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BIODIVERSITY OF WEEDS IN POTATO (*SOLANUM TUBEROSUM*) IN PANGALENGAN AND CIKAJANG SUB-DISTRICTS OF INDONESIA

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ABSTRACT: Potato is one of the horticulture crops with the highest economic worth and the steadiest market interests. Weeds can affect agricultural output through competition for nutrients and water, sunlight for photosynthesis, and growing space. This study attempts to comprehend the proliferation of weeds in potato cultivation in West Java's Potato Centers of Pangalengan and Cikajang Subdistricts. The study was done between December 2020 and February 2021 using survey and vegetation analysis techniques. The vegetative analysis demonstrates that the diversity of weeds in potato cropping in the Pangalengan and Cikarang Subdistricts led to precise results. Four kinds of grassy weeds, two sedges, and eight broadleaf weeds were discovered in potato cropping throughout the Pangalengan Subdistrict. Two species of grassy weeds, two species of sedges, and eleven species of broadleaf weeds were discovered in the potato cropping across the Cikarang Subdistrict, which contained a total of fifteen species. The weeds with the greatest SDR (Summed Dominance Ratio) values in these two regions were Cyperus rotundus and Eleusine indica. The species diversity index value (H'), which fell into the medium category, and the community coefficient index value (C), which has significant degrees of difference, also revealed differences in diversity.

KEYWORDS: Cikajang Sub-district, Pangalengan Sub-district, potato, vegetation analysis

INTRODUCTION

Potatoes (*Solanum tuberosum* L.) are one of Indonesia's most important horticultural products. However, its manufacturing rate has yet to reach its optimal level. In 2015, potato production in Indonesia reached 1,219,269 tons, evenly distributed across all provinces. In 2018, according to the same data from the Indonesian Central Statistics Bureau, West Java was Indonesia's most significant producer of potatoes, with a net production of 259,228 tons. Despite this, the trend of potato output in West Java is downward. According to data from the Indonesian Central Statistics Bureau[1], in 2018, net production decreased from 261,967 tons in 2012 to 245,337 tons in 2014.

Culturing superior varieties with high productivity and disease resistance features and controlling plant pests can improve potato productivity (del Mar Martínez-Prada *et al*., 2021). The existence of other pests like weeds in agricultural land will cause competition in using factors of growth between cultivated plants and weeds (Mukhtar Iderawumi, 2018). Weeds can reduce crop yield through competition regarding needs for nutrients and water, sunray for photosynthesis, and growing space (Korav *et al*., 2018). Weeds in the cultivation area can cause a loss in quality and quantity of production.

Weeds are one of the causing problems of potato production decrease. They refer to plants inhibiting or harming cultivation that, by extension, bother or harm human interests so that humans try to control them. Types of weeds include grassy weeds, sedges, and broadleaf weeds (Meirista *et al*., 2018).

Various factors influence the types and diversity of weeds in the land, including soil

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or soil humidity and crown condition. Cultural control practices will influence the degrees of competition between weeds to cultivated plants. It is further stated that the density of weeds growing in agricultural lands varies according to the season. During the rainy season, water reserves are plenty and, in turn, increase weed population, and vice versa (Bir *et al*., 2014).

The diversity of weeds is strongly influenced by the environment in which such weeds grow. Several factors that affect weed diversity are the type and level of soil fertility, temperature, the height of the premises, mode of cultivation, seeding methods, water management, tillage, and weed control (Cahyanti & Etica, 2020; Kurniadie *et al*., 2018).

Weed diversity and distribution are strongly influenced by various factors such as climate and meteorological conditions (length of vegetative season, air temperature, rate, and rainfall distribution). In addition, cultivation techniques such as loosening the soil can affect the spread, variability, and density of weed growth in the yard (Juraimi *et al*., 2011; Romaneckas *et al*., 2021)60 and 90 DAS. The difference in the level of condition factors that support the growth and spread of weeds causes the diversity of weed vegetation in each country to be different (Rahayu *et al*., 2019)Bantul, Yogyakarta from December 2016 to May 2017. The study used a completely randomized block design with 2 factors with three replications. The first factor was corn cultivar, consisting of four cultivars (Bisi 18, NK 33, DK 95 and Sukmaraga.

