International Journal of Engineering, Science and InformationTechnology
Volume 4, No. 3 (2024) pp. 97-105
ISSN 2775-2674 (online)
Website: http://ijesty.org/index.php/ijesty
DOI: https://doi.org/10.52088/ijesty.v4i3.536
Research Paper, Short Communication, Review, Technical Paper

Selectivity of Herbicides in Controlling Weeds in Corn (Zea Mays L) With A Tegel and Jajar Legowo Planting Pattern in West Aceh Regency

Fakhrurrazi*, Baidhawi, Yusra

Department of Agroecotechnology, Faculty of Agriculture, Universitas Malikussaleh, Aceh, Indonesia

**Corresponding author Email: ozzie.sgl@gmail.com*

The manuscript was received on 1 February 2024, revised on 10 April 2024, and accepted on 3 September 2024, date of publication 7 September 2024

Abstract

Maize (*Zea mays* L.) has a strategic role in meeting global food needs. How is the selectivity of herbicides in cultivation patterns 1 (single rows) and 2 (double rows) in Maize plants (*Zea Mays* L), how is the combination of herbs and plant pattern suitable for the management of weeds in corn crops (*Zea mays* L), how are the interactions of selectivities of herbicides and cultivation of maize (*Zea mays* L). This study uses Random Group Design (RGD) factorial patterns where factor 1 (herbicide) and factor 2 (planting pattern). The herbicide is composed of 4 types: H_0 (control), H_1 (Atrazine 180g/l + Mesotrione 40g/ l + Nicosulfuron 20 g/l, H_2 (Atazine 500g/L, Mesotrione 50 g/L) and H_3 (Topramezone 10 g/ L + Atrazine 300 g/ l). While the planting pattern consists of 2 types: P_1: single row (70 x 20 cm) and P_2: double rows (100x20x40 cm). Some conclusions were obtained, among others: The use of the herbicide atrazine in several formulas within the tile and legowo planting patterns does not cause poisoning in corn plants. The combination of herbicides (Topramezon 10 g/l and Atrazine 300 g/l / Tile) is most suitable for corn plants. There is an interaction between the herbicide and the planting pattern on the parameters of ear weight without husk and ear length without husk, which shows significant differences.

***Keywords**: Atrazine, Mesotrione, Nicosulfuron, Topramezone.*

1. Introduction

Corn (Zea mays L.) has a strategic role in meeting global food needs. In addition to providing nutrition, corn is also used as an industrial raw material. However, one of the challenges in corn cultivation is the growth of weeds around the plants. Weeds can compete with corn for nutrients, water, light, and growing space, so weed control is very important to increase yields [1].

With a population density of 61,500–77,000 plants/ha, the use of single-row and jajar legowo planting systems has not changed the morphology of the stems and leaves of semi-corn other than the middle and lower corners of the leaves. However, physiological characteristics, such as chlorophyll content and leaf stomata density, have changed. The fresh weight of semi-cobs per plant is not affected by the jajar legowo and single-row planting systems [2].

Therefore, choosing the right planting system is very important to increase corn yields. The combination of tile and jajar legowo planting patterns can be an innovative solution, combining the advantages of both methods to increase the efficiency and productivity of corn cultivation. By using mesotrione as an active ingredient, several types of broadleaf weeds, such as Agregatum conyzoides, Amarantus spinosus, Emilia sonchifolia, Ipomea aquatica, and Ottochloa nodosa, can be controlled. Atrazine herbicide can control broadleaf weeds such as Agregatum conyzoides, Euphorbia hirta L, Amarantus spinosus, Emilia sonchifolia, Ipomea aquatica, and grass species Ottocholoa nodosa. The dose of herbicide with the active ingredient mesotrione 480 grams/ha and herbicide atrazine 570 grams/ha is the best dose to control weeds and increase sweet corn yields. The dose of herbicide with the active ingredient mesotrione 960 g/ha and herbicide atrazine 760 g/ha causes toxicity to sweet corn plants[3]. With a planting distance of 50 x 30 cm, 60 x 25 cm, and 75 x 20 cm, paraquat and atrazine herbicides effectively control weeds and suppress the wet and dry weight of grass and broadleaf weeds 2 Weeks After Application (MSA), the dry weight of dominant weeds Adropogon aciculata and Euphorbia hirta, and cause weed poisoning 2 to 4 MSA[4].

The use of jajar legowo planting distance affects the growth and yield of corn plants. The use of jajar legowo 4:1 with a planting distance of 25 cm x 50 cm x 50 cm x 100 cm has the greatest effect on plant height, number of leaves, stem diameter, cob circumference, cob length, and cob weight compared to conventional planting 55 cm x 70 cm[5].
This study aims to determine the selectivity of herbicides in planting pattern 1 (Tegel) and planting pattern 2 (Jajar Legowo 2:1) on corn (Zea mays L), to determine the combination of herbicides and planting patterns that are suitable for weed management in corn (Zea mays L), and to determine whether there is an interaction between selective herbicides and planting patterns in corn (Zea mays L).

