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Weed Vegetation Analysis Based on Sdr and Ivi in Peanut (*Arachis hypogaea* L.) Fields of Cipocok Jaya District, Serang.

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Abstract. Peanut (*Arachis hypogaea* L.) is an important agricultural commodity with high economic value and serves as a significant source of protein. This study aimed to identify dominant weed species based on the Summed Dominance Ratio (SDR) and Importance Value Index (IVI) in peanut cultivation areas. The research was conducted from August to October 2025 at the Link Beberan farmer group field in Banjaragung Village, Serang, Banten. The quadrat method was applied using 20 randomly selected plots measuring 1 × 1 m². The results identified 15 weed species belonging to nine families, with a total of 614 individuals consisting of grasses and broadleaf weeds. *Rottboellia cochinchinensis* was the most dominant species, with 241 individuals m^{-2} and a relative density of 39.22%. The highest relative frequency was also recorded for *Rottboellia cochinchinensis* and *Richardia brasiliensis*, each at 20.83%. *Rottboellia cochinchinensis* exhibited the highest IVI (87.10) and SDR (29.03%) values, indicating strong dominance. Weed diversity was categorized as medium (H′ = 1.58). Differences in dominance levels reflect interactions between weed biological traits and local environmental conditions.

Keywords: *Frequency value, Importance Value Index (IV), Peanut plant, Summed Dominance Ratio (SDR), Weed*

INTRODUCTION

Indonesia is an agrarian country rich in food sources in the agricultural sector, one of which is peanuts (*Arachis hypogaea* L), which are high in protein and have economic value. Peanuts are a type of legume that contains vegetable protein, such as fat (40-50%), protein (27%), carbohydrates and vitamins (A, B, C, D, E and K). In addition, they also contain minerals such as Ca, Ci, Fe, Mg, P and K, which have many health benefits (Komala et al., 2024). One agricultural commodity that can help increase income and welfare is peanuts. Peanuts are a type of legume that has considerable strategic potential for development in Indonesia. Peanuts are an important commodity as a source of nutrition for the community because they contain high levels of vegetable protein, so the demand for peanuts from the processed food industry is increasing every year. This will spur an increase in the income of farmers in various regions that cultivate peanuts (Haqia and Suhesti, 2024).

The presence of weeds in crop areas can interfere with growth by competing for space, nutrients, water and sunlight, thereby reducing productivity (Sobari and Fatkurohman (2017). Competition between peanuts and weeds affects the number of pods, pod weight and peanut seed weight. In addition, the critical period of competition between peanuts and weeds occurs when the plants are 14-35 days old after planting (Adli et al. 2018). Weeds have superior physiological properties such as high germination and pollination rates and are quick to adapt to the environment. This causes disruption to the crop if weeds are present in the cultivation area (Oksari, 2017). In addition, weeds also compete with the main crop for water, light, space, and nutrients (Duwadi et al., 2021). The main principle for controlling weeds on cultivated land is to suppress the weed population before it harms the crops. Weed control on peanut cultivation land commonly practised by farmers today is through weeding and herbicide spraying. These efforts are still ineffective and inefficient due to farmers' lack of understanding of the vegetation of weeds that grow, resulting in inappropriate weed control methods (Shintarika, 2021).

Imaniasta et al. (2020) stated that the identification, description and recognition of dominant weed species are the first and important steps in determining the success of weed control. Given that each weed species has different biological, morphological and ecological characteristics.

Research on weed vegetation analysis using the Summed Dominance Ratio (SDR) and Importance Value Index (IVI) in wet tropical peanut cultivation, particularly in Serang City, remains limited. Previous studies have largely emphasized herbicide effectiveness without comprehensively examining weed community structure and ecological dominance mechanisms. This study offers novelty through the application a community ecology approach integrating density, frequency, biomass dominance, SDR, IVI, and the Shannon–Wiener diversity index to describe weed community structure more comprehensively. The findings provide ecological insights into dominant species, particularly *Rottboellia cochinchinensis*, whose dominance is influenced by biological traits, spatial distribution, biomass accumulation, and adaptation to wet tropical conditions with high rainfall and humidity (Snoe et al., 2025). This study is expected to contribute to the development of ecologically based and locally adaptive weed management strategies in Serang City.

RESEARCH METHODOLOGY

This research was conducted from September to November 2025 in Link Beberan, Banjaragung Village, Cipocok Jaya District, Serang City, Banten Province. The topography of Cipocok Jaya is mostly flat, with an average elevation of less than 500 metres above sea level. The soil type is clay with a crumbly structure, the average air temperature ranges from 26.9°C to 28.1°C, and the average annual rainfall is 150.30 mm/year. Using the Universal Transverse Mercator (UTM) coordinate system Zone 48E, the Serang City area is located at coordinates 618,000m to 638,600m from west to east and 9,337,725m to 9,312,475m from north to south. The tools used in this study were wooden stakes, knives, measuring tape, brown envelopes, raffia rope, stationery, camera, an oven, analytical scales, and a weed identification book entitled A Guide Book to Invasive Plant Species in Indonesia by the Research, Development and Innovation Agency of the Ministry of Environment and Forestry of the Republic of Indonesia in 2015, the picturethis application, and camera. While the materials used in this study were peanut plants and weeds.