The relatively more significant proportion of use of organic fertilizer or manure, especially in annual horticulture, has the potential to spread weeds as a source of infestation if manure or organic fertilizer is not treated thoroughly (Bajwa *et al*., 2014). In addition to processing, organic fertilizer can affect the distribution level and the types of weeds that will grow in the yard. Research by Patel *et al*., (2018) shows that manure can reduce weed growth populations compared to other types of natural fertilizers.

Potatoes grown without mulch will increase the likelihood that weeds will grow, so weed control is necessary to prevent more significant output losses. The species and density of weeds, the competition's length, and the weeds' allelopathic release all affect yield reduction. Overall, weeds cause more crop loss than pests and illnesses combined. Even so, their losses are typically estimated since weeds' effects are only sometimes apparent. Numerous studies have revealed a negative relationship between dry weed weight and crop production (Rahman *et al*., 2017). This study aimed to identify the biodiversity of weeds in potato cultivation in Pangalengan and Cikajang sub-districts, Indonesia.

MATERIALS AND METHODS

Area of Study and Experimental Site

The research was conducted from December 2020 to February 2021 in potato fields in Cikajang and Pangalengan Sub-districts. Pulosari and Cikadang villages were selected as the places to conduct vegetation analysis. Five potato fields with different agro climates and agroecological conditions were selected for this research in one village.

The Geographical Conditions of Study Sites

Observations in Pulosari village, Pangalengan Sub-district, Bandung regency found it at an approximate altitude of ±1460 m asl (meter above sea level). The altitude of the location observed is not the general requirement for necessitating the growth of Cyperus rotundus, usually found at lowlands

with 1000 m asl altitude. However, based on land characteristics, the weed prefers growing in an open place or places not exposed to direct sunlight, such as humid agricultural lands, fields, gardens, moors, or roadsides. Pangalengan Sub-district, located on a plateau or mountain area, has a cool climate, ranging from 16 °C to 25 °C. In 2020, rainfall in this area was measured to be 1.996 mm/ year with an average of 5.47 mm/day. The highest rainfall was recorded in February, measuring 11.61 mm/day, while the lowest was recorded in July, measuring 0.34 mm/ day. Also, in the year, the highest days of rain occurred in February, while the lowest days occurred in July, based on Pangalengan Local Statistics.

Cikajang Sub-district, located on a plateau or mountain area, has a cool climate, ranging from 24 ºC to 29 ºC. In 2020, rainfall in this area was measured to be 1,736 mm/year with an average of 4.83 mm/day. The highest rainfall was recorded in March, measuring 7.2 mm/day, while the lowest was recorded in July, measuring 1.9 mm/day. Also, in the year, the highest days of rain occurred in March, while the lowest days occurred in July, based on Cikajang Local Statistics.

Pangalengan and Cikajang Sub-districts are in plateaus with good soil fertility, enabling them to grow and cultivate agricultural commodities. Pangalengan Sub-district has an andisol type of soil. Its spread is limited to surrounding or near volcanoes (Hartono *et al*., 2019), while the Cikajang Sub-district has an andosol associate soil type (Randriani *et al*., 2014)komponen buah, komponen biji, dan hasil biji beras pada tanaman kopi merupakan hal penting dalam program pemuliaan dan seleksi. Model saling keterkaitan antar karakter tersebut adalah model sebab-akibat dan dapat dianalisis melalui analisis lintasan bertahap (ALB.

Methods of Data Collection

The research used a qualitative method in the form of a weed survey and a quantitative method in identification. The researchers selected five horticultural plant areas with potatoes as produce in one village in each sub-district, with diverse agro climate and agroecological conditions. Vegetation analysis was conducted once in each sample location with plots distributed in the lower right, lower left, upper right, upper left, and center of the field for each area of the potato field with the Quadrate Sampling Technique method on a double plot, with the quadrant measurement used is 0.5 m × 0.5 m. At the time of analysis, the potato crops were aged ±30 days.

Diversity Index (H') Analysis

Determination of the Diversity Index (H') is carried out based on the method of Shannon-Wiener with calculations using the formula (1) based on research conducted by Nolan & Callan (2006).

$$H' = -\sum_{i=1}^{s}(pi)(\ln pi) \ldots\ldots\ldots\ldots\ldots (1)$$

As well as H′ = diversity index, *pi* = The sum of the important values of a species/ the sum of the important values of all species, ln = Logaritme natural.

