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Analysis of Weed Diversity in Maize (*Zea mays* L.) Field in Lowland and Highland Areas

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ABSTRACT
Weeds are very detrimental to maize because they compete for light, water and nutrients. This observation aims to determine the composition and structure of weeds on narrow leaves on corn cultivation land in the lowlands, namely in the Saworatap area, Gedangan subdistrict and the highlands in Randuagung village, Wonosari subdistrict, Malang. This observation was carried out in November 2024. The method used in this observation was survey and sample collection techniques were purposive sampling, making plots measuring 1 m x 1 m with a total of 6 plots in both locations. In the lowlands, the composition of grass weeds is only two species, namely *Eleusine indica* and *Setaria verticillata* which belong to the Poaceae family. The composition of grass weeds in the highlands has a higher species diversity, namely six species divided into two families. Weed species belonging to the Poaceae family are *Echinochloa colona, Setaria verticillata, Eleusine indica,* and *Chrysopogon zizanioide*, while grass weeds belonging to the Cyperaceae or enigma family are *Cyperus iria* and *Cyperus rotundus*.
***Keywords**: grass; highlands; lowlands; maize; weed*

INTRODUCTION

Corn (*Zea mays* L.) is one of the types of food crops that are widely cultivated in Indonesia. The need for corn every year is increasing, because in addition to being a source of carbohydrates, it can also be used as animal feed, oil producer, processed into flour, and as the main raw material in the industrial sector (Yuliana & Ami, 2020). Corn can grow in lowlands, highlands and mountains at elevations of 1,000-1,800 meters above sea level. Corn production can continue to increase in line with the implementation of various appropriate and quality cultivation technical activities. One of the technical cultivation activities related to corn production is weed control.

Weeds are plants that are in the wrong place, not wanted because the place to grow is intended for cultivated plants. Weeds in agriculture negatively impact cultivated crops both directly and indirectly. Weeds are often considered as nuisance plants due to the competition of water, nutrients, and growing places with cultivated staple crops (Yuliana & Ami, 2020). The existence of competition between weeds and cultivated plants will result in several factors such as stunted plant growth so that production starts longer, decreased quality and quantity of production results, requires high costs to control weeds and will become a nest of pests and diseases.

The percentage of decrease in production of each type of plant varies depending on the density and species of weeds on the land. According to Sepe et al. (2024) that the presence of weeds on corn planting land will reduce the yield and quality of corn seeds. The decrease depends on the type of weed, the length of competition, the density, and the allelopathic compounds released by the weed. According to Dahlianah (2019), weeds are a limiting factor in plant growth and

production, as well as losses caused by weeds accumulating in the final production of cultivated crops. Most grass weeds belong to the gramineae family (poaceae). Weeds of grass groups are of various sizes such as upright, creeping, seasonal, or annual (Nurjannah et al., 2024).

The main principle in weed control on cultivated land is to suppress the weed population before it harms the plant. Weed control by farmers on corn cultivation land is carried out by weeding and spraying herbicides. However, these efforts are still not effective and efficient, because farmers still lack understanding of the weed vegetation that grows, so the control method is still not appropriate (Bayyinah et al., 2022). Weeds from the graminae family are classified as narrow-leaved leaves that have properties that are resistant to mechanical control. For this reason, proper handling is needed so as not to cause damage to corn plants.

Weeds in corn fields in lowlands and highlands will be different, the difference is due to differences in where they grow and other environmental factors. Therefore, it is necessary to compare weeds found in lowlands and highlands. Environmental factors such as climate, altitude, temperature, and different humidity will give rise to diverse weeds. Based on the description above, this research aims to determine the diversity of narrow-leaved weeds, density and relative density in corn cultivation land in lowlands and highlands. So that the control can be carried out effectively.

METHODS

Observations were made in November 2024 on corn cultivation land in Randuagung Village, Singosari District, Malang Regency, with an altitude of 487 meters above sea level, and in the corn cultivation land of Sawotratap Village, Gedangan District, Sidoarjo Regency, with an altitude of 4 meters above sea level. The tools used in this weed diversity analysis are notebooks, cameras, and scissors. The materials used in the analysis of this weed diversity are raffia rope and wood. The methods used are surveys and sampling techniques. Weed sampling was carried out on predetermined plots in highland and lowland corn cultivation areas. Plots - plots made are 1 m x 1 m, with a sample of 6 plots at both locations. Weeds found from the plots were then recorded in type and counted, while weeds of unknown type were identified using reference books and the internet. The data that has been collected is then analyzed quantitatively by calculating using the formula (Turnip & Arico, 2019):

Density = (Number of individual species) / (Plot area)
Relative Density = (Density of species) / (Density of all species) x100%
Frequency = (Number of plot species found) / (Number of all plots)
Relative Frequency = (Frequency of species) / (Frequency all of plots) 100%