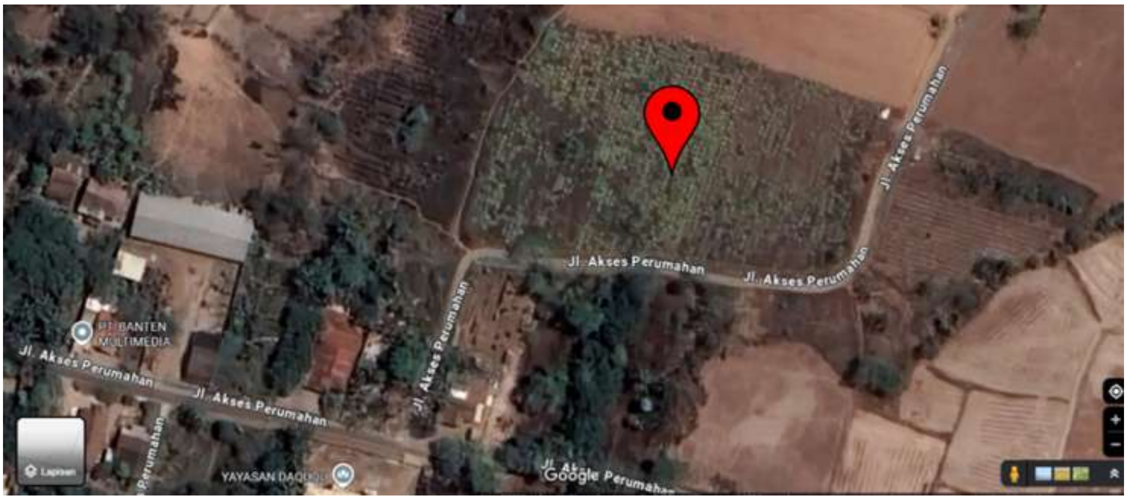

Figure 1. Research GPS Coordinates

Methods

This study was conducted through a series of systematic procedures to obtain accurate data on the weed community structure in peanut cultivation areas. The initial stage involved direct field observation, including determination of the sampling technique, observation of peanut plant characteristics, land area measurement, assessment of environmental conditions, and identification of commonly applied weed control methods. This study were established by installing wooden stakes at each corner to delineate plot boundaries. Each 1 × 1 m^{-2} plot required four wooden stakes and raffia rope tied to form a square. A random sampling method was used to determine 20 plots at 20 different points, each labeled accordingly. Weed sampling was performed within these randomly distributed plots to represent the spatial variability of the weed community in peanut fields.

Weed removal and observations were conducted weekly in the morning during the vegetative phase (7–14 days after planting) and the generative phase (40 days after planting) to capture variations in weed emergence. Data obtained from both phases were integrated into a single analysis to provide a comprehensive overview of the weed community structure throughout the growing season. Identification was performed in each plot after recording the weed species and the number of individuals per species. The collected weeds were separated based on their morphological characteristics and documented using the PictureThis application. All weed samples were oven-dried at 40°C and 80°C for 2 × 24 hours to reduce moisture content and obtain dry biomass, after which the samples were weighed to determine their dry weight. Absolute and Relative Density, Absolute and Relative Frequency, and Absolute and Relative Dominance. Weed diversity was then analyzed using the Shannon–Wiener Index formula (1949) to determine the level of diversity of the observed community were calculated according to established formula :

a. Density of a type of weed

Absolute Density (AD) = $\frac{\textit{The number of individuals of a species}}{\textit{Wide observation area}} \times 100\%$

Relative Density (RD) = $\frac{\textit{The number of individuals of a species}}{\textit{Wide observation area}}$

b. Frequency

- Absolute Frequency (AF) = $\frac{\textit{Number of sample plots filled}}{\textit{The total number of sample plots taken}} \times 100\%$
- Relative Frequency (RF) = $\frac{\textit{Absolute dominance value of weed species}}{\textit{The total absolute frequency of all species}} \times 100\%$

c. Dominance

- Absolute Dominance (AD) is the total dry weight of a weed species calculated from all sample units..
- Relative Dominance (RD) = $\frac{\textit{Absolute dominance value of weed species}}{\textit{The total absolute dominance value of all species}} \times 100\%$

d. Summed Dominance Ratio (SDR*)*

$$SDR = \frac{IVI}{3} \times 100\%$$

e. Important Value Index (IVI)

IVