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Effectiveness of Bioherbicide of Reed Extract (*Imperata cylindrica)* on Weed Control on Corn Plants *(Zea mays L)* Pelangi Cultivar

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Abstract. Corn is one of the strategic food crops in Indonesia. Various factors, including disruption of plant pests, such as weeds can influence the decline in corn production. The presence of weeds on cultivated land can reduce the production of 20-80% of cultivated plants. The presence of weeds can also be a host for pests and diseases. The rampant use of chemical herbicides is a concern in the agricultural sector, with the negative impacts caused by the use of chemical herbicides, then various efforts have emerged to reduce the use of chemical herbicides and switch to bioherbicides or environmentally friendly organic herbicides. The purpose of the study was to determine the ability of cogongrass extract bioherbicides in controlling weeds in corn plants, the most effective concentration for controlling weeds in corn plants, phytotoxicity in corn plants. The experimental method used a Randomized Block Design (RAK), there were 8 treatments repeated 4 times, so that 32 experimental plot units were obtained, namely A1 (Control), A2 (20%), A3 (25%), A4 (30%), A5 (35%), A6 (40%), A7 (45%), A8 (50%). The results showed that cogongrass extract bioherbicides did not have a significant effect on all vegetative observations of corn plants and weed populations, weed biomass, weed competitiveness values and did not cause phytotoxicity in corn plants. Bioherbicides had a significant effect on the results of dry corn kernels. The concentration of 50% cogongrass extract bioherbicide produced 3.72 kg of dry corn kernels or the equivalent of 9.3 tons/ha

Keywords: *Reed, Bioherbicide, Corn*

INTRODUCTION

Corn plants are widely cultivated in Indonesia, often used as an alternative the main food ingredient to replace rice, besides that it is also used as a mixture in making animal feed livestock and other industries. Harvest area of dry corn kernels in Indonesia in 2020 reached 12,928,941 tons and continued to increase in the following two years, namely in 2010. 2021 as much as 13,414,922 tons then in 2022 as much as 16,527,273 tons, however in 2023 with an area of 2,487,101 hectares only 14,774,433 tons from all provinces In Indonesia, the figure has decreased from the previous year (BPS, 2024). Weeds can causing a 20-80% decrease in yield (Efendy *et* al., 2020). Weeds that grow on cultivated land will be detrimental to farmers because it will compete with cultivated plants in absorption of nutrients, sunlight, water, pest nests and pathogens, so it will affect plant productivity. Identification of weed types can be done by observing the morphological conditions, habitat, and growth forms. The existence of Weeds in cultivated areas require farmers to control their populations. so that its existence is not detrimental. Weeds can be controlled by: Mechanical, Biological, Chemical. Weed control must be selective so that cultivated plants remain maintained. Based on Palandi, (2022) several types of weeds in cultivated land areas corn including: *Leersia hexandra S, Amaranthus spinosus L, Eleusine indica Gaerth, Euphorbia hirta L, Panicum maximus, Solanum nigrum L, Cyperus rotundus, Imperata cylindrica.*

Bioherbicides have many benefits in controlling weeds naturally, environmentally friendly and safe, but there are some weaknesses that make The use of bioherbicides is less appropriate than chemical herbicides, especially on a large scale. wide (Faridati, 2021). Cogongrass contains flavonoid compounds, one of which is the group flavonols such as hyperoside, isoquer citrin, koersehin, koersitrin, and rotin. Cogongrass also contains tannins of the castalaqin and vescalgia groups (Rinah *et* al., 2021), (Khaerunnisa *et* et al., 2020). The content of flavonoid compounds found in reeds can be used as an alternative to bioherbicides. The way these compounds work is by damaging the parts chloroplasts, mitochondria, peroxisomes, and other photosynthetic and respiratory metabolites, The compound works by increasing the production of specific reactive oxygen specific. (ROS) (Sharma *et* al., 2012). ROS formation occurs from electron transfer leakage. chloroplasts, mitochondria, plasma membranes so that when ROS production increases it will causes damage to lipids, proteins and DNA. This reaction can change the properties intrinsic membranes such as fluidity, ion transfer, loss of enzyme activity, cross-linking proteins, protein synthesis inhibitors, and DNA damage. This results in cell death (Ma *et* al., 2017). Reed extract bioherbicide absorbed by seeds through the seed coat is able to damage the structure of the seed tissue which is absorbed by the scutellum then enters the endosperm causing inhibition of the starch hydrolysis process, protein, oil as a seed food source.

