cowpea (Igna lutela). This can occur due to the influence of the use of herbicides which causes the evolution of resistance in weeds that can survive for a long time, resulting in more resistant weeds, changes in environmental conditions that allow the discovery of new species, changes in land management can cause an increase in the population and types of weeds. Changes in the composition of weeds that grow can be influenced by ineffective soil cultivation methods and herbicide use, as well as factors in environmental conditions. The abundance of weed seeds in the soil is also an important factor and determines the existence of a weed species, the sustainability of weeds, and the dominance of weeds in an ecosystem [6]. In Umiyati's research [14], it was also added that the growth and spread of weeds are influenced by environmental conditions such as soil type, altitude, water conditions, and habitat. The spread of weeds is carried out with the help of wind, water, animals, and humans. Changes in weed types will always occur in every weed control carried out, these changes are more apparent when using herbicides.

The presence of weeds in cultivated land is very widespread. The number of weeds can be known by calculating the percentage of the Dominance Ratio (NJD). The Dominance Ratio (NJD) of weeds is a ratio used to measure weed dominance in a particular area. The Dominance Ratio (NJD) provides an overview of how dominant a weed species is in the overall weed population in the area being studied. This can help and understand the structure of the weed community and can identify the most dominant weed species so that special attention is needed in weed control strategies. In Table 15, the number of weeds that dominate the most in the corn cultivation area is Echinochloa colona (60.59%), Oldenlandia corymbosa (7.14%) and Jussiaea linifolia (6.20%). More complete information on the Dominance Ratio (NJD) of weeds can be seen in the following table.

Table 16. Total Dominance Ratio (NJD) of Weeds

No	SPECIES	Total Dominance Ratio (NJD)
1	*Echinochloa colona*	60,59
2	*Oldenlandia corymbose*	7,14
3	*Jussiaea linifolia*	6,20
4	*Mitracarpus hirtus*	5,34
5	*Mimosa Pudica L.*	4,38
6	*Cyperus rotundus*	4,21
7	*Catabrosa aquatica*	3,86
8	*Mecardonia procumbens*	2,41
9	*Euphorbia heteprophylla*	2,32
10	*Eleusine indica*	1,60
11	*Philantus urinaria*	1,39
12	*Vigna luteola*	0,56
	Total	100

The results of the analysis of variance of the dry weight of dominant weeds showed that the dry weight of dominant weeds did not have a significant effect on the variety and had a significant effect on weed control techniques, and there was no interaction between variety and weed control techniques. The following is a table of the average dry weight of dominant weeds.

Table 17. Average dry fruit weight (dominant weed) on corn plants

Treatment	Dry weight of dominant weeds (g)
T0 (No Control)	199,94ab
T1 (Manual)	271,53a
T2 (Husk charcoal)	106,06bc
T3 (atrazin,mesotrion 1,35 ml)	68,14c
T4 (nikosulfuron,atrazine 1,35 ml)	103,67bc
T5 (topramezon,atrazine 1,35 ml)	94,57bc
V1 (Bisi-18)	169,85a
V2 (Bisi-2)	111,45a

Description: The average number followed by the same letter in the same column does not show a significant difference.

Based on the table above, the dominant dry weight of weeds in the highest control technique is at T1, followed by T0, and the dominant dry weight of weeds is low at T2, T4, T5, and T3, in this case involving varieties of both V1 and V2. The presence of weeds around the main plants is detrimental and disruptive. Weeds are included in the group that have a negative effect on cultivated plants because they have properties that are difficult to control and have a wide distribution space so that they will always be present in every cultivated land [15].

The application of herbicides derived from organic or inorganic chemical compounds is toxic to weeds. Too low a dose causes the herbicide used to be less effective, while a high dose can control weeds faster because of the large amount of active ingredients given [8]. This aims to kill weeds so that competition in obtaining light, water, and nutrients is sufficient for plants. The higher the competition that occurs, the more growth is inhibited. The application of herbicide doses can increase the percentage of weed control and reduce the dry weight of sugar and increase the components of plant yields [16].

The results of the analysis of variance of total weed biomass weight showed that the total weed biomass weight did not have a significant effect on the variety but had a significant effect on the weed control technique, and there was no interaction between the variety and the weed control technique. The following is a table of the average total weed biomass weight.

Tabel 18. Rerata bobot biomassa gulma total pada tanaman jagung

Treatment	Total weed weight (g)
T0 (No Control)	278,47a
T1 (Manual)	233,33ab
T2 (Husk charcoal)	114,54bc
T3 (atrazin,mesotrion 1,35 ml)	20,39c
T4 (nikosulfuron,atrazine 1,35 ml)	105,11bc
T5 (topramezon,atrazine 1,35 ml)	95,44bc

V1(Bisi-18)	162,64a
V2(Bisi-2)	119,77a

Description: The average number followed by the same letter in the same column shows no significant difference.

The highest total weed biomass weight was found in treatments T0 and T1 and the lowest total weed biomass weight was found in treatments T2, T4, T5, and T3, this involved both V1 and V2 varieties as seen in the table above. Total weed biomass is the total amount of weed mass in a certain area, usually measured by including all parts of the weed such as leaves, stems, and roots.

4. Conclusion

The conclusions from the research results that have been conducted are as follows:

1. The most effective control technique in suppressing weed growth in corn plants is T5 (chemical, topramezone + atrazine 1.35 ml per 9 m2, at 21, 40 and 56 HST), then followed by T2 (culture technique using rice husk charcoal), T4 (chemical, nicosulfuron + atrazine 1.35 ml per 9 m2, at 21, 40 and 56 HST) and T1 (Manual, at 21, 40 and 56 HST) have the same position, then T3 (chemical, atrazine + mesotrione 1.35 ml per 9 m2, at 21, 40 and 56 HST), and the last position in weed control techniques is T0 (without control).
2. The effect of weed control techniques on corn production and plants in the study was very influential. The applied weed control is able to increase production results without any side effects from the poisoning of the herbicides given. The applied weed control is able to suppress weed growth so that there is no competition between corn plants and weeds, so that corn plants can grow well.
3. Weed control both manually, mechanically, and chemically has interactions that can suppress weed growth. The combination of these three can maximize the effectiveness of weed control and minimize damage to corn plants. So that corn production achieves optimal and sustainable results in corn cultivation.

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