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The Effect of Reed Rhizome Extract Concentration on the Growth of Teki Grass

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ABSTRACT

This study aims to determine the effect of reed rhizome extract at concentrations of 8 ml, 12 ml, 16 ml, and 20 ml on the growth of teki grass. A randomized block design was used with five treatments and six replications. The herbicide spraying process was carried out every four days at 8:00 AM, with a spraying volume of 250 ml per polybag. Data collection was conducted every four days until ten sets of observation data were obtained. The data were analyzed using various statistical methods. The Smallest Significant Difference (SSD) test was performed at the 5% significance level if significant differences were found. The analysis continued with the calculation of the percentage of teki grass mortality. The results indicated that the lowest mortality rate occurred in the t1 treatment (8 ml), while the highest mortality was observed in the t4 treatment (20 ml), with an average mortality rate of 1.20%. This is due to the high concentration of herbicides that control teki grass weeds. These results support the allelopathic theory, which suggests that the phenolic compounds in reeds may act as growth inhibitors. The implications of this research contribute to sustainable agricultural practices.

Pengaruh Konsentrasi Ekstrak Rimpang Alang-Alang terhadap Pertumbuhan Rumput Teki

ABSTRAK: *Penelitian ini bertujuan untuk mengetahui pengaruh ekstrak rimpang alang-alang pada konsentrasi 8 ml, 12 ml, 16 ml, 20ml terhadap pertumbuhan rumput teki. Penelitian ini menggunakan Rancangan Acak Kelompok dengan 5 perlakuan dan 6 ulangan. Proses penyemprotan herbisida dilakukan setiap 4 hari sekali pada pukul 08.00 WIB dengan volume penyemprotan sebanyak 250 ml tiap polybag. Pengambilan data dilakukan setiap 4 hari sekali sampai mendapatkan 10 data pengamatan. Data yang diperoleh dianalisis dengan menggunakan sidik ragam, jika terdapat perbedaan yang nyata maka dilakukan dengan uji Beda Nyata Terkecil (BNT) pada taraf 5%. Metode analisis dilanjutkan menghitung persentase kematian rumput teki. Hasil penelitian menunjukkan bahwa tingkat kematian terendah pada perlakuan t1 (8ml) dan kematian tertinggi terdapat pada perlakuan t4 (20ml) dengan rata-rata kematian sebesar 1.20. Hal ini disebabkan karena tingginya konsentrasi herbisida yang digunakan untuk mengendalikan gulma rumput teki. Hasil ini mendukung teori alelopati yang menunjukkan bahwa fenol dalam alang-alang berpotensi bertindak sebagai stimolator pertumbuhan. Implikasi penelitian ini mengarah pada praktik pertanian berkelanjutan.*

INTRODUCTION

Weeds are plant pests, in addition to pests and diseases. These weeds grow alongside staple crops, but their presence is undesirable for farmers because they interfere with crop growth (Kubiak et al., 2022). Due to competition for resources such as food, water, and nutrients, weeds can reduce the yield of cultivated crops and serve as hosts for pests and diseases (Benjamin et al., 2024). Weeds can also harm plants due to the allelopathic substances they contain (Choudhary et al., 2023). If not controlled, these weeds will compete for nutrients needed for growth and development, leading to a significant decrease in the productivity of major crops in Indonesia, which have high and low economic value (Erythrina et al., 2021). Controlling weed populations does not require total eradication; inhibiting their growth or reducing their numbers is enough to prevent economic harm (Nath et al., 2024).

However, some weed plants can be useful as natural bioherbicides to control other weeds, providing a safe and environmentally friendly alternative (Valiño et al., 2023);(Ananda et al., 2023). Examples include reeds, teki grass, bandotan, ketapang, purslane, and others that thrive in agricultural areas. Reeds and teki grass are common weeds in many agricultural lands and plantations (Eddy et al., 2022);(Sutaryono et al., 2023). Reeds (*Imperata cylindrica* L.) and teki grass (*Cyperus rotundus* L.) are two examples of invasive plants that grow on land (Andriani et al., 2023).

Weed plants in Indonesia can be grass, teki, and broadleaf (Murtilaksono et al., 2023). Teki grass (Cyperus rotundus L.) belongs to the teki weed group. It is a flowering plant from the Cyperaceae family found in tropical and subtropical regions (Lazar et al., 2024). Teki grass commonly grows in open spaces such as fields, grasslands, and natural environments (Skaldina et al., 2024). Some weed plants that thrive in the environment have natural chemical compounds, including reeds and teki grass (Elkhouly & Aboulsoud, 2023). Teki grass tubers exhibit properties such as ovicidal and larvicidal effects, insect control, antimicrobial, antimalarial, anti-inflammatory, antiviral, anti-obesity, antiemetic, antidiarrheal, and monokaryotic activities (Fitriyati et al., 2024).