Allelopathy is a chemical compound in plants that can be released into the environment. the growing environment so that it has an influence on the surrounding plants. This statement is supported by research (Deden *et* al., 2020) that cogongrass *(Imperata cylindrica)* contains polyphenol compounds such as flavonoids and tannins which can inhibit the germination of several types of weeds, in his research get the best recommendation result of 300g/liter in weed control. Weeds can affect the growth and yield of corn plants, the presence of weeds in the area Cultivated land can cause competition for nutrients and growing space so that can be detrimental both economically and ecologically to the main crops (Mamarimbing *et* al., 2022). The critical period for weeds in corn plants is at age 21 DAT-28 DAT (Wilter Januardi *et al.*, 2017)

The allelopathic compounds found in cogongrass are flavonoids, tannins, saponins, terpenoids, alkaloids, phenols, and glycosides (Edi Kamal & Yusti, 2022). Faridati, (2021) cogongrass extract can inhibit germination and growth of bandotan concentration of 5% (50g/l water). Meanwhile, the most influential concentration is at concentration 20% (200g/l water).

METODE

The research was conducted in Kalisapu Village, Gunung Jati District, West Java Regency. Cirebon at an altitude of 15 meters above sea level (ASL), starting in March until July 2024. The study used a Randomized Block Design (RBD), with 8 The treatment was repeated 4 times, so that 32 experimental plot units were obtained as follows; A1: Control, A2: 20%, A3: 25%, A4: 30%, A5: 35%,A6: 40%, A7: 45%, A8: 50%.The ones used are: cogongrass, rainbow cultivar corn kernels, fertilizer and insecticide. While the tools used are: Office Stationery, envelopes, scales, oven, label paper, camera, leaf color chart, electric sprayer. Steps. The steps for implementing the research experiment are as follows: Making cogongrass extract carried out according to Faridati (2021) Reed is obtained from open land, taken with the method of hoeing to the roots. The cogongrass used is young cogongrass with good morphology, indicated by the absence of flowers. The cogongrass is washed clean, then dried under the sun at an average temperature of 24ºc-30ºc for 3 days (depending on weather conditions). Next, the reeds are cut into pieces into small pieces of approximately 2-3 cm, then blended dry until it becomes powder, then reed powder is soaked for 24 hours using 96% ethanol, 100g of cogongrass powder in 1 liter of ethanol, after which it is filtered to separate the pure solution from the dregs of cogongrass powder.

Application of cogongrass extract bioherbicide was carried out only once. three days after planting by spraying using *a sprayer.* Application of bioherbicides cogongrass according to the treatment is carried out with the following concentration: A1 (Bioherbisida 0 ml:800 ml air), A2 (Bioherbisida 160 ml:640 ml air), A3 (Bioherbisida 200 ml:600 ml water), A4 (Bioherbicide 240 ml:560 ml water), A5 (Bioherbicide 280 ml:520 ml water), A6 (Bioherbicide 320 ml:480 ml water), A7 (Bioherbicide 360 ml:440 ml water), A8 (Bioherbicide 400 ml:400 ml water).