Community Coefficient (C) Analysis

The Community Coefficient (C) was measured using the formula by Sumekar & Widayat (2021) shown in (2).

$$C = \frac{2W}{a+b} \times 100\% \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

As well as C = Community Coefficient, W = the sum of the two lowest quantities for species from each community, a = the sum of all the quantities in the first community, b = the sum of all the quantities in the second community.

Summed Dominance Ratio (SDR) and Important Value Index (IVI) Analysis

Summed dominance ratio value is calculated using formula (3) & (4) based on Satriawan & Fuady (2019).

$$SDR = \frac{Importance\ value\ index\ (IVI)}{Number\ of\ spices} \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

IVI = Relative Density + Relative Frequency + Relative Dominance.....(4)

RESULTS AND DISCUSSION

Results revealed the presence of 14 weed species in Fields 1-5 at Pangalengan Sub-district, consisting of four species of grassy weeds (*Cynodon dactylon, Eleusine indica, Paspalum conjugatum, Digitaria sanguinalis*), two species of sedges (*Cyperus rotundus, Erigeron sumatrensis retz)*, and eight species of broadleaf weeds (*Portulaca oleracea, Galinsoga parviflora, Richardia brasiliensis, Drymaria villosa, Erechtites sp., Alternanthera sessilis, Calopogonium mucunoides Desv, Alternanthera philoxeroides).* In this list, the dominant weeds in Pangalengan fields were *Cyperus rotundus, Cynodon dactylon, Eleusine indica,* and *Galinsoga parviflora* (Table 1).

In contrast to Pangalengan, the data in Table 1 shows that there are 15 species of weeds found in Cikajang. Two types of grass weeds (*Cynodon dactylon, Eleusine indica*) were recorded, two types of reed grass (*Cyperus rotundus, Oxalis latifolia*), and 11 types of broadleaf weeds (*Portulaca oleracea*, *Artemisia vulgaris* L, *Galinsoga parviflora*, *Alternanthera sessilis*, *Erechtites sp.*, *Amaranthus spinosus* L, *Celosia argentea*, *Drymaria villosa*, *Ageratum conyzoides, Hydrocotyle leucocephala*, and *Richardia brasiliensis*). The dominant weeds in

Table 1. Average of Importance Value Index, Summed Dominance Ratio, Species Diversity Index, and Dry Weight of Weed in Pangalengan and Cikajang sub-districts

No.	Name of Species	Importance Value Index (%)		Summed dominance ratio (%)		Species Diversity Index (H')		Weight Dry Weeds (g/0,25 m^2)	
		CKJ	PNG	CKJ	PNG	CKJ	PNG	CKJ	PNG
1	*Ageratum conyzoides*	5.13	-	0.34	-	0.019	-	0.02	-
2	*Alternanthera philoxeroides*	-	155.99	-	10.4	-	0.235	-	0.92
3	*Alternanthera sessilis*	262.09	101.05	17.47	6.74	0.305	0.182	4.04	0.32
4	*Amaranthus spinosus* L	20.19	-	1.35	-	0.058	-	0.06	-
5	*Artemisia vulgaris* L	37.82	-	2.52	-	0.093	-	0.34	-
6	*Calopogonium mucunoides* Desv	-	137.56	-	9.17	-	0.219	-	0.4
7	*Celosia argentea*	9.13	-	0.61	-	0.031	-	0.02	-
8	*Cynodon dactylon*	114.53	223.44	7.64	14.9	0.196	0.284	2.58	4.86
9	*Cyperus rotundus*	42.66	281.94	2.84	18.8	0.101	0.314	1.24	4.84
10	*Digitaria sanguinalis*	-	13.66	-	0.91	-	0.043	-	0.22
11	*Drymaria villosa*	101.17	75.23	6.74	5.02	0.182	0.150	0.38	0.78
12	*Eleusine indica*	337.55	212.66	22.5	14.18	0.336	0.277	6.82	2.42
13	*Erechtites* sp.	89.56	5.16	5.97	0.34	0.168	0.020	1.78	0.1
14	*Erigeron sumatrensis* retz.	-	11.93	-	0.8	-	0.038	-	0.1
15	*Galinsoga parviflora*	311.25	227.95	20.75	15.2	0.326	0.286	4.66	2.56
16	*Hydrocotyle leucocephala*	5.13	-	0.34	-	0.019	-	0.02	-
17	*Oxalis latifolia*	112.98	-	7.53	-	0.195	-	0.42	-
18	*Paspalum conjugatum*	-	6.82	-	0.45	-	0.025	-	0.04
19	*Portulaca oleracea*	34.12	40.49	2.27	2.7	0.086	0.098	0.2	0.74
20	*Richardia brasiliensis*	16.69	6.12	1.11	0.41	0.050	0.022	0.08	0.08
Total value		1500	1500	100.0	100.0	2.166	2.193	22.660	18.380

Note : CKJ : Cikajang; PNG : Pangalengan

Cikajang were *Alternanthera sessilis, Galinsoga parviflora, Drymaria villosa*, and *Eleusine indica*.

