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ANALYSIS OF WEED VEGETATION ON PADDY RICE (*Oryza sativa*) PLANT IN KOYA VILLAGE, SOUTH TONDANO DISTRICT

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Abstract

Paddy Rice (*Oryza sativa*) is the main food commodity in Indonesia, because most of the Indonesian population's staple food is Paddy Rice. Demand for Paddy Rice continues to increase from time to time along with population growth. The aim of this research is to determine the types and control of weeds in lowland Paddy Rice plants (*Oryza sativa*). This research is a qualitative descriptive study using a survey method directly observing weeds in the Paddy Rice planting area in Koya village, South Tondano subdistrict. The results of research on the density, dominance, and frequency of weed types in lowland Paddy Rice plants in Koya Village, South Tondano District show that there are 4 types of weeds in lowland Paddy Rice plants in Koya Village, namely *Panicum repens, Fimbristylis litotoralis, Cyperus rotundus*, and *Pistia stratiotes*. P.repens is a grass weed, F.litoralis and C.rotundus are a weed, and P.stratiotes is a broadleaf weed. The type that has the highest relative density (KR) is P. repens, namely 3.33%, followed by F. litoratlis, namely 26.67%, and the lowest is C. rotundus and P. stratiotes, namely 20.0%. Relative Dominance Value The highest (DR) was found in the weed type P. stratiotes, namely 51.56%, then followed by C. rotundus, namely 19.27%, F. litoralis, namely 15.10%, and the lowest, P. repens, namely 14.06%. The highest relative frequency (FR) was in P. repens and C. rotundus, namely 33.33%, followed by F. litoralis, namely 22.22% and the lowest was P. stratiotes, namely 11.11%. Based on the research results, it can be concluded that there are 4 types of weeds in lowland Paddy Rice plants in Koya Village, South Tondano District with the highest weed dominance index value, namely P. stratiotes, namely 27.55787; Weed control can be done chemically, biologically, mechanically and physically.

Keywords: Weed vegetation, density index, frequency, dominance index, weed control.

INTRODUCTION

Paddy Rice (*Oryza sativa*) is the main food commodity in Indonesia, because most of the staple food of the Indonesian population is Paddy Rice. Demand for Paddy Rice continues to increase from time to time along with population growth. In recent years, the problem of food security has become an important issue in Indonesia and in the last year the world has also started to be hit by a food crisis. The food crisis this time is the biggest global crisis of the 21st century which has affected 36 countries in the

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world, including Indonesia(Sumekar & Widayat, 2021) .

Efforts to increase Paddy Rice production often fail due to many obstacles, both biotic and abiotic. Biotic constraints include the presence of weeds, pest attacks and disease, while abiotic constraints generally consist of physiological environmental pressures such as excess or lack of air, excess or lack of nutrients, increased or decreased temperature, and cations that are toxic to plants (Sumekar & Widayat, 2021).

So far, farmers have generally implemented a lowland Paddy Rice planting system with a transplanting (tapin) planting system. Apart from not requiring many special requirements, this system also does not require many risks. However, there are still many farmers who use seeds with a relatively large number of seeds (7 – 10 stems per bunch, even more than 10 stems per bunch). In fact, the general recommendation for using lowland Paddy Rice seeds is 3 stalks per hill. Even in SRI (The System of Paddy Rice Intensification) technology, the number of seeds used is one stem per hill (Al-Snafi, 2016).

Minahasa Regency is one of the districts in North Sulawesi Province. Because this district is suitable for agricultural crop areas, almost all sub-districts have various agricultural crops that grow well. Paddy Rice cultivation in the Paddy Rice fields here is generally in the form of semi-technical and simple irrigated Paddy Rice fields, apart from that there are also rain-fed Paddy Rice fields. The food crops cultivated by the population are Paddy Rice, corn, tubers and other horticultural crops. As many as 33.41 percent of the population works on agricultural land. South Tondano is an area with a land area of 2,000 hectares in South Tondano District which is used as agricultural land to plant Paddy Rice, corn, nuts, vegetables and cloves. The remaining land is used as an organization (Syafii et al., 2022). The aim of this research is to determine the types of weeds and weed control in lowland Paddy Rice plants (*Oryza sativa*).