Observations of weed populations are carried out before land cultivation to determine types of weeds in the experimental land area, the implementation method is carried out by means of Visual estimation of the data obtained is represented by the percentage of weed population. Land area The experiment was divided into four parts using a rope measuring 4.7 m x 9.5 m. Each section is visually identified to determine the initial weed population before implementation of research experiments. Planting is carried out 3 days before application (DBA), by making holes with a plant distance of 40cm x 40cm. Each planting hole 2 seeds were inserted. Fertilization was carried out twice according to the recommended dosage, The first fertilization was given with all SP-36 fertilizer, ½ part KCl fertilizer, and ½ part Urea fertilizer is given when the plants are 7 days old by spreading it to a depth of 100 cm. 3-5 cm distance from the plant 5 cm, additional fertilizer is given when the plant is old 21 DAT with a dose of ½ part urea and ½ part KCl given in the same way. The fertilizers to be given are as follows: Urea 120 g/plot (4.8 g/plant), KCl 60 g/plot (2.4 g/plant), SP-36 60 g/plot (2.4 g/plant). OPT control carried out by applying insecticides and fungicides depending on the conditions in the land area experiment. Sampling of weed observations using quadrants with sizes 30cm x 30cm, sorted by species, then oven-dried at 60ºC for 48 hours and the dry weight of the weeds was weighed. Data collection on weed biomass and population weed control was carried out at 7 days after application (DAA), 14 DAA, 21 DAA, in the sample plot. The data is used to determine the dominant weeds based on the *Summed* value. *Dominance Ratio* (SDR).

RESULTS AND DISCUSSION

Weed Population Before Application (%)

Based on the table below, there are various weed species in the land area experiment. Weed species found in the experimental land before land cultivation can seen in the table 1. Based on weed observations before application on the experimental land, the table above shows the most dominant *Cyperus rotundus* weed population in the experimental land area, The population reached 31.25%. Many other types of weeds are also found in the land experiments on a population range of 1.25-6.25%, including *Amaranthus spinosus, Phyllanthus urinaria, Mimosa pudica, Kyllinya brevifolia, Acalypha indica, Eleusine indica, Elephantopus scaber, Tridax procumbens, Passiflora foetida, Dhysalis angulata, Imperata cylindrica, Sieruela rutidosperma, Dioscorea hispida, Oldenlandia, Eclipta prostrata* and *Cymbopogon citrus*. Based on the results of observations of weed populations before application of bioherbicides in experimental fields, it can be concluded that there are many types of weed population as one of the indicators of fertile land category, in line with Salam (2020) that weed density in a land area can indicate the availability of nutrients. abundant nutrients.

Table 1. Weed Population Before Land Cultivation (%)

No	Spesies	Average (%)
1	*Cyperus rotundus*	31,25
2	*Amaranthus spinosus*	6,25
3	*Phyllanthus urinaria*	5,00
4	*Mimosa pudica*	3,75
5	*Kyllinya brevifolia*	5,00
6	*Acalypha indica*	2,50
7	*Eleusine indica*	5,00
8	*Elephantopus scaber*	5,00
9	*Tridax procumbens*	2,50
10	*Passiflora foetida*	5,00
11	*Dhysalis angulate*	2,50
12	*Imperata cylindrical*	6,25
13	*Sieruela rutidosperma*	5,00
14	*Dioscorea hispida*	2,50
15	*Oldenlandia*	5,00
16	*Eclipta prostrata*	5,00
17	*Cymbopogon citrus*	1,25

Weed Population Before Application (%)

Weed population after application per plot was observed at the ages of 7, 14 and 21 DAA. showed no significant difference in results. Observation data on weed populations after application can be seen in the table below.

Table 2. Average Weed Population After Application (%)

No	Spesies	Average Weed Population (%)		
		7 DAA	14 DAA	21 DAA
1	*Cyperus rotundus*	30,0a	38,0a	47,0a
2	*Sieruela rutidospermae*	16,0a	19,0a	17,0a
3	*Poa annua*	9,0a	11,0a	6,0a
4	*Ipomea aquatica*	11,0a	7,0a	5,0a
5	*Amaranthus viridis*	14,0a	5,0a	4,0a
6	*Chorozophora tinctoria*	7,0a	4,0a	5,0a
7	*Tridax procumbens*	13,0a	16,0a	4,0a
8	*Ageratum conyzoides*	0	0	8,0a
9	*Physalis angulata*	0	0	4,0a

Description: Not significantly different at the 5% F test level

Observations at the age of 7 and 14 DAA there are the same weed species. Bioherbicide extract of cogongrass did not provide any significant difference in *Cyperus rotundus* because it increased with each observation. Observation 7 DAA and 14 DAA increased in the species