2. Research Method

This research was conducted in March-June 2024, located in the complex of the Food Crops and Horticulture Service of West Aceh Regency in Suak Raya Village, Johan Pahlawan District, West Aceh Regency, which is located on a plain at an altitude of 6 meters above sea level with the following climate conditions: (1) average air temperature ranges from 26.2-27.5 0C; (2) average air humidity ranges from 87.8-91.3; (3) Average Wind Speed 3.4-8.8; (4) Rainfall 122-603 mm/year; (5) number of rainy days 11-22 days; (6) Sunlight 41-90. The materials used in this research include Materials (Bisi 2 hybrid corn seeds, inorganic fertilizer NPK 16:16:16 300 kg/ha, fungicides, insecticides, ropes, bamboo, wood, nails, nets, and herbicides which will be studied consisting of 3 active ingredients formulations including: (1) Atrazine 180 g/l + Mesotrion 40 g/l + Nicosulfuron 20 g/l, (2) A trazin 500 g/l, and Mesotrion 50 g/l (3) Topramezon 10 g/l, Atrazine 300 g/l, Water, bamboo, rope), Tools (Hand Tractor, Hoe, rake, and shovel, gembor, Hand Sprayer, Meter, Caliper, tape measure, scales, oven, syringe, grain moisture measuring tool, Personal Computer).
This study used a factorial Randomized Block Design (RAK), with two factors studied, namely selective herbicides (H) consisting of three levels and planting patterns (P) consisting of two levels. The experimental factors studied were as follows:
Factor I. Herbicides (H)
a. H0: Control (without Treatment).
b. H1: (Atrazin 180g/l + Mesotrion 40g/l + Nicosulfuron 20 g/l) with a dose of 5 ml/l of water.
c. H2: (Atrazin 500g/l, Mesotrion 50 g/l) with a dose of 5 ml/l of water.
d. H3: (Topramezon 10 g/l, Atrazine 300 g/l) with a dose of 5 ml/l of water.

Factor II. Planting Pattern (P)
a. P1: Tile planting pattern (70 x 20 cm).
b. P2: Jajar Legowo 2:1 planting pattern (100x20x40 cm).

Table 1. Combination of selective herbicide treatments and cropping patterns

Planting Pattern	Herbicide			
	H_0	H_1	H_2	H_3
P_1	H_0 P_1	H_1 P_1	H_2 P_1	H_3 P_1
P_2	H_0 P_2	H_1 P_2	H_2 P_2	H_3 P_2

There are 8 treatment combinations with 3 replications so there are 24 experimental plots. Each treatment plot measures 300 cm x 300 cm with a Tegel planting pattern (70 x 20 cm), and a 2:1 jajar legowo planting pattern (100 x 20 x 40 cm) so that the number of plants per plot of the Tegel planting pattern is 70 plants while the number of plants per plot of the jajar legowo planting pattern is 70 plants and the number of sample plants per plot is 12 samples. the distance between replications is 80 cm.
Before starting the research, land preparation was carried out with steps including preparation of materials and tools, land division and plot determination, initial Summed Dominance Ratio (SDR) analysis, land clearing, soil processing, making experimental plots, preparing seeds, herbicides, fertilizers, and pesticides. The land was plowed with a cultivator, leveled using a hoe, then a 300 x 300 cm plot was made as many as 24 plots with a distance between plots of 80 cm.
After land preparation, corn seeds are planted with the provisions of the predetermined planting pattern (P_1 and P_2), namely P_1 with a plant distance of 70x20 cm and P_2 100x20x40 cm. Corn planting is done using a 3-5 cm deep digging system with 1 seed per planting hole. Replanting is done by replacing dead plants with new plants in the nursery of the same age as the others, fertilization is done by digging fertilizer at a distance of 5-10 cm from the corn stalks, and watering is done if the land conditions are dry. Fertilizer was given 300 kg of NPK 16:16:16 with two stages of administration, namely the first stage at the age of 7 days after planting ((DAP) with a dose of 100 kg/Ha and the second stage at the age of 30 days after planting (DAP) with a dose of 200 kg/Ha.
Management of plant pests includes the use of insecticides, and fungicides if needed. Insecticides are used with active ingredients chlorantraniliprole and thiamethoxam while fungicides are used with active ingredients propiconazole and tricyclazole.
Implementation of treatment by spraying Herbicide with a dose of each herbicide 5 ml/liter of water + surfactant 1.6 ml/liter of water. Spraying was carried out 14 DAP by spraying from the top of the plant evenly on the plot using an electric sprayer. Herbicide spraying was only done once and after spraying the corn plants were not hilled.

3. Result And Discussions

3.1. Initial Weeds (before tillage)

Initial vegetation analysis on corn planting land that has been carried out before tillage with three quadrant throws obtained the analysis results as shown in Table 2 below:

Table 2. Results of initial weed vegetation analysis (before tillage).