RESULTS AND DISCUSSION

The results of the identification of the diversity of narrow-leaved weeds in highland and lowland corn fields have different compositions. In the lowlands of the composition of narrow-leaved weeds, there are only two species, namely *Eleusine indica* and *Setaria verticillata* which belong to the Poaceae family. The composition of narrow-leaved weeds in the highlands has a higher diversity of

species, namely six species divided into two families, namely Poaceae and Cyperaceae. According to Gawaksa et al. (2016) the Poaceae and Cyperaceae families have high adaptability. This adaptability is reflected through the strong rhizome rooting system and the diversity of propagule types. Weed species that belong to the Poaceae family are *Echinochloa colona, Setaria verticillata, Eleusine indica,* and *Chrysopogon zizanioide*, while weeds that belong to the Cyperaceae family are *Cyperus iria* and *Cyperus rotundus* (**Table 1**). The large number of weed species in both corn fields is because farmers have not carried out weed control when the corn has entered the generative phase and passed through a critical period. The critical period of maize plants is in the age range of 21 to 28 days after planting (Padang et al., 2017).

The results of the weed diversity analysis showed that *E. indica* in lowland corn fields had the highest density value of 38.5 individuals/m^2 with a relative density of 70.43%, while in the highland, the absolute density value decreased by 4.17 individuals/m^2. This can be caused by environmental factors that are not optimal for its growth, one of which is air temperature. According to Seng et al. (2023), increasing temperature can accelerate the germination time of *E. indica,* at a temperature of 35°C, it only takes 20-23 hours to reach 50% germination (T50), then, along with the decrease in temperature, there will be an increase in germination time. This causes a decrease in the density of grasses in the highlands. *S. verticillata* has a density value of 16.71 individuals/m^2 in lowlands, not much different from the density in highlands of 15.50 individuals/m^2. This shows that these plants can adapt and live in various environmental conditions. *S. verticillata* seeds have tolerance to high temperatures, allowing them to have an advantage in competing with cultivated plants and other weed species (Mollaee et al., 2020).

Table 1. Narrow-leaved weed diversity in highland and lowland maize fields

Location	Family	Species	Number
Lowland	Poaceae	*Eleusina indica*	231
	Poaceae	*Setaria verticillata*	97
Highland	Poaceae	*Echinochloa colona*	82
	Poaceae	*Setaria verticillata*	93
	Cyperaceae	*Cyperus iria*	1
	Poaceae	*Eleusine indica*	25
	Poaceae	*Chrysopogon zizanioides*	25
	Cyperaceae	*Cyperus rotundus*	13

E. colona or duck grass has an absolute density of 13.67 individuals/m^2 and the highest relative density of 34.31% at the highlands, indicating that *E. colona* can spread more evenly than other species. However, *E. colona* is not found in lowland observation grounds. The absence of duck grass in the lowlands can be caused by the location of the observation land, surrounded by residential areas, thus causing selective pressure on the diversity of weed species. According to Peerzada et al. (2016), *E. colona* has several characteristics that cause it to be among the most persistent weeds, namely short seed dormancy, abundant seed

production, a wide temperature range for germination, resistance to several herbicides, and widespread distribution around the world.

Teki-tekian weeds have a low density, namely *C. iria* with the lowest density in highland corn fields of 0.17 individuals/m^2 and only contributes 0.42% to the overall frequency of individuals, and *C. rotundus* with a density value of 2.17 individuals/m^2 with a relative frequency contribution of 12%. The low density of *Cyperus* can be caused by several abiotic factors, such as soil pH, light intensity, air temperature, humidity, and wind speed. Weeds of the genus *Cyperus* require high light intensity, a fairly high temperature, and a slightly acidic to neutral pH of the soil and water (From et al., 2022). In the observation field, microclimatic conditions in weed strata have moderate light intensity and temperatures range from 25°C. The low light intensity is caused because the corn crowns are intertwined as the corn plants have completed the vegetative phase. *Cyperus,* belonging to the family Cyperaceae can synthesize allelochemical compounds and can increase in stressful conditions (Assa et al., 2017).

C. zizanioides or vetiver has the same absolute density value of 4.17 individuals/m^2 with a relative density of 10.46%. Vetiver is a hyperaccumulator plant that can live in stifled conditions, such as in polluted conditions. Besides that, the growth rate of vetiver roots is relatively fast (Komarawidjaja and Garno, 2016). Hyperaccumulators are the ability of plants to absorb and accumulate metals into their biomass (Irhamni et al., 2017). Although it is considered a weed because its growth is not expected, vetiver can act as a phytoremediation agent due to its ability. Phytoremediation is a method of eliminating contaminants such as organic and inorganic pollutants by utilizing plants so that they are not harmful to the environment (Juhriyah et al., 2023). Very fast root growth can also be used as a means of landslide and erosion prevention in aquatic areas.