Reeds are often used as research products because they are part of a common group of grasses known as weeds (Anderson et al., 2021). The reed plant is a sun-loving plant. It is a plant whose top is at the ground level, but the rhizome is widely spread below it (Nazhifah & Advinda, 2024). Reeds can withstand extreme heat thanks to their incredible hardiness, and because it is difficult to regulate, any plant that lives along with reeds must compete with them for water, nutrients, and sunlight (Reed et al., 2022).

Using reed weed plants as bioherbicides or natural herbicides to control other weed plants can reduce the use of synthetic herbicides (Lopes et al., 2022). Chemical compounds held by reeds are included in phenol compounds that inhibit growth or act as bioherbicides (Ocán-Torres et al., 2024). Weed plants that contain allelopathy will emit these substances through organs located above or underground organs (Zuo et al., 2022). Allelopathic chemicals can be released by evaporation, root exudate, leaching, or degradation of dead organ components (Clavijo McCormick et al., 2023);(Jeremy, 2023).

Although the probability of reed allelopathy in controlling weeds has been studied quite a lot, research on the specific effect of reed extract on the growth of teki grass is still very limited. A gap analysis needs to be filled with more detailed empirical data about the influence of reed extract on main crops such as teki grass. Previous research has focused on other plants or general testing of reed-reed allelopathy compounds without delving deeper into how these treatments affect specific teki grass growth parameters. For example, research by Cahyati & Sutanto (2021) found that reed extract can suppress shallots' growth under high competition conditions. Still, few have explored its effects on other plants, such as teki grass, with different physiological characteristics. Therefore, in this study, the researcher will utilize the reed weed plant extract as an inhibitor of the growth of teki grass weed plants so that it is also indirectly beneficial for farmers in managing lava more efficiently and sustainably.

METHOD

This research was carried out from January to February 2024. The research site was the Warugunung Village, Pacet District, Mojokerto Regency. The materials used in this study were soil, water, reed rhizomes, and 96% ethanol solution. The tools used were hoes, paper, polybags, sieves, scales, measuring cups, scissors, blander, wooden pots, stationery, and cameras. This study was a 5-treatment factorial experiment with six replicates and was conducted in a group randomized design. The treatment (t), consisting of 5 levels, includes: Control (t0), Treatment with 8 ml (t1), Treatment with 12 ml (t2), Treatment with 16 ml (t3), and Treatment with 20 ml (t4). The controlled weeds are teki grass.

The first step in the research was a field survey. This phase began with surveying the location of land overgrown with reed weeds, followed by seeding with teki grass seeds. Next, reed rhizome extract was prepared. The reed rhizomes were collected, cleaned with water, dried, and cut into small pieces. Five kilograms of reed rhizomes were crushed or blended and soaked in 96% ethanol and 2 liters of water. The mixture was placed in a closed container and soaked for 24 hours. After soaking, the reed rhizomes were filtered to obtain the reed rhizome extract, which was used as a bioherbicide.

The bioherbicide was sprayed every 4 days in the morning at 08:00 WIB. The spraying volume for each treatment was 250 ml per 10 kg polybag, with each polybag containing 5 kg of soil and six weeds planted. A sprayer was used to ensure the bioherbicide was evenly applied to each weed, focusing on the teki grass treatment.

Data collection was conducted while the bioherbicide spraying process was ongoing. The data collected in this study included the number of weeds that died in each treatment over 40 days. Observations were made every 4 days until 10 sets of data were obtained. These observations were conducted in the morning after spraying the bioherbicide reed extract. Once the data was collected, it was transformed using the formula Arc√(X+0.5).

The data was analyzed using fingerprint analysis. If there was a significant difference, further analysis was conducted using the Smallest Real Difference test at the 5% significance level.

RESULTS AND DISCUSSION

Based on the variety analysis results, the death of Teki grass weeds shows a real effect. Table 1 presents the results of the observation of the average mortality of Teki grass weeds.

Description: The number owned or the same letter indicates no difference in BNT 5% (BNT g = 0.43; BNT t = 0.39).