No	Species	Parameter					
		KM	KN (%)	FM	FN (%)	INP	SDR (%)
1	Brachiaria mutica	12	19,05	10,00	20,41	3,00	12,50
2	Digitaria ternata	9	14,29	7,00	14,29	3,00	12,50
3	Scoparia dulcis L	7	11,11	7,00	14,29	2,00	8,33
4	Phylantus urinaria L	4	6,35	8,00	16,33	1,00	4,17
5	Plectranthus monostanchyus	5	7,94	5,00	10,20	2,00	8,33
6	Hyptis brevides	4	6,35	5,00	10,20	2,00	8,33
7	Melochia corchoryfolia L	5	7,94	1,00	2,04	2,00	8,33
8	Cleome ruditosperma Dc	4	6,35	1,00	2,04	2,00	8,33
9	Chanthilium cinerem L	4	6,35	1,00	2,04	2,00	8,33
10	Mimosa pudica	3	4,76	1,00	2,04	2,00	8,33
11	Stachytarpheta indica	4	6,35	2,00	4,08	1,00	4,17
12	Ludwigia octovalvis	2	3,17	1,00	2,04	2,00	8,33

Description: KM: absolute density, KN: relative density, FM: absolute frequency, FN: relative frequency, DM: absolute dominance, DN: relative dominance, INP: importance value index, and SDR: summed dominance ratio.

The following is the order of weed dominance based on the Summed Dominance Ratio (SDR) analysis. Brachiaria mutica is in first place with the highest SDR of 17.32%, indicating significant dominance in the research area. In second place is Digitaria ternata with an SDR of 13.69%. In third place is Scoparia dulcis L, although it has a lower summed dominance ratio than the first two species, namely 11.24%, it still shows significant dominance. All weed species in the field with each SDR value can be seen in Table 3 below:

Table 3. Summed dominance ratio of initial weeds (before tillage)

No	Weed Name	SDR (%)	Dominance Order
1	Brachiaria mutica	17,32	1
2	Digitaria ternata	13,69	2
3	scoparia dulcis L	11,24	3
4	Phylantus urinaria L	8,95	4
5	plectranthus monostanchyus	8,82	5
6	hyptis brevides	8,30	6
7	Melochia corchoryfolia L	6,10	7
8	Cleome Ruditosperma Dc	5,57	8
9	Chanthilium cinerem L	5,57	9
10	Mimosa Pudica	5,05	10
11	Stachytarpheta indica	4,87	11
12	Ludwigia octovalvis	4,52	12
	Total	100	

Description: SDR: summed dominance ratio

Before the use of land for research, the land was previously planted with red chilies and was no longer used for six months.

Table 4. Results of initial weed vegetation analysis after tillage.

No	Spesies	Parameter					
		KM	KN (%)	FM	FN (%)	INP	SDR (%)
1	Ludwigia octovalvis	55	16,92	45	20,55	37,47	12,49
2	Melochia corchoryfolia L	50	15,38	42	19,18	34,56	11,52
3	Cyperus rotundus	48	14,77	43	19,63	34,40	11,47
4	Brachiaria mutica	20	6,15	5	2,28	8,44	2,81
5	Phylantus urinaria L	20	6,15	13	5,94	12,09	4,03
6	Boreria latifolia	25	7,69	10	4,57	12,26	4,09

7	Setaria verticillata	20	6,15	4	1,83	7,98	2,66
8	Puspalum conjugatum	15	4,62	6	2,74	7,36	2,45
9	Colocasia sp	12	3,69	7	3,20	6,89	2,30
10	Panicum repens	11	3,38	2	0,91	4,30	1,43
11	Mimosa Pudica	12	3,69	21	9,59	13,28	4,43
12	Bacopa caroliniana	7	2,15	21	9,59	11,74	3,91
13	oldenlandia corymbosa	7	2,15	21	9,59	11,74	3,91
14	Acalypha virginia	6	1,85	21	9,59	11,44	3,81
15	Erigeron annus	5	1,54	21	9,59	11,13	3,71
16	Agregatum conyzoides	5	1,54	21	9,59	11,13	3,71
17	Scoparia dulcis	4	1,23	21	9,59	10,82	3,61
18	Iscemum rugosom	3	0,92	21	9,59	10,51	3,50

Description: KM: absolute density, KN: relative density, FM: absolute frequency, FN: relative frequency, DM: absolute dominance, DN: relative dominance, INP: important value index, and SDR: summed dominance ratio.

Based on the Summed Dominance Ratio (SDR) analysis of early weeds after tillage, it was found that Ludwigia octovalvis weeds were in first place with the highest SDR of 12.49%, followed by Melochia corchoryfolia L. (11.52%) and Cyperus rotundus (11.47%) compared to other weeds. These three weeds have good adaptability and high competitive power, so they can control the land significantly after tillage.

Mimosa pudica weeds were in fourth place with an SDR of 2.81%, but this dominance was much lower than the three main weeds. Other weeds such as Panicum repens (4.03%) and Bacopa caroliniana (4.09%).

Table 5. Summed dominance ratio of initial weeds (after tillage)

No	Weed Name	SDR (%)	Dominance Order
1	Ludwigia octovalvis	12,49	1
2	Melochia corchoryfolia L	11,52	2
3	Cyperus rotundus	11,47	3
4	Mimosa Pudica	2,81	4
5	Panicum repens	4,03	5
6	Bacopa caroliniana	4,09	6
7	oldenlandia corymbosa	2,66	7
8	Acalypha virginia	2,45	8
9	Phylantus urinaria L	2,30	9
10	Boreria latifolia	1,43	10
11	Erigeron annus	4,43	11
12	Agregatum conyzoides	3,91	12
13	Scoparia dulcis	3,91	13
14	Iscemum rugosom	3,81	14
15	Brachiaria mutica	3,71	15
16	Setaria verticillata	3,71	16
17	Puspalum conjugatum	3,61	17
18	Colocasia sp	3,50	18
	Total	100	

Description: SDR: summed dominance ratio.