Table 2. Analysis of weed diversity in highland and lowland maize fields

Location	Species	Density	Relative Density (%)	Frequency	Relative Frequency (%)
Lowland	*Eleusine indica*	38.50	70.43%	0.50	50%
	Setaria verticillata	16.17	29.57%	0.50	50%
	Total	54.67	100%	1.00	100%
Highland	*Echinochloa colona*	13.67	34.31%	1.00	35%
	Setaria verticillata	15.50	38.91%	0.83	29%
	Cyperus iria	0.17	0.42%	0.17	6%
	Eleusine indica	4.17	10.46%	0.33	12%
	Chrysopogon zizanioides	4.17	10.46%	0.17	6%
	Cyperus rotundus	2.17	5.44%	0.33	12%
	Total	39.83	100.00%	2.83	100%

The presence of weeds on cultivated land not only causes competition for resources with cultivated crops, but can also become an alternative host for plant-disrupting organisms. Narrow-leaved weeds are one of the alternative hosts that are suitable for several of the main pests of corn, one of which is *Spodoptera frugiperda* or armyworm. According to Agravante et al. (2022), the life cycle

period, resistance percentage and number of eggs produced by *S. frugiperda* are higher than in broadleaf weeds, which indicates the suitability and adequacy of weed nutrition for pests. Therefore, control or management is needed to minimize the presence of weeds and reduce economic losses caused directly or indirectly.

Weed control can be done by various methods, such as mechanical, physical, chemical, technical culture, and integrated control. However, the most common method used in corn crops is mechanical and chemical control. Mechanical control is carried out by pulling weeds using your hands or a simple tool such as a hoe. Meanwhile, chemical control uses herbicides to inhibit or kill weed growth. The post-growth herbicides that are often used contain active ingredients such as Atrazin and Mesotrion, which have different ways of working in controlling weeds. Herbicide combinations can be economically beneficial because the herbicide dosage used is lower and ecologically can inhibit the occurrence of weed resistance due to the use of herbicides in the same way continuously (Faudi & Wicaksono, 2018). Herbicides are chemicals used to control, kill, or inhibit the growth of weeds that interfere with major crops. All doses of herbicides can control weeds due to the toxic nature they contain. Nonetheless, herbicides can be toxic to weeds and cultivated plants if not used appropriately. At low doses, herbicides can kill weeds without damaging cultivated crops. Herbicides containing the active ingredient bispiribac sodium are effective for controlling narrow weeds (Zakaria et al., 2019). The response of weeds to herbicides also depends on the type of herbicide used, be it frequency or selectivity (Faudi & Wicaksono, 2018).

CONCLUSION

Weed diversity analysis showed that *E. indica* in lowland corn fields had the highest density value of 38.5 individuals/m^2 with a relative density of 70.43%, while in the highland, the absolute density value decreased by 4.17 individuals/m^2. This can be caused by environmental factors that are not optimal for its growth, one of which is air temperature. Weeds found in lowland and highland will be different; the difference is due to differences in where they grow and other environmental factors. So, it is necessary to compare weeds found in lowlands and highlands. This is to find out the types of weeds that are most commonly encountered or grown in each region. Environmental factors such as climate, altitude, temperature, and humidity will give rise to diverse weeds.

REFERENCES

Agravante, A. S., Alviar, K. B., Ramirez, A. H. A., & Yap, S. A. (2022). Biology of *Spodoptera frugiperda* (JE Smith) (Lepidoptera: Noctuidae) on selected weed species associated with corn in North Cotabato, Philippines. *Philippine Journal of Science*, *151*(5), 2011-2020.

Assa, K. S. A., Tumewu, P., & Tulungen, G. (2017). Inventarisasi Gulma Pada Tanaman Jagung (*Zea mays* L.) Dataran Tinggi di Desa Palelon dan Dataran Rendah di Kelurahan Kima Atas. *COCOS,* 3(1).

Bayyinah, L. N., Pratama, R. A., dan Mutala'liah. 2022. Analisis Vegetasi Gulma Pada Lahan Budidaya Jagung Di Arcawinangun, Purwokerto Timur, Banyumas. *AGROSCRIP.* 4(2), 75-82.

Dahlianah, Inka. 2019. Analisis Vegetasi Gulma Di Pertanaman Jagung (*Zea mays* L.) Rakyat dan Hubungannya dengan Pengendalian Gulma Di Desa Mangga Raya Kecamatan Tanjung Lago Kabupaten Banyuasin. *KLOROFIL. 14(1),* 12-17.