Summed Dominance Ratio (SDR) and Important Value Index (IVI)

Cyperus rotundus (18.80 %) was the weed with the highest SDR in Pangalengan. It is included in *the Cyperaceae* family (sedges). *Cyperus rotundus* is a C4 weed, marked by high photosynthetic efficiency, which causes it to be more bothersome than C3 weeds (Baloch, 2015). The damaging effects of *Cyperus rotundus* on eco-nomically-important vegetable produce and crops are significantly visible. The weed works differently in different crops, and therefore an interspecific solution between *Cyperus rotundus* and different vegetables shows the negative impact of the weed on the vegetable yield. For instance, an 89% decrease in onion yields, 62% decrease in okra yields, 39-50% decrease in carrot yields, 43% decrease in cucumber yields, and 35% decrease in cabbage yields are reported when grown on a field full of *Cyperus rotundus* (Du *et al*., 2019)which infests peanut fields in south China and causes considerable peanut yield losses. Information on the interference of purple nutsedge on peanut and its economic threshold (ET. In addition to the damage caused, *Cyperus rotundus* has adaptive characteristics where this weed can grow strong and fertile in tropical and subtropical agricultural land (Peerzada, 2017; Sutomo & Fardila, 2015).

The high SDR value in *Cyperus rotundus* is because this weed has broad growing power with fibrous roots that can grow to a soil depth of 40 cm and reproduce horizontally with large areas with rhizome organs (Baloch, 2015).

Various attempts have been made to deal with this weed either by crop rotation with bean plants to tillage either manually using a hoe or using a machine due to failure to remove weeds to the root tubers where these organs can last up to two years in the soil as long as moisture conditions are met. In addition, different tuber sizes correlate with different dormancy levels, the most critical adaptive factor that allows *Cyperus rotundus* to cope with a less conducive environment (Baloch, 2015; Ravisankar *et al*., 2017). *Under favorable conditions, a plant originating from a single tuber can multiply into 100 or more tubers in approximately 100 days* (Baloch, 2015; Ravisankar *et al*., 2017).

Unlike the Pangalengan area, *Eleuisine indica* (22.50 %) has the highest SDR value in Cikajang. It is included in the *Eleusine* genus of the *Poaceae* family. It is a seasonal grass with strap-shaped leaves (Zakri *et al*., 2021). It forms a dense, slightly widened, low clump since it grows in clumps and has a fibrous rooting system. Its leaves are green and have silvery color on their base, with an elongated shape and folded strands (Boyd *et al*., 2020). In the leaf, surface fluffs are nearly not found. The weed has panicles that appear serrated. The seeds are arranged like bunches on flower stalks. In each panicle, there exist 3-7 bunches at the end of the stem with more than 50,000 seeds (Breeden *et al*., 2017).

The planting pattern in Cikajang uses rotation with carrots. Here, tillage is still performed manually. Even though plant rotation is conducted, the weed will remain flowering each year, with each plant producing up to 140,000 seeds each season (Lee & Ngim, 2000; Nambela, 2019)this weed could be easily controlled by glyphosate at 720 g isopropylamine salt ha-1. In late 1997, a fruit grower in Teluk Intan, Perak, Malaysia, reported that glyphosate failed to give adequate control of E indica in his four-year-old orchard. In response to the grower's feedback, an on-site field trial was initiated to evaluate the efficacy of glyphosate at 720 to 5760 g salt ha-1 for control of the

weed. Results from this trial confirmed the grower's observation. Glyphosate at 5760 g salt ha-1 gave only about 25% control of E indica ('Teluk Intan' biotype.

In this experiment, a direct test on the field was conducted in the form of soil observation. It was found that the average pH was 5.92 with 55% humidity, therefore classifying the soil as suitable for the classification of tools used for the potato crop.