Sieruela rutidospermae, Poa annua and *Tridax procumbens.* Unlike the weed species *Ipomea aquatica* and *Amaranthus viridis* experiencing a population decline at every observation that is suspected of being unable to compete with other species. The emergence of new weed species at the age of 21 DAA Among others, *Ageratum conyzoides* and *Physalis angulate* increase the weed population. This is because weed seeds can experience dormancy. According to Umiyati & Widayat (2017) The increase in weed species is caused by various factors, including seeds. abundant, weeds are able to reproduce vegetatively and have the properties extensive dormancy. In addition, the emergence of new weed species within a certain period of time because weeds have high competitive power. The diversity of weed populations can influenced by various factors in the experimental area, including soil cultivation, light, air, nutrients, plant cultivation methods, and planting distance or plant density cultivation (Imaniasita *et* al., 2020). The highest average value is different from other species allows for the dominance of certain weed species in the experimental land area very invasive so that it is able to control the habitat it occupies (Setiarno *et* al., 2020).

Average *Summed Dominance Ratio* (SDR) (%)

SDR value calculations are carried out to determine the competitiveness of weeds in an area. experimental land. Weed species with SDR values of more than 50% are grouped into dominant weed species (Mawandha *et* al., 2019). The SDR values are as follows.

Table 3. Average SDR Value (%)

Nama Spesies	Average Value of SDR (%)		
	7 DAA	14 DAA	21 DAA
Cyperus rotundus	20,16a	22,41a	24,64a
Sieruela rutidospermae	15,12a	15,61a	13,29a
Poa annua	12,41a	13,06a	7,46a
Ipomea aquatic	14,45a	11,96a	9,04a
Amaranthus viridis	13,79a	12,33a	9,72a
Chorozophora tinctoria	9,59a	10,26a	9,38a
Tridax procumbens	14,49a	14,38a	7,38a
Ageratum conyzoides	0	0	10,12a
Physalis angulate	0	0	8,96a

The *Cyperus rotundus* species has the highest SDR value for each observation, the value SDR *Cyperus rotundus* each observation shows high weed competitiveness. Meanwhile, the weed species *Tridax procumbens, Ipomea aquatica, Amaranthus viridis,* experienced a decrease in competitiveness in each observation. Different from weed species *Chorozophora tinctoria, Sieruela rutidospermae* experienced increased competitiveness in age 14 DAA but experienced a decrease again at age 21 DAA. There are species new weeds in the third observation, namely *Ageratum conyzoides, Physalis angulate.* In general In general, the SDR value indicates the competitiveness of weeds which is determined by density, frequency and dominance (Yuliana & Ami, 2020).Weed Biomass (g)

Results of the analysis of observation data on weed biomass observed at ages 7, 14, and 17. 21 DAA showed no significant difference in results. Observation data on weed biomass can seen in the table below.

Table 4. Average Weed Biomass Per Plot at Ages 7, 14, and 21 DAA (g)

Treatment	Average Weed Biomass (g)		
	7 DAA	14 DAA	21 DAA
A1 (Kontrol)	7,18a	13,88a	26,13a
A2 (20%)	3,80a	10,23a	21,98a
A3 (25%)	5,10a	8,78a	31,48a
A4 (30%)	8,28a	4,93a	23,03a
A5 (35%)	6,03a	5,55a	24,03a
A6 (40%)	6,98a	12,63a	27,93a
A7 (45%)	5,48a	9,68a	23,45a
A8 (50%)	3,25a	6,95a	22,03a

Keterangan: Not significantly different at the 5% F test level

Based on the table above, all treatment concentrations at all ages observations did not show any significant effect on weed biomass parameters. This is thought to be because the bioherbicide extract of Reed is unable to suppress weed growth, because weeds have a defense system against toxic compounds and certain environmental changes. Kurniati, (2018) stated that the phenomenon common phenomenon shown by plants as a response mechanism to plant symptoms environment. Efendy *et* al., (2020) added that the rate of weed growth can be observed in collecting weed biomass data, the higher the biomass data, the higher the also the rate of weed growth, so that cultivated plants will compete and will affect crop yields.