The results of Anggraini's research [6] showed that 11 weed species grew in the cultivation of Pertiwi variety corn, including 6 species of narrow-leaf weeds, 2 species of sedges, and 3 species of broad-leaf weeds. Narrow-leaf weeds (grass) are the weeds that are most widely planted in the cultivation area of the Pertiwi variety. The weeds that dominate the cultivation area of corn varieties are Cynodon dactylon with a summed dominance ratio of 19.95, and Echinochloa colona with a summed dominance ratio of 10.44. The Poaceae / Graminae family is the main weed family that grows in the cultivation area.

3.2. Wet Weight of Dominant Weeds (G)

Based on the results of observations on the average weight of wet shoots of three dominant weeds (Ludwigia octovalvis, Melochia corchoryfolia L, and Cyperus rotundus), there were significant differences in various herbicide treatments and planting patterns. Ludwigia octovalvis in the control treatment (H_0) in the tile planting pattern (H_0P_1) showed the highest average weight of wet shoots of 1,162.33 g, while in the jajar legowo planting pattern (H_0P_2) the weight was slightly lower at 1,078 g. The use of herbicide H1 (Atrazin 180 g / l, Mesotrion 40 g / l, and Nicosulfuron 20 g / l) in the tile planting pattern (H_1P_1) reduced the weight of wet shoots to 1.31 g but increased in the jajar legowo planting pattern (H_1P_2) to 12.5 g. Treatment with herbicides H_2 (Atrazin 500g/l and Mesotrion 50 g/l) and

H_3 (Topramezon 10 g/l and Atrazine 300 g/l) showed very effective results with a wet bunch weight of 0 g in both planting patterns. Meanwhile, Melochia corchoryfolia L. in the control treatment (H_0), the tile planting pattern (H_0P_1) showed an average wet bunch weight of 517 g, while in the jajar legowo planting pattern (H_0P_2) the weight was 0 g. Herbicide H_1 in the tile planting pattern (H_1P_1) increased the weight to 634 g, while in the jajar legowo planting pattern (H_1P_2) the weight reached 588 g. The use of herbicides H_2 and H3 in both planting patterns also showed very effective results with a wet bunch weight of 0 g. The development of cyoperus rotundus in the Control Treatment (H_0) in the tile planting pattern (H_0P_1) showed an average wet bunch weight of 464 g, while in the jajar legowo planting pattern (H_0P_2) the weight was slightly lower at 415.67 g. Herbicide H1 in the tile planting pattern (H_1P_1) showed a decrease in weight to 22 g, and in the jajar legowo planting pattern (H_1P_2) to 1.5 g. The use of herbicides H_2 and H_3 in both planting patterns showed very effective results with a wet bunch weight of 0 g. The use of herbicides significantly reduced the average wet bunch weight in the three dominant weed types compared to the control [7]. The combination of herbicides H_2 (Atrazin 500g/l and Mesotrion 50g/l) and H_3 (Topramezon 10g/l and Atrazine 300g/l) showed the highest effectiveness with a wet-stem weight of 0g in all observations, both in the tile and jajar legowo planting patterns. The planting pattern also had an effect, although not as large as the effect of herbicides. The tile planting pattern tended to show a higher wet-stem weight compared to the jajar legowo planting pattern in several treatments, but this difference was not always consistent, possibly caused by other factors outside the observation variables.

Table 6. Average Wet-Stem Weight of Dominant Weeds (g).

Treatment	Average wet weight of dominant weeds (g)		
	1	2	3
Herbicide			
H_0(control)	1120.2a	439.8a	439.8a
H_1 (Atrazine 180g/l, Mesotrione 40g/l, and Nicosulfuron 20 g/l)	4.4b	12.3b	12.3b
H_2 (Atrazine 500g/l and Mesotrione 50 g/l)	0.2b	1.8b	3.0b
H_3 (Topramezon 10 g/l and Atrazine 300 g/l)	0.3b	3.0b	1.8b
Planting Pattern			
P_1 (tile)	290.77a	158.50a	139.67a
P_2 (jajar legowo)	271.75a	129.25a	132.36a

Description: Values followed by different letters indicate significant differences based on the 5% DMRT test. 1: Ludwigia octovalvis, 2: Melochia corchoryfolia L, 3: Cyperus rotundus

3.3. Dry Weight of Dominant Weeds (g)

Based on the results of the analysis of variance in Table 9 regarding the dry weight of dominant weeds, it can be seen that herbicide treatment has a significant effect on reducing the dry weight of weeds. In the control treatment (H_0), the dry weight of the three types of weeds, namely Ludwigia octovalvis, Melochia corchoryfolia L., and Cyperus rotundus remained high, at 236.53 g, 140.09 g, and 104.91 g, respectively. This shows that without herbicide application, weeds grow optimally and dominate corn fields.