RESEARCH METHODS

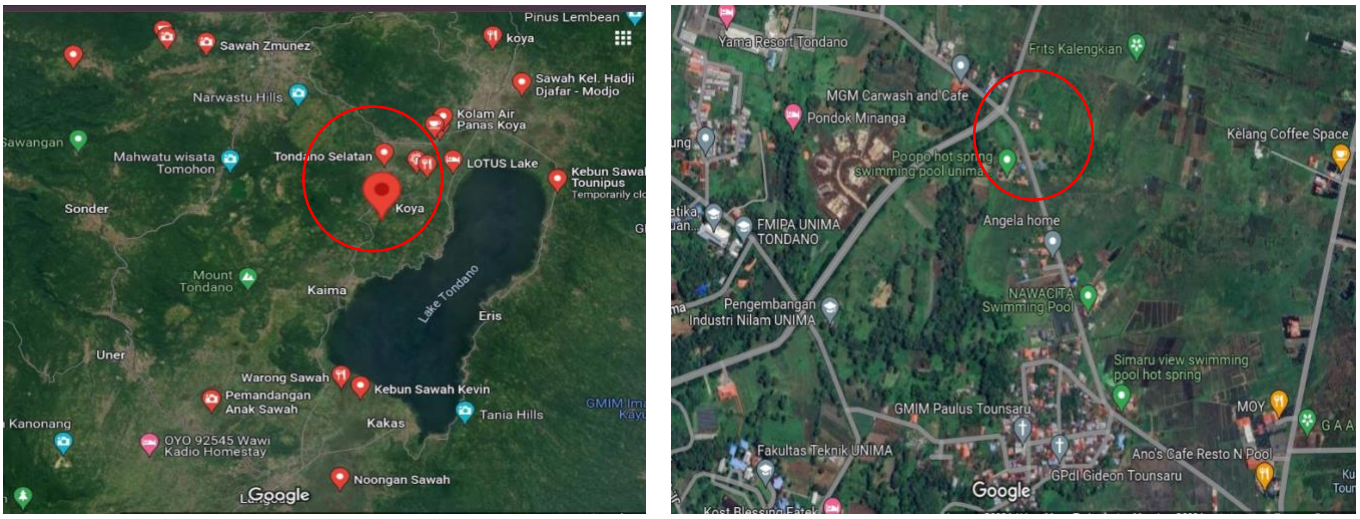

Figure 1. Location Research Koya Village, South Tondano.

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This research is a qualitative descriptive study using a survey method directly observing weeds in the Paddy Rice planting area in Koya village, South Tondano subdistrict. Determining the research location uses the method of deliberately determining the research location based on specified conditions (purposive sampling method). The lowland Paddy Rice plants observed were lowland Paddy Rice plants aged 3 - 6 months, divided into 2 groups of age plant categories, namely lowland Paddy Rice plants aged 0 - 3 weeks and 3 - 6. The sample plots were 6 x 8 m and the sample unit 2 x 2 m. The way to determine sample units uses the diagonal method. The observation plan and taking samples of weeds in lowland Paddy Rice plants can be followed in Figure 2.

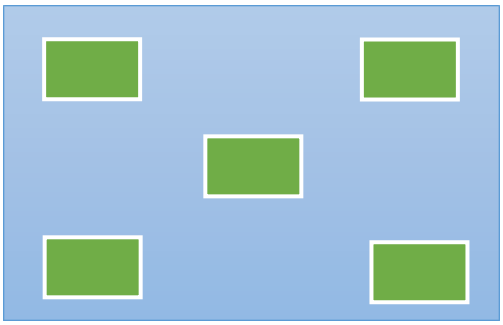

Figure 2. Method Determination of sample plots and sample units by diagonal method

Research Procedure

Preparation

Prepare research materials and equipment as needed and prepare the land for conducting the research. Prepared according to the sample size and sample unit in the type of research method.