Table 1. Death of Teki Grass Weeds

Treatment	Deuteronomy						Average
	1	2	3	4	5	6	
t0	0.71	0.71	0.71	0.71	0.71	0.71	0.71[a]
t1	0.71	0.71	0.71	0.71	0.71	0.71	0.71[a]
t2	0.71	1.68	1.68	1.68	0.71	0.71	1.20[b]

Treatment	Deuteronomy						Average
	1	2	3	4	5	6	
t3	1.95	1.95	0.71	1.68	1.68	1.68	1.61[bc]
t4	1.95	2.13	2.13	1.95	0.71	1.68	1.76[c]
Average	1.20[ab]	1.44[b]	1.19[ab]	1.35[ab]	0.90[a]	1.10[ab]	

Figure 1. Teki Grass Growth

Discussing weed control is an important challenge in agriculture because weeds can reduce plant productivity by competing for nutrients, water, and light. Agricultural ecological theory studies the relationship between cultivated crops and their environment, including interactions with weeds. Weeds can affect agricultural ecosystems by altering resource availability and disrupting agricultural processes (Anwar et al., 2021);(Khattak et al., 2024). Chemical herbicides are often used to address this issue, but their use negatively impacts the environment and human health (Rani et al., 2021). A more environmentally friendly alternative is using bioherbicides, which are natural herbicides utilizing the allelochemical potential of plants (Islam et al., 2024).

Bioherbicides are herbicides derived from natural materials, particularly plants, which can inhibit the growth or kill weeds (Duke et al., 2022). The active compounds in bioherbicides are usually allelochemicals—chemicals produced by certain plants that can affect the growth of nearby plants. The advantages of bioherbicides include their environmentally friendly nature, as they are easier to decompose than chemical herbicides, reducing soil and water pollution. Additionally, they are safer for human and animal health, as they are derived from natural ingredients and help reduce weed resistance. Continuous use of chemical herbicides can lead to resistance in weeds, but bioherbicides reduce this risk with their different mechanisms of action. Furthermore, bioherbicides often utilize local plants with allelopathic potential, empowering local resources.

Bioherbicides offer a more environmentally friendly and sustainable solution for weed control than chemical herbicides (Helo & Hao, 2022). With continued research and development, bioherbicides have the potential to become an integral part of sustainable agricultural practices. Using bioherbicides can reduce our dependence on chemical herbicides and help maintain the sustainability of agricultural ecosystems (Adedibu, 2023). The reed rhizome is the most effective part of the plant in producing allelochemicals.

To achieve optimal results, the rhizomes used must meet certain conditions. They should be fresh, ensuring the active compounds are still intact. They should also have a yellowish-white color, indicating they are in good condition and have not begun to decay. Additionally, the rhizomes should not be rotten or overly juicy, as they need to be free of spoilage and maintain an adequate moisture content for easier extraction.

The rate and timing of weed death vary with each treatment and are influenced by both internal and external factors. Internal factors stem from the weeds themselves. For example, weeds already in the generative (flowering) phase are less sensitive to bioherbicides from reed rhizomes. Research suggests that the optimal time for applying bioherbicides is when weeds are still young and in the vegetative phase, as they absorb the active ingredients more effectively (Roberts et al., 2022). External factors include environmental conditions such as weather, wind, and sunlight.

Weather plays a significant role in the success of bioherbicides. The research was conducted from June to August when there was no rain, and the death of the weed Cyperus rotundus was observed. The percentage success of various concentrations of reed rhizome extracts measured this. The discoloration of leaves characterized symptoms of weed death and stems, indicating chlorosis (Laosinwattana et al., 2024). Chlorosis occurs when chlorophyll is lacking, interfering with photosynthesis and respiration, which leads to the death of weed cells and tissues. The theory of allelopathy describes a phenomenon in which plants release certain chemical compounds into their environment that can affect the growth and development of other plants (Xie et al., 2021). Reed rhizome extract contains allelopathic compounds known to inhibit the growth of *Cyperus rotundus* (Kong et al., 2024)

Weather also affects the success of bioherbicides. The study, conducted from June to August without rain, observed the death of Cyperus rotundus, measured through the success rate of different concentrations of reed rhizome extracts. Symptoms of weed death included discoloration of leaves and stems, signaling chlorosis (Roberts & Punja, 2022). Chlorosis occurs due to a lack of chlorophyll, which interferes with photosynthesis and respiration, ultimately leading to the death of weed cells and tissues. The theory of allelopathy explains how plants release chemicals that influence the growth and development of other plants. Reed rhizome extract has been shown to contain allelopathic compounds that inhibit the growth of *Cyperus rotundus* in research by Andriani et al. (2023).

CONCLUSIONS AND SUGGESTIONS

The reed rhizome extract used in this study has been shown to effectively control teki grass weeds. At a concentration of 20%, the reed extract resulted in an average mortality rate of 1.20 at the 5th treatment (T4). The allelopathic compounds, particularly phenols, present in the extract function as natural inhibitors of weeds while also acting as growth stimulators. Therefore, a 20% concentration is recommended for optimal production efficiency.

Farmers can consider using reed extract as a natural method for weed control, which also supports eco-friendly agricultural practices. Future research should include tests with concentrations above 20% and field trials to assess the impact under uncontrolled conditions. Exploring potential combinations with other cultivation methods could yield more optimal results.

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