On the other hand, in the treatments H_1 (Atrazin 180g/l, Mesotrion 40g/l, and Nicosulfuron 20g/l), H_2 (Atrazin 500g/l and Mesotrion 50g/l), and H_3 (Topramezon 10g/l and Atrazine 300g/l), there was a very significant decrease in the dry weight of weeds, in several types of weeds. The treatments H_2 and H_3 produced the lowest dry weight, especially in the weeds Melochia corchoryfolia L. and Cyperus rotundus, with values of 0.00 g to 1.73 g. This indicates that these three herbicide combinations are effective in controlling the growth of dominant weeds in corn fields. Meanwhile, the tile planting pattern (P_1) and legowo row (P_2) did not show a significant difference in the dry weight of weeds. Although P_1 tends to have a slightly higher weight than P_2, the three types of weeds are not significantly different. The planting pattern did not have a significant effect on the dry weight of weeds, while the application of herbicides was significantly different in its effectiveness in suppressing the dry weight of dominant weeds.

Table 7. Dry fruit weight of dominant weeds (g)

Treatment	Dry Weight of Dominant Weeds (cm)		
	1	2	3
Herbicide			
H_0(control)	236.53a	140.09a	104.91a
H_1 (Atrazin 180g/l, Mesotrion 40g/l, and Nikosulfuron 20 g/l)	0.86b	0.01 a	1.84 b
H_2 (Atrazin 500g/l and Mesotrion 50 g/l)	0.06b	0.00b	1.73b
H_3 (Topramezon 10 g/l and Atrazin 300 g/l)	0.05b	0.00b	0.68 b
Planting Pattern			
P_1 (tile)	62.14a	39.44a	28.44a
P_2 (jajar legowo)	56.61a	30.61a	26.15a

Description: Values followed by different letters indicate significant differences based on the 5% DMRT test. 1=Ludwigia octovalvis, 2=Melochia corchoryfolia L, 3=Cyperus rotundus.

There is no interaction between herbicides and planting patterns. The combination of herbicides atrazine 500g/l + Mesotrion 40 g/l dose 2 ml/l in the tile planting pattern and Jajar legewo is very effective in suppressing the biomass of Ludwigia octovalvis and melochia cochoryfolia L, and Cyperus rotundus. This is in line with research [8-10].

3.4. Total Weed Biomass (g)

Based on the results of the analysis of variance in Table 8 regarding total weed biomass, herbicide application had a very significant effect on reducing weed biomass compared to the control treatment. In the control treatment (H_0), the total weed biomass reached 508.18 g, which shows that without herbicide application, weeds grew significantly and dominated the land. Treatments with herbicide applications, namely H_1 (Atrazin 180g/l, Mesotrion 40g/l, and Nicosulfuron 20g/l), H_2 (Atrazin 500g/l and Mesotrion 50g/l), and H_3

(Topramezon 10g/l and Atrazin 300g/l), significantly reduced the total weed biomass. Treatment H_3 showed the most drastic decrease with a weed biomass of 3.07 g, the combination of Topramezon and Atrazin herbicides was very effective in suppressing weed growth. Treatments H_1 and H_2 also showed effective results with weed biomass of 6.41 g and 9.47 g respectively, although not as good as H_3. These results indicate that the three combinations of herbicides used have high effectiveness in controlling weed growth.

There was no interaction between herbicides and planting patterns. The jajar legowo planting pattern (P2) tended to have slightly higher weed biomass (144.44 g) compared to the tegel planting pattern (P_1) which was 119.12 g, the planting pattern did not directly affect the amount of weed biomass, while the application of herbicides had a deep influence in suppressing weed growth.

Table 8. Total Weed Biomass (g)

Treatment	Total weed biomass weight
Herbicide	
H_0(control)	508.18a
H_1 (Atrazin 180g/l, Mesotrion 40g/l, and Nikosulfuron 20 g/l)	6.41b
H_2 (Atrazin 500g/l and Mesotrion 50 g/l)	9.47b
H_3 (Topramezon 10 g/l and Atrazin 300 g/l)	3.07b
Planting Pattern	
P_1 (tegel)	119.12a
P_2 (jajar legowo)	144.44a

Description: Values followed by different letters indicate significant differences based on the 5% DMRT test.

The results of this study are in line with Lolitasari and Hasjim [11] who showed that the use of herbicides with active ingredients atrazine, mesotrione, and paraquat can effectively reduce the biomass of grass and broadleaf grass. Atrazine herbicide with a dose of 750-1,500 g/ha can reduce the dry weight of weeds as a whole (total), including broadleaf weeds and grasses. Herbicide ability. Atrazine herbicide 500 g/l at a dose of 750 - 1,500 g/ha is effective in controlling the growth of total weeds, broadleaf weeds, grass, dominant weeds Digitaria ciliaris and Richardia brasiliensis. at a dose of 500–1,500 g/ha effectively controls the dominant weeds Eleusine indica, Cleome rutidosperma, and Commelina benghalensis [10].