Potato fields in Cikajang have humid characteristics due to low temperatures. It correlates positively with the weed's growth requirement, in which it can grow on a humid or not too dry and open or a little shaded land. Garut regency's rainfall, amounting to more than 1000 mm annually, includes this area in the C category, according to Schmidt-Ferguson, or dampish. The weed's area of spread, which covers the land with 0-1600 m asl altitudes, is suitable for the location of Cikandang village, Cikajang Sub-district, Garut regency, which has an approximate altitude of ±1380 m asl (Breeden *et al*., 2017).

Weed control on potato crop fields in Pangalengan and Cikajang is performed using mechanical and chemical means. Mechanical control is performed ±30 days after planting, while chemical control uses Roundup™ herbicides. *Roundups*™ is a herbicide that uses glyphosate-active ingredients often used globally. Glyphosate (N-phosphonomethyl-glycine) controls weed and perennial grass in various farming crops, such as rice, corn, and soy (Baer & Marcel, 2014; Kanissery *et al*., 2019). It inhibits plant metabolism, especially in synthesizing amino acids (Kőmíves & Schröder, 2016). The plant will wither, turn yellow, and die some days after spraying. Glyphosate herbicide contains chemical ingredients that make it stay on the leaves, enabling it to move from the plant surface to the plant cells.

In general, broadleaf weeds were the most found type of weeds. It was high in population and quite dominant. *Asteraceae* is included in annual, widely scattered weed. Weeds belonging to this family are considered malignant, therefore explaining their often dominance over other wild plants in one land (Araújo *et al*., 2021).

Broadleaf weeds are plants that play a vital role in the stability of the ecosystem in an area, one of which is to prevent soil erosion in an area (Lenka *et al*., 2017). Broadleaf weeds can also grow well in a tropical continent with high-intensity sunlight, which is most relevant with open potato lands since sunlight is the primary energy source in helping photosynthesis, a food production process for the plant (Khan *et al*., 2020)"ISSN": "21680485","abstract":"Biodegradable mulches are considered a promising alternative to polyethylene-based, nonbiodegradable mulch for sustainable agriculture. In the present study, a bioactive 2-methyl-4-cholorophenoxyacetic acid/poly(3-hydroxybutyrate-co-3-hydroxyvalerate.

Types with high relative frequency values also have a high density and tend to occupy a wide area. Generally, plants with the highest importance value index (IVI) have better-adapting power, competition power, and reproduction capability than other plants in a particular land (Didita *et al*., 2010; Ismail *et al*., 2017).

Species Diversity Index (H')

This research used Shannon-Wiever's Species Diversity Index (H') value, which employed criteria in further meaning interpretation. H' value usually approximates from 0-7. H' < 1 is considered very low, H' > 1-2 is considered low, H' < 2-3 is considered medium, H' > 3-4 is considered high, and H' > 4 is considered very high.

Data in Table 1 show that Species Diversity Index (H') value in Pangalengan amounted to 2.19, therefore considered medium. Species diversity consists of two components: the number of species in a community, usually called species wealth, and species similarity. The similarity here refers to the abundance of individuals of one type. Data in Table 1 show that Species Diversity Index (H') value in Cikajang was found to amount to 2.16, therefore considered medium, with the same components of species diversity: the species wealth and similarity.

Several factors can influence the type and diversity of weeds in the land, including soil type and crown condition. Cultural control practices will influence the degrees of competition between weeds to cultivated plants. It is further stated that the density of weeds growing in agricultural lands varies according to the season. During the rainy season, water reserves are plenty and, in turn, increase weed population, and vice versa (Bir *et al*., 2014).

Species diversity indices of the two sub-districts are included in the medium category, following the reference index by Barbour *et al*. (1987). This condition follows the research of Furtak & Gałązka (2019) and Haq *et al*. (2022), stating that a specific range of environment also has specific edaphic parameters, meaning that soil nutrients in the location of the study are not distributed so that even distribution of species living on it is not possible. Based on the observation and analysis results, it was apparent that components of species wealth or types of species living in the location of the study are pretty high.

Community Coefficient Index (C)

The index of the coefficient of community similarity ranges from 0 to 100%. The nearer to 100% the number, the higher the stand condition is compared. From the community similarity value (IS) obtained, the coefficient of community dissimilarity (ID) can be calculated using the formula of 100 – IS. Density, biomass, crown placement, or IVI can be used to calculate IS.