Plant Height (cm)

Results of analysis of plant height observation data at ages 7, 14 and 21 DAT showed no significant difference due to the treatment of cogongrass extract bioherbicide. Data Plant height observations can be seen in the table below.

Table 5. Average Observation of Corn Plant Height at Ages 7, 14 and 21 DAT (cm)

Treatment	Average Plant Height (cm)		
	7 DAT	14 DAT	21 DAT
A1 (Kontrol)	20,47a	49,66a	90,30a
A2 (20%)	21,54a	49,77a	93,35a
A3 (25%	22,69a	53,30a	97,85a
A4 (30%)	20,12a	46,26a	86,63a
A5 (35%)	19,60a	45,46a	90,30a
A6 (40%)	21,68a	49,98a	94,60a
A7 (45%)	20,32a	51,78a	92,95a
A8 (50%)	20,67a	50,58a	95,95a

Description: Not significantly different at the 5% F test level

Based on the data above, at all observation ages (7, 14 and 21 DAT) shows that all concentrations of the bioherbicide treatment of cogongrass extract do not gives a significant influence on plant height parameters. Height uniformity plants are suspected because plant height is influenced by plant genetics, plant heightis also affected by planting distances that are too close so that the plants shade each other, the struggle for nutrients and growing space results in the plant's photosynthesis process less than optimal. The availability of nutrients, light and growing space affects plant growth process, so that plants will undergo cell division process with normal (Asmarajaya & Hadid, 2023). Kantikowanti *et* al., (2022) the planting distance that too tight will cause the growth and development process of the plant to be hampered inhibited because plants shade each other, compete for nutrients, lack of light sun.

Number of Leaves (Strands)

Results of data analysis of observations of the number of leaves observed at ages 7, 14, and 21 DAA showed no significant difference. Data on the number of leaves can be seen in The table 6.

The results of observations on the number of leaves did not show any significantly different results due to administration of cogongrass extract bioherbicide, which means the number of corn plant leaves relatively the same at the age of 7, 14, 21 DAA as well as plant height, number of leaves does not have any effect due to the administration of cogongrass extract bioherbicides other than that The number of leaves is more influenced by plant genetic factors. Asmarajaya & Hadid, (2023) explains that the number of plant leaves is influenced by the genetic factors of the plant because Each seed produced by a plant has a different genetic structure.

Table 6. Average observation of the number of leaves of corn plants age 7, 14, dan 21 DAT (Strands)

Treatment	Average Number of Leaves (Strands)		
	7 DAT	14 DAT	21 DAT
A1 (Kontrol)	3,25a	6,00a	7,05a
A2 (20%)	3,20a	6,65a	7,35a
A3 (25%	3,35a	6,50a	7,15a
A4 (30%)	3,00a	5,60a	6,90a
A5 (35%)	3,30a	6,25a	7,30a
A6 (40%)	3,30a	6,25a	7,50a
A7 (45%)	3,40a	6,10a	6,30a
A8 (50%)	3,50a	6,35a	7,35a

Description: Not significantly different at the 5% F test level

Stem Diameter (mm)

The diameter of the corn plant stem was observed at the age of 7, 14 and 21 DAA showing the results not significantly different. Observation data on the diameter of corn plant stems can be seen in The table below.

Table 7. Average Observation of Corn Plant Stem Diameter at Ages 7, 14, dan 21 DAT (mm)

Treatment	Average Stem Diameter (mm)		
	7 DAT	14 DAT	21 DAT
A1 (Kontrol)	3,76a	7,74a	15,11a
A2 (20%)	4,17a	8,33a	16,37a
A3 (25%	4,19a	8,41a	16,78a
A4 (30%)	3,94a	7,88a	15,66a
A5 (35%)	4,25a	8,51a	16,05a
A6 (40%)	4,77a	9,53a	16,86a
A7 (45%)	4,47a	9,60a	16,20a
A8 (50%)	4,44a	8,87a	15,76a

Description: Not significantly different at the 5% F test level

The table above shows that administering the bioherbicide Reed extract did not affects the diameter of corn plant stems, uniformity of diameter size corn plant stems are thought to be due to the plant being able to adapt after being given bioherbicide extract of cogongrass. According to the research results of Firmansyah *et* al., (2018) Corn plants have strong enough resistance so they do not show any reaction due to the administration of allelochemical compounds from cogongrass leaf extract.