3.5. Toxicity of Dominant Weeds

Based on the results of observations on toxicity in three types of dominant weeds, namely Ludwiga octovalvis, Melochia corchoryfolia L, and Cyperus rotundus, it was found that the treatment of all herbicide combinations showed very good results in controlling the three dominant weeds as shown in the following table:

Table 9. Weed toxicity scores

Treatment	Toxicity		
	Ludwigia octovalvis	Melochia corchoryfolia L	Cyperus rotundus
Herbicide/ Planting pattern			
H_0P_1 (control/l/Tegel)	0	0	0
H_0P_2 (control/ Jajar Legowo)	0	0	0
H_1P_1 (Atrazin 180g/l, Mesotrion 40g/l, and Nicosulfuron 20 g/l/Tegel)	4	4	4
H_1P_2 (Atrazin 180g/l, Mesotrion 40g/l, and Nicosulfuron 20 g/l/ Jajar Legowo)	4	4	4
H_2P_1 (Atrazin 500g/l and Mesotrion 50 g/l / Tegel)	4	4	4
H_2P_2 (Atrazin 500g/l and Mesotrion 50 g/l / Jajar Legowo)	4	4	4
H_3P_1 (Topramezon 10 g/l and Atrazine 300 g/l / Tegel)	4	4	4
H_3P_2 (Topramezon 10 g/l and Atrazine 300 g/l / Legowo Row)	4	4	4

Description: 1 (Ludwigia octovalvis), 2 (Melochia corchoryfolia L), 3 (Cyperus rotundus). Score: very good (4), good (3), moderate (2), sufficient (1) and no effect (0).

Weeds began to react to herbicides starting on the 6th day, but after spraying the herbicide, weed growth stopped and would be visible after seven days and peaked on the 14th day after application. Similar things were also stated by The highest symptoms of poisoning were seen in observations 2 weeks after application because the herbicide had reacted 1 week after application, especially in the application of herbicides containing the active ingredient mesotrione [3].

Application of herbicides Atrazine 500g/l and Mesotrione 50 g/l, Atrazine 180g/l, Mesotrione 40g/l and Topramezone 10 g/l and Atrazine 300 g/l did not poison the main plant but were very effective in controlling weeds. Application of atrazine herbicide 500 g/l at a dose of 500 – 1,500 g/ha does not cause poisoning and inhibits growth, and corn production results are equivalent to manual weeding [10]. This is in line with the results of research that has been conducted where the dose of atrazine 500 g/l does not cause symptoms of poisoning in corn.

3.6. Plant Height (cm)

Based on the results of the analysis of variance in Table 10 regarding the height of corn plants at 30, 40, and 50 days after planting (DAP), it can be seen that herbicide treatment has a significant effect on the growth of corn plant height. H0 shows that plant height at each observation stage is lower than with herbicide treatment. At 30 DAP, corn plants without treatment only reached 30,183 cm, while herbicide treatments H_1, H_2, and H_3 showed a significant increase, with the highest value at H_3 of 42,333 cm. Herbicide application helps reduce weed competition with corn plants so that plants can grow more optimally. At 40 DAP, the difference in corn plant height between herbicide treatment and control remained significant. Plants in the control treatment only reached 78,633 cm, while treatments

H_1, H_2, and H_3 each produced plant heights above 99 cm, H_3 showed the highest results of 110,383 cm. The combination of Topramezon and Atrazine is more effective in supporting plant growth than other herbicide combinations.

At 50 HST, H_0 produced a plant height of only 143.87 cm, while plants in the herbicide treatment experienced a significant increase. Although not all herbicide treatments were significantly different from each other at this stage, the H_3 treatment still showed the highest value of 198.87 cm.

Meanwhile, the tile planting pattern (P_1) and legowo row (P_2) did not show a significant difference in terms of corn plant height in the three observations where at 30 HST, plant heights in P_1 and P_2 were relatively balanced, with 38,050 cm and 37,292 cm respectively. Likewise, at 40 HST and 50 HST, the difference in plant height between the two planting patterns was not significantly different. Although P_1 had a slight advantage in height at 50 HST, namely 183.85 cm compared to P_2 which was only 173.66 cm.

Table 10. Corn Plant Height

Treatment	Plant Height (cm)		
	30 HST	40 HST	50 HST
Herbicide			
H_0(control)	30.183b	78.633b	143.87b
H_1 (Atrazine 180g/l, Mesotrion 40g/l, and Nicosulfuron 20g/l)	38.300a	99.050a	178.31ab
H_2 (Atrazine 500g/l and Mesotrion 50g/l)	39.867a	104.350a	187.31ab
H_3 (Topramezon 10g/l and Atrazine 300g/l)	42.333a	110.383a	198.87 a
Planting Pattern			
P_1 (tile)	38.050a	99.600a	183.85 a
P_2 (jajar legowo)	37.292a	96.608a	173.66 a

Note: Values followed by different letters indicate significant differences based on the 5% DMRT test.