Sample Determination

This research was conducted by conducting surveys and collecting data on weeds encountered by farmers in Paddy Rice *(Oryza sativa)* crops by conducting interviews with farmers. The data obtained is an initial description to find out the types of weeds that exist in Paddy Rice*(Oryza sativa*) that grow on Paddy Rice fields in Tondano which can be used as a survey result directly in the field.

Determination of Sample Points

Sample plots are made in locations where there are the most weeds in Paddy Rice fields. Determination of the location of plots or sampling plots is usually based on various factors such as vegetation conditions, soil types, geology, river flow systems and based on the location of villages (Saidah, 2022).

Sampling Technique

Weed sampling was carried out on paddy Paddy Rice plants aged 3-6 weeks after planting (vegetative phase) in accordance with the age grouping of types and research methods. The 3-6 month old plants

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were taken because the Paddy Rice plants in weeks 3-6 of the Paddy Rice plant condition are still weak and the ability to compete with weeds is still low so that the weeds that grow in this week must be identified in order to be controlled effectively (Bastian, 2017).

Vegetation Analysis

According to Heddy 2012, qualitative analysis parameters and descriptions on weed vegetation analysis in paddy Paddy Rice include:

Density of a Weed species

Absolute density, determined by counting the number of a weed species in each sample plot:

KMn = [(Number of weeds-n) ÷ (sample plot)], n is the weed species observed.

Relative Density, determined by comparing the absolute density of a weed species to the total absolute density of a weed species:

[KRn = [(KMn) ÷ (total KMn)] x 100%, n is the weed species observed.

Frequency of a Weed Species

Absolute frequency, determined by comparing the number of sample plots of a weed species encountered to all sample plots made:

FMn = [(Σ weed sample plots-n encountered) ÷ (Σ all sample plots)], n being the weed species observed.

Relative frequency, determined by comparing the frequency of a particular weed species to the total frequency of all weed species:

FRn = [(FMn)/(total FMn) x 100%. N is the weed species observed.

Dominance of a weed species

Absolute dominance, determined through the dry weight of a weed species in each sample plot:

DMn = [(Dry weight of weed-n)/(sample plot), n is the weed species observed.Relative dominance, determined by comparing the absolute dominance of a weed species to the total absolute dominance of all weed species:

DRn = [(DMn)/(total DMn)] x 100%, n is the weed species observed.

Weed index of importance (INP)

INP is used to determine the dominance of a species over other species, or in other words, INP is important to describe the ecological position of a species in the community.

INP is calculated based on relative density, relative frequency, and relative dominance (Soerianegara and Indrawan, 2015) and is formulated as follows:

INP = KR + FR + DR, where KR = relative density (%), FR = relative frequency (%), relative dominance (%).

Summed Dominance Ratio (SDR) or importance ratio (PNP)

SDR or PNP shows the ratio of the INP value to the number of quantities that make it up.

The SDR value is never more than 100% or between (1-100) % and is formulated as follows:

SDRn = [(INPn)/(number of relative variables)], where n is the type of weed analyzed.

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RESULTS AND DISCUSSION

Types of Weeds in Paddy Rice Paddy Crops in Koya Village, South Tondano Subdistrict

Figure 3. shows the types of weeds in paddy Paddy Rice plants in Koya Village, South Tondano District, namely there are 4 types, namely *Panicum repens*, *Fimbristylis littoralis*, *Cyperus rotundus*, and *Pistia stratiotes*. *P. repens* includes grass weeds, *F. littoralis* and *C. rotundus* include weeds, and *P. stratiotes* includes broadleaf weeds.

Figure 3. Weeds in paddy Paddy Rice plants in Koya Village, South Tondano Sub-district.

Panicum repens

Fimbristylis littoralis

Cyperus rotundus

Pistia stratiotes

Density, Dominance, and Frequency of Weed Species in Paddy Rice Field Crops in Koya Village, South Tondano Subdistrict

The results of research on the density, dominance, and frequency of weed species in paddy Paddy Rice plants in Koya Village, South Tondano District can be followed in Table 1.