Dry Shelled Corn Yield Per Plot (Kg)

The results of the observation data on the weight of corn kernels per plot gave significantly different results. analysis of variance at 5% level so that it was further tested using the Scoot Knott cluster formula. Observation data can be seen in the table below.

Table 8. Dry Corn Shelling Yield Per Plot (kg)

Treatment	Average (kg)
A1 (Kontrol)	3,15 b
A2 (20%)	3,00 a
A3 (25%)	3,19 b
A4 (30%)	3,36 c
A5 (35%)	3,41 c
A6 (40%)	3,48 c
A7 (45%)	3,22 b
A8 (50%)	3,72 c

Description: No significant difference in the 5% Scoot Knott cluster test

The data in Table 8 shows that there is a significant difference in the shelling results. dry corn per plot due to the treatment of cogongrass extract bioherbicide. Treatment bioherbicide concentrations A4 (30%), A5 (35%), A6 (40%) and A8 (50%) showed good results which is different compared to other treatments. The highest weight result of dry corn kernels obtained from the A8 treatment (50%), with a yield of 3.72 kg or equivalent to 9.3 tons/ha. The results different corn kernels due to the reduction of weed species in the experimental field area so that plants are able to compete with weeds, reducing weed species in The experimental land area has an effect on cultivated plants in absorbing elements nutrients, photosynthesis, growing space so that plants can grow optimally. According to with the statement of Pujiwati, (2011) that the use of cogongrass extract can suppress germination of weed seeds *Amaranthus spinosus, Tridax procumbens, Mimosa pudica, Oldenlandia, Eclipta prostrata* by controlling these weeds can provide optimal results in cultivated plants. Research results of Kholifah et al., (2018) explains that allelochemical compounds are able to slow down germination by inhibiting enzyme activity and degrading food reserves on the seeds so that the energy produced is very low.

Phytotoxicity of Corn Plants (%)

Results of phytotoxicity observation data observed at the ages of 7, 14, and 21 DAA showed no significant difference in results. Phytotoxicity observation data can be seen in The table below.

Table 9. Phytotoxicity Observations of Corn Plants at 7, 14, dan 21 DAA (%)

Treatment	Phytotoxicity (%)		
	7 DAA	14 DAA	21 DAA
A1 (Kontrol)	3,0a	3,0a	0,0a
A2 (20%)	5,0a	3,0a	2,0a
A3 (25%	5,0a	3,0a	2,0a
A4 (30%)	5,0a	3,0a	2,0a
A5 (35%)	5,0a	4,0a	1,0a
A6 (40%)	6,0a	4,0a	2,0a
A7 (45%)	6,0a	4,0a	2,0a
A8 (50%)	7,0a	2,0a	1,0a

Description: Not significantly different at the 5% F test level

The table above shows that the bioherbicide extract of Reed grass does not provide the real effect on the phytotoxicity of corn plants is thought to be due to the solution given undergo leaching and evaporation so that the bioherbicide is unable to reach the seeds corn and has quite strong resistance. Strengthened by research that conducted by Kusumawati, (2021) organic solutions have the disadvantage that they are easy to washed and evaporate quickly so additional compounds are needed. Firmansyah *et* al., (2018) stated that corn plants have better resistance to the allelochemical influence of cogongrass leaves so that it does not provide interaction between treatment of extract concentration with corn plants. The response of plants that experience poisoning will give a response of wilted leaves, slow growth, color brownish or burnt leaves, if left untreated the plant will die Wati *et* al., (2021). Phytotoxicity of plants depends on the method of application, plant height, and shelf life. environment (Alhuda, 2017).

CONCLUSION

The conclusions obtained from this research are as follows.

1. Bioherbicide reed extract is not able to control weeds in plants corn.
2. All concentrations of bioherbicide reed extract were unable to control weeds on corn plants.
3. Application of bioherbicide reed extract did not show any symptoms of poisoning on corn plants

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