3.7. Area of Corn Plant Leaves (cm^2)

The observation results showed significant variations in the leaf area of corn plants depending on the herbicide treatment and planting pattern. In the control, the leaf area was smaller compared to the treatment using herbicides. This shows that the use of herbicides contributes positively to better leaf growth. The control treatment with the jajar legowo planting pattern (H_0P_2) showed a fairly large leaf area of 300.00 cm2 compared to the control with the tegel planting pattern (H_0P_1) which only had a leaf area of 193.75 cm2, these results indicate that the Jajar Legowo planting pattern is more effective in supporting the growth of the leaf area of corn plants. The use of a combination of Atrazine 180g/l, Mesotrion 40g/l, and Nicosulfuron 20 g/l (H_1) in the tile and jajar legowo planting patterns also gave good results even though the tile planting pattern (P_1) had a larger leaf area than Jajar Legowo (P_2) where the leaf area with the tile pattern was 457.75 cm2 and the jajar legowo pattern was 321.42 cm2, the growth of leaf area in the combination of Atrazine 180g/l, Mesotrion 40g/l, and Nicosulfuron 20 g/l with the jajar legowo planting pattern (H_1P_2) compared to the control treatment (H_0) showed that this herbicide combination was effective in both planting patterns. Increasing the dose of Atrazine 500g/l and Mesotrion 50 g/l (H_2) in the tile planting pattern and the legowo row planting pattern resulted in a larger leaf area, with the combination of Atrazine 500g/l and Mesotrion 50 g/l with the tile planting pattern (H_2P_1) achieving the largest leaf area among all treatments, which was 561.58 cm2. This shows that higher doses of atrazine and mesotrion without Nicosulfuron contributed positively to increasing leaf area. Treatment with Topramezone 10 g/l and Atrazine 300 g/l (H_3P_1 and H_3P_2) with leaf areas of 437.58 cm2 and 474.48 cm2, respectively. More details can be seen in table 4 below:

Table 11. Leaf area of corn plants

Treatment	Leaf Area (cm^2)
	50 HST
Herbicides/ Planting patterns	
H_0P_1 (control/l/tile)	193.75e
H_0P_2 (control/ Legowo Row)	300.00d
H_1P_1 (Atrazin 180g/l, Mesotrion 40g/l, and Nicosulfuron 20 g/l/tile)	457.75c
H_1P_2 (Atrazin 180g/l, Mesotrion 40g/l, and Nicosulfuron 20 g/l/ Legowo Row)	321.42d
H_2P_1 (Atrazin 500g/l and Mesotrion 50 g/l / Tile)	561.58a
H_2P_2 (Atrazin 500g/l and Mesotrion 50 g/l / Legowo Row)	502.48a
H_3P_1 (Topramezon 10 g/l and Atrazine 300 g/l / Tile)	437.58c
H_3P_2 (Topramezon 10 g/l and Atrazine 300 g/l / Legowo Row)	474.48bc

Note: Values followed by different letters indicate significant differences based on the 5% DMRT test.

3.8. Stem Diameter (cm)

The results of the analysis of variance showed that the diameter of corn stalks showed significant differences between herbicide treatments and planting patterns at various time stages (30 HST, 40 HST, and 50 HST). At 30 HST, the herbicide treatment H_3 (Topramezon 10 g/l and Atrazine 300 g/l) produced the largest stem diameter of 8.4167 cm, followed by H_2 (Atrazin 500g/l and Mesotrion 50 g/l) of 8.1000 cm, and H_1 (Atrazin 180g/l, Mesotrion 40g/l, and Nicosulfuron 20 g/l) of 7.9667 cm. The control treatment (H_0) showed the smallest stem diameter of 6.6667 cm. At 40 DAP and 50 DAP, the same pattern continued with H_3 still showing the largest stem diameter of 15.0500 cm at 40 DAP and 15.5183 cm at 50 DAP, while the control remained the smallest. Observations on the planting pattern showed that the tile planting pattern (P_1) had a larger stem diameter than the jajar legowo planting pattern (P_2) at all time stages. At 30 DAP, the stem diameter in the tile pattern was 8.025 cm, while in the jajar legowo, it was 7.550 cm. The tile planting pattern continued to be superior at 40 DAP (14.3917 cm) and 50 DAP (14.9167 cm) compared to the jajar legowo planting pattern which showed 13.500 cm and 13.936 cm respectively. Observations of herbicide combinations and planting patterns showed consistent results where H_3P_1 (Topramezon 10 g/l and Atrazine 300 g/l with a tile planting pattern) gave the best results with a stem diameter of 8,533 cm at 30 HST, 15,300 cm at 40 HST, and 15,760 cm at 50 HST. In contrast, the control in the tile planting pattern (H_0P_1) showed the smallest diameter of 6,566 cm at 30 HST, 11,600 cm at 40 HST, and 12,247 cm at 50 HST. In the jajar legowo planting pattern, H_3P_2 (Topramezon 10 g/l and Atrazine 300 g/l) also gave good results although slightly lower than the tile planting pattern.

Table 12. Stem diameter (cm)

Treatment	Stem diameter (cm)		
	30 HST	40 HST	50 HST
Herbicide			
H_0(control)	6.667b	11.83b	12.36b
H_1 (Atrazine 180g/l, Mesotrion 40g/l, and Nicosulfuron 20g/l)	7.967a	14.26a	14.72a
H_2 (Atrazine 500g/l and Mesotrion 50g/l)	8.100a	14.63a	15.10a
H_3 (Topramezon 10g/l and Atrazine 300g/l)	8.416a	15.05a	15.51a
Planting Pattern			
P_1 (tile)	8.02a	14.39a	14.91a
P_2 (jajar legowo)	7.55a	13.50a	13.93a

Description: Values followed by different letters indicate significant differences based on the 5% DMRT test.