Table 1. Types of Weeds on Paddy Rice Plants in Koya Village, South Tondano District

No	Jenis Gulma	KM	KR%	DM	DR%	FM	FR%	INP	SDR%
1	*Panicum repens*	5	33.33333	0.27	14.0625	3	33.33333	80.72917	26.90972
2	*Fimbristylis littoralis*	4	26.66667	0.29	15.10417	2	22.22222	63.99306	21.33102
3	*Cyperus rotundus*	3	20	0.37	19.27083	3	33.33333	72.60417	24.20139
4	*Pistia stratiotes*	3	20	0.99	51.5625	1	11.11111	82.67361	27.55787
	Jumlah	15	100	1.92	100	9	100	300	100

Information:
KM: Absolute Density
KR: Relative Density KM Type of Weed/amount x 100
DM: Absolute Dominance
DR: Relative Dominance DM type of weed/amount x 100
FM: Absolute frequency
FN : Relative Frequency
INP: Important Value Index (KR+DR+FR)
SDR: Summed Dominance Ratio INP/3

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The weed species that had the highest relative density (KR) was *P. repens* at 33.33%, followed by *F. littoratlis* at 26.67%, and the lowest was *C. rotundus* and *P. stratiotes* at 20.0%. The highest relative dominance (DR) value was found in the weed species *P. stratiotes*, 51.56%, followed by *C. rotundus*, 19.27%, *F. littoralis*, 15.10%, and the lowest *P. repens* , 14.06%. The highest relative frequency (FR) in *P. repens* and *C. rotundus* is 33.33%, then followed by *F. littoralis* which is 22.22% and the lowest in *P. stratiotes* which is 11.11%.

Dominance Index of Weed Species in Paddy Rice Field Crops in Koya Village, South Tondano Subdistrict

The results of the calculation of the weed dominance index in paddy Paddy Rice plants in Koya Village, South Tondano Subdistrict can be followed in Figure 4. The data in Figure 4 shows that the highest value of weed dominance index of paddy Paddy Rice plants in Koya Village, South Tondano Subdistrict is *P. stratiotes*, which is 27.55787, followed by *P. repens*, 26.90972, *C. rotundus*, 24.20139, and the lowest is *F. littoralis*, 21.33102.

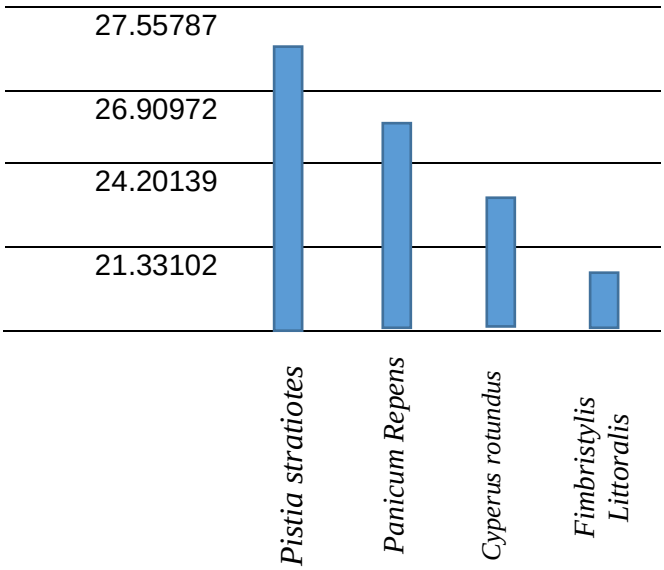

Figure 4. Weed dominance index in paddy Paddy Rice plants in Koya Village, South Tondano Sub-district.

Discussion

The initial step in this research was that researchers conducted a survey and collected data by conducting interviews with farmers. This aims to help researchers as an initial overview to find out the types of weeds that exist on Paddy Rice plants (Oryza sativa) in Paddy Rice fields in Koya Village, South Tondano District. After obtaining initial data, the researcher conducted a survey directly using a purposive sampling method which determined the research location based on the specified conditions (Damayanti et al., 2020).

Based on the results of researchers on Paddy Rice paddy farmers in Koya Village, South Tondano

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District, there are 4 types of weeds that grow on Paddy Rice paddy plants in Koya Village, South Tondano District, namely: *P. repens*, *F. litoratlis, C. rotundus* and *P. stratiotes,* and the following ways to control them

Apu wood (*P. stratiotes*)

Apu wood **(***P. stratiotes*) is an aquatic plant commonly found floating in still waters or ponds. Leaves that grow on the surface of the water are slightly circular lobe-shaped, chlorophyll so green, and the surface is covered with white hairs that are slightly transparent.

Figure 5. *P.stratiotes* (Personal documentation, 2023)

Apu Wood Control

Control of Apu wood *(P. stratiotes)* there are various ways of control in paddy Paddy Rice can be done by manual, mechanical, technical culture, or chemical with herbicides. Control of Apu wood *(P. stratiotes)* by using herbicides should be selective to inhibit or kill Apu wood*(P. stratiotes)* but does not interfere with the growth of Paddy Rice plants. Efforts to control Wormwood*(P. stratiotes)* appropriately and economically need to be done for the formation of optimal and profitable tillers using certain herbicides (Nirmala, 2016)

Recommendations for Weed Control in Paddy Rice Crops Kayu apu (*P. stratiotes*)

Control of Kayu apu (*P. stratiotes*) using herbicides should be selective to inhibit or kill Kayu apu (*P. stratiotes*) but not interfere with the growth of Paddy Rice plants. Efforts to control Kayu apu (*P. stratiotes*) appropriately and economically need to be done for the formation of optimal and profitable tillers using certain herbicides (Nazir et al., 2022).

(Gao et al., 2022), weed control using herbicides will cause changes in the weed community. Greater changes in weed species are likely due to the higher selectivity pressure of the herbicides used. Changes in the weed community can also be caused by differences in the response of each weed species to the treatment given and the transmission of weed seeds from the surrounding area and the regrowth of the remaining vegetative parts in the soil.

P. repens

This species is a member of the panicum genus. *P. repens* has a stem that grows creeper, this type of plant is a weed that is able to grow on various types of soil, both on fertile and dry land, this is because

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Bengal grass has a deep, dense and fibrous root system (Rao & Matsumoto, 2017).

Figure 6. *P.repens* (Personal documentation, 2023)

Control of Weed *P.repens*

Chemical Control

Chemical handling can be done by using herbicide chemicals such as Cliper 2500, Paddy Ricestar, Nominee and DMA 6. but the negative impact is greater for the environment. In controlling using chemical techniques to overcome high levels of plant growth, it will require a lot of chemicals. This causes problems not only in the fields but also pollutes the aquatic environment where the water from the fields is discharged.

Biological Control

Biological control can be carried out using specialist herbivores (e.g. *Spodoptera pactinicornis, Neohydronomus affinis*) (Gao et al., 2022). Although the negative impacts are hardly noticeable, the process takes a long time.

Mechanical/Physical Control

Mechanical control using tools is suitable for application in Paddy Rice fields. An effective, efficient, economical, safe, and reversible way of controlling plants in Paddy Rice fields is physical, i.e., by picking them up by hand. Mechanical control of newly grown *C. rotundus* which has shallow roots can be done by pulling it out manually by hand (Sumekar & Widayat, 2021).

Recommendations for Weed Control in Paddy Rice Crops Kayu apu (*P. repens*)

Paddy Rice paddy weed control that has generally been carried out by farmers is in a direct way, namely weeding by hand by mechanical means using hedgehog / gasrok tools with human labor and by chemical means, namely the use of herbicides. Weed control by mechanical means has advantages over the other two methods, namely more efficient than weeding by hand even though it still requires a lot of labor as well, and more effective than chemical means even though it sometimes results in damage to Paddy Rice roots. Weed control using hedgehogs/gasrok is carried out twice in a period of three months, when the age of the Paddy Rice plant is two weeks and six weeks (*after fertilization*).

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C. rotundus

Grass with the scientific name *Cyperus rotundus* also known as *Purple nutsedge* has been called one of the weeds in agriculture. Teapot grass*(C.rotundus*) is widespread in tropical and subtropical regions, growing in almost all types of soil, altitude, soil moisture and pH, but not in high salt content soils. This plant is included in wild plants that are difficult to eradicate because it produces tubers that make this plant very quickly regenerate (Kuotsu & Singh, 2020). Teapot grass*(C.rotundus*) has a 25 cm long stem, triangular in shape, and overlaps with leaves. The leaves are 5-20 cm long, grooved, dark green, and grow from the base of the plant (Hsia et al., 2015).

Figure 7. *C. rotundus* (Personal documentation, 2023)

Control of *C. rotundus*

Mechanical control of newly grown *C. rotundus* which has shallow roots can be done by pulling it out manually by hand (Syafii et al., 2022). Technical control of *C. rotundus* chemically has been carried out using emarty herbicides. The use of herbicides or other chemicals to eradicate *C. rotundus* must be done carefully and wisely by fulfilling the 6 right, namely: the right quality, the right time, the right target, the right dose, the right concentration and the right method of application. In addition, it must also consider efficiency, effectiveness, and safety for the environment. Herbicides that have been carried out are systemic herbicides. The way this herbicide works is flowed into the *C. rotundus* tissue and kills its target tissues such as leaves, sprouting points, and shoots to the roots. Its specialty is that it can kill the shoots in the soil, thus inhibiting the growth of *C. rotundus* (Muhammad et al., 2016).

Recommendations for Weed Control in Paddy Rice Crops Kayu apu (*C.rotundus*)

Excessive use of synthetic herbicides can cause a decrease in soil fertility, pest and disease outbreaks, environmental pollution,and weed resistance to herbicides (Bir et al., 2024).Therefore, weed control is needed that is environmentally friendly. One of the efforts to controlling weeds that are environmentally friendly is by utilizing allelopathic compounds According to (Huang et al., 2020)allelopathy can inhibit growth, reduce productivity and dry weight plants.

F. Littoralis

F. littoralis, commonly known as *lesser fimbry* or *lesser fimbristylis,* is a sedge of the family *Cyperaceae* native to Africa, Asia and Oceania including much of northern Australia. The weed belongs

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to the class of weeds found in Paddy Rice paddy fields. This weed does not pass causing economic disturbance, so it can still be tolerated (Akobundu & Agyakwa, 1998). *F. littoralis* is from the genus teki-tekian, so there are 200 to 300 species spread throughout the world. *F. littoralis* is common, with its stiff, triangular, sometimes round and usually hollow stems, leaves arranged in three rows, lacking leaf tongues*(ligules*). The peduncle of the wreath has no books, but the flowers are often in*spikelets (spica*) or spikelets. *F. littoralis* is usually found in wet environments so it is mostly found in Paddy Rice paddies and is most diverse in tropical and subtropical regions.

Figure 8. *F.Littoralis* (Personal documentation, 2023)

Control of *F. littoralis* (Hidayat et al., 2022)

Mechanical/physical control (earthwork, weeding, uprooting, clearing, and burning). biological control (reducing natural enemies, manipulating natural enemies, and processing natural enemies in a region). Chemical control (*herbicides used with various formulations, sufactants and afflication devices*).

F. littoralis can also be used as fodder for livestock, and can also function as an *over crop* or cover *crop* that has a positive value on preventing or anticipating flooding or degradation of a land. Another benefit of *F. littoralis* is that it can be used as handicrafts such as mats. This of course can have a positive impact and also add added value to the weed to make it more useful (Iwasa et al., 2023)

Recommendations for Weed Control in Paddy Rice Crops Kayu apu (*F. littoralis*)

Using mechanical and chemical control with herbicide made from *isopropylaminaglifosate*. This herbicide is applied at during land preparation. Glyphosate herbicide herbicide works systemically by inhibiting protein synthesis and is not active in soil. Glyphosate is absorbed by the leaves and photosynthetic parts of the plant, then transported to other parts through the phloem. This herbicide is effective for eradicating annual and perennial weeds that are deep-rooted and broad-leaved, but not selective on broad-spectrum.

CONCLUSION

There are 4 types of weeds found in Paddy Rice plants in Koya Village, South Tondano subdistrict, namely Panicum repens, Fimbristylis litotoralis, Cyperus rotundus, and Pistia stratiotes. The highest weed dominance index value for lowland Paddy Rice plants is P. stratiotes, namely 27.55787. Weed control can be done chemically, biologically, mechanically, and physically.

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