Dari, C. A. W., Hardiansyah, H., & Noorhidayati, N. (2022). Keanekaragaman Jenis Rumput (Genus *Cyperus*) di Kawasan Persawahan Pasang Surut Desa Beringin Kencana Kecamatan Tabunganen. *Wahana-Bio: Jurnal Biologi dan Pembelajarannya*, *14*(2), 65-73.

Faudi, R. T., dan Wicaksono. 2018. Aplikasi Herbisida Berbahan Aktif Atrazin dan Mesotrin Terhadap Pengendalian Gulma dan Hasil Tanaman Jagung Manis (*Zea mays* L. Saccharata) Varietas Bonanza. *Jurnal Produksi Tanaman*, 6(5), 767-774.

Gawaksa, H. P., Damhuri, D., & Darlian, L. (2016). Gulma di lahan pertanian jagung (*Zea mays* L.) di Kecamatan Barangka Kabupaten Muna Barat. *Jurnal Alumni Pendidikan Biologi*, *1*(3).

Irhamni, I., Pandia, S., Purba, E., & Hasan, W. (2017). Kajian akumulator beberapa tumbuhan air dalam menyerap logam berat secara fitoremediasi. *Jurnal Serambi Engineering*, *1*(2).

Juhriyah., Zakariyah., M., & Umar, M. R. (2023). Fitoremediasi Tanaman Hias Bunga *Impatiens balsamina* L., dan *Zinnia elegans* (Jacq.) Kuntze Terhadap Polutan Merkuri pada Tanah:-. *BIOMA: Jurnal Biologi Makassar*, *8*(2), 1-10.

Komarawidjaja, W., & Garno, Y. S. (2016). Peran Rumput Vetiver (*Chrysopogon zizanioides*) dalam Fitoremediasi Pencemaran Perairan Sungai. *Jurnal Teknologi Lingkungan Vol*, *17*(1).

Mollaee, M., Darbandi, E. I., Aval, M. B., & Chauhan, B. S. (2020). Germination response of three Setaria species (*S. viridis, S. verticillata,* and *S. glauca*) to water potential and temperature using non-linear regression and hydrothermal time models. *Acta Physiologiae Plantarum*, *42*, 1-14.

Nurjannah, H., Almaniar, S., Junainah, J., dan Feriadi, F. 2024. Inventarisasi Gulma Dominan Di Lahan Jagung (*Zea mays* L.) Di Desa Sembawa Kecamatan Sembawa Kabupaten Banyumas. *Klorofil: Jurnal Penelitian Ilmu-Ilmu Pertanian*, 19(1), 30-35.

Padang, W. J., Purba, E., & Bayu, E. S. (2017). Periode Kritis Pengendalian Gulma Pada Tanaman jagung (*Zea mays* L.): Critical periode of weed control in Zea mays L. *Jurnal Online Agroekoteknologi*, *5*(2), 409-414.

Peerzada, A. M., Bajwa, A. A., Ali, H. H., & Chauhan, B. S. (2016). Biology, impact, and management of *Echinochloa colona* (L.) Link. *Crop Protection*, *83*, 56-66.

Seng, C. T., Nam, H. C., Norzaidi, N. I., & Giap, S. G. E. (2023). Seed Germination Characteristics as Affected by Interaction of Moisture Stress and Temperature in Sethoxydim-Resistant Biotype of Goosegrass (*Eleusine indica* (L.) Gaertn.) from Malaysia. *Sains Malaysiana*, *52*(7), 1985-1997.

Sepe, M., Suhardi., & Rosa, H. O. (2024). Periode Kritis Kompetisi Tanaman Jagung Varietas Hibrida Terhadap Gulma. *Jurnal Ilmu Pertanian.* 9(1), 88-97.

Turnip., L., & Arico., Z. (2019). Studi Analisis Vegetasi Gulma Pada Perkebunan Kelapa Sawit (*Elaeis guineensis* Jacq.) Di Unit Usaha Marihat Pusat

Penelitian Kelapa Sawit Kabupaten Simalungun Sumatera Utara. *Jurnal Biologica Samudra*, 1(1): 64-73.

Yuliana, A. I., & Ami, M. S. (2020). Analisis Vegetasi dan Potensi Pemanfaatan Jenis Gulma Pasca Pertanaman Jagung. *Jurnal Agroteknologi Merdeka Pasuruan.* 4(2), 20-28.

Zakaria, M. T., Syafii, M., dan Sugiono, D. 2019. Uji Tingkat Efikasi Herbisida Berbahan Aktif Bispiribac Sodium Terhadap Gulma Daun Sempit Pada Tanaman Padi (*Oryza sativa* L.) Varietas Ciherang. *Jurnal Agrotek Indonesia*, 7(2), 28-32.