3.9. Weight of Corn Cobs Without Husks (G)

From the results of the analysis of the variance of herbicides and planting patterns, it gave better results. The combination of H_3P_1 (Topramezon 10 g/l and Atrazine 300 g/l with a tile planting pattern) showed the best results with a corn cob weight reaching 160.75 g. In contrast, the control in the tile planting pattern (H_0P_1) had the lowest corn cob weight of 25.50 g. In the jajar legowo planting pattern, the combination of H_2P_2 (Atrazin 500g/l and Mesotrion 50 g/l) produced a corn cob weight of 115.00 grams, higher than other herbicide combinations with the same planting pattern.

Table 13. Weight of corn cobs without husks (g)

Treatment	Weight of corn without husk (g)
Herbicides/ Cropping patterns	
H_0P_1 (control/l/Tegel)	25.50c
H_0P_2 (control/ Jajar Legowo)	40.75bc
H_1P_1 (Atrazin 180g/l, Mesotrione 40g/l, and Nicosulfuron 20 g/l/Tegel)	116.25abc
H_1P_2 (Atrazin 180g/l, Mesotrione 40g/l, and Nicosulfuron 20 g/l/ Jajar Legowo)	60.50bc
H_2P_1 (Atrazin 500g/l and Mesotrione 50 g/l / Tegel)	129.00ab
H_2P_2 (Atrazin 500g/l and Mesotrione 50 g/l / Jajar Legowo)	115.00abc
H_3P_1 (Topramezon 10 g/l and Atrazine 300 g/l / Tegel)	160.75a
H_3P_2 (Topramezon 10 g/l and Atrazine 300 g/l / Jajar (Let's go)	78.50bac

Description: Values followed by different letters indicate significant differences based on the 5% DMRT test.

Weed management did not significantly affect plant height, but significantly affected cob production per plot [12]. The use of Atrazine herbicide 180g/l, and Mesotrion 40g/l resulted in higher cob production compared to no weed control. Plant height and cob length in corn plants were higher on land applied with Atrazine Herbicide 500 g/l, which was not significantly different from manual weeding. Likewise with the size of the cob diameter [10]. the closer the planting distance, the lower the height of the corn plant will be, conversely the less frequent the planting distance, the better the growth of the corn plant [13].

3.10. Length of Corn Cob Without Husk (Cm)

Based on the results of the analysis of variance on the length of the cob without husk (cm) in corn plants, there were significant differences influenced by herbicide treatment and planting patterns and there was an interaction between the two factors. Herbicide treatment showed a significant effect on the length of the corn cob without husk. Herbicide H_0 (control) produced the shortest cob length, which was 10.58 cm. Herbicide H_1 (Atrazin 180g/l, Mesotrion 40g/l, and Nicosulfuron 20 g/l) produced a cob length of 12.33 cm, which was significantly different from H_0 but significantly different from H_2 and H_3 where H_2 (Atrazin 500g/l and Mesotrion 50 g/l) and H_3 (Topramezon 10 g/l and Atrazine 300 g/l) produced the same cob length, which was 14.67 cm, which was the highest result and did not differ significantly from each other. There is an interaction between herbicide treatment and planting patterns that shows a more complex variation in cob length. H_2P_1 (Atrazin 500 g/l and Mesotrion 50 g/l / Tegel) produces the highest cob length of 14,750 cm, which is not significantly different from H_2P_2, H_3P_1, and H_3P_2. The combination of H_0P_2 (control / Jajar Legowo) and H_1P_2 (Atrazin 180g/l, Mesotrion 40g/l, and Nikosulfuron 20 g/l / Jajar Legowo) produces the shortest cob length of 9,250 cm, which is significantly different from other combinations. H_2 and H_3 give better results in terms of cob length without husk compared to H_0 and H_1. The Tegel planting pattern overall supports the growth of longer corn cobs compared to the jajar legowo planting pattern.

Table 14. Cob Length Without Husk (cm)

Treatment	Length of corn cob without husk (cm)
Herbicides/ Planting patterns	
H_0P_1 (control/l/tile)	11.25ab
H_0P_2 (control/ Legowo Row)	9.25b
H_1P_1 (Atrazin 180g/l, Mesotrion 40g/l, and Nicosulfuron 20 g/l/tile)	13.87ab
H_1P_2 (Atrazin 180g/l, Mesotrion 40g/l, and Nicosulfuron 20 g/l/ Legowo Row)	9.25b
H_2P_1 (Atrazin 500g/l and Mesotrion 50 g/l / Tile)	14.75a
H_2P_2 (Atrazin 500g/l and Mesotrion 50 g/l / Legowo Row)	14.50a

H_3P_1 (Topramezon 10 g/l and Atrazine 300 g/l / Tile)	16.00a
H_3P_2 (Topramezon 10 g/l and Atrazine 300 g/l / Legowo)	12.00ab

Note: Values followed by different letters indicate significant differences based on the 5% DMRT test.

4. Conclusion

The use of herbicides in the Tegel and jajar legowo planting patterns did not cause poisoning in corn plants. This shows that the herbicides used are safe and do not harm the health of corn plants. The combination of herbicides (Topramezon 10 g / l and Atrazine 300 g / l / Tegel) is most suitable for corn plants. There is an interaction between herbicides and planting patterns on the parameters of the weight of the cob without husks and the length of the cob without husks which show significant differences.

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