Table 3 shows the weed dominance index (C) in the Pangalengan and Cikajang Sub-districts, which amounts to 54.64% or can be said to have a high degree of difference. Based on the benchmark value in Table 2, the value of the weed dominance index is included in the category level of Similar in the level of community similarity. The existence of high difference levels of weeds is because species growing in Pangalengan did not grow in Cikajang.

Species that show dominance in a plant community state the level of species domination (Avolio *et al*., 2019). Dominance states the main plant species that influence and control the community. The dominance of a plant species is shown through its large population, the larger diameter of its stem, and dominant growth.

Table 2. Community Coefficient Benchmark Value

Benchmark Value	Information
91%-100%	There is a very high community similarity
71%-90%	There are similarities in the same community
56%-70%	Similar level of community similarity
45%-55%	Low level of similarity or different
<45%	Very different degree of similarity

Table 3. Coefficient Community value in Pangalengan and Cikajang sub-districts

Compound	Value
W	54.64
A (Cikajang)	100
B (Padalarang)	100
C (%)	54.64

Note : W: The sum of the two lowest quantities for the type of each community, a : The sum of all the quantities in the first community, b : The sum of all the quantities in the second community, C : Community Coefficient (%)

According to Kaur *et al*. (2018), weeds can reproduce and survive more than the main plant because they have special characteristics, including having quite a rapid pace of reproduction both vegetatively and generatively.

Dry Weight of Weed

Data in Table 1 show that the weed species having the total weight in all observed fields in Pangalengan is *Cynodon dactylon,* while those in Cikajang are *Eleusine indica.* Total dry weight in all observed fields amounted to 18.38 g, while those in Cikajang amounted to 22.66 g.

Research results show that results in Pangalengan and Cikajang Sub-districts were found to have little difference since two control mechanisms are used in the two places: mechanical and chemical control. Both areas used Roundup™ herbicide, a type of pre-growth herbicide. Spraying was performed before tillage in the initial stage of soil preparation. This condition conforms to Matloob *et al*. (2020) and Singh *et al*. (2022) who stated that weeds interact with plants through competition to obtain one or more limited growth factors such as light, nutrients, and water. This condition also fits to statement by Hussain *et al*. (2018)the efficacy of mechanical weed control has been reevaluated. Tillage (used for soil preparation for planting that mechanical control of weeds can suppress weed growth by damaging part of the plant until they die or until their growth is inhibited.

Weed growth is a complex combination, which is a process of growth leading to plant dry weight accumulation. This condition is because the weed's vegetative growth greatly influences dry weight. If the vegetative growth rises, then the dry weight rises also. There are many factors influencing weed closing and dry weight on cultivation lands. Intensive land use will make weed closing and dry weight rise, but both will drop with plowing or flipping soil over.

Weeding activities can reduce competition between weeds and the main crop. Reducing the number of weeds spread in one area plot can reduce the intensity of competition for nutrients, water, and light to provide growing space and better facilities for the main crops for growth and development (Gosh *et al*., 2021; Swanton *et al*., 2015).

The dry weight of weeds tends to increase again during harvest. This condition happens when the wedding is not performed. In succeeding development, weed develops fast and starts showing active growth, so the weed population reflects the more significant weed density (Baloch, 2015).

CONCLUSION

The results of the vegetative analysis revealed that the populations of weeds on potato plants in the districts of Pangalengan and Cikajang were distinct. Pangalengan has 14 varieties of weeds, including four types of grasses, two types of grasses, and eight types of broadleaf weeds. In Cikajang, there are 15 types of weeds, including two types of grasses, two types of weeds, and two types of weeds. *Cyperus rotundus* and *Eleusine indica* obtained the region's highest Summed Dominance Ratio (SDR) values. The species diversity index (H') values of 2.16 and 2.19, which fall within the medium category, and the community coefficient index value (C) of 54.64% also reveal differences in biodiversity. Due to variations in land conditions, this number has a large margin of error (micro-climate). The anticipated outcome of this research is that it can serve as a reference for applying methods and chemicals for effective and efficient weed control. With the information obtained from identifying the spread of weed development, it is intended

that the methods and materials for weed control will be applied with precision.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest

ETHICAL STATEMENT

This article does not contain any studies with human participants or animals performed by any of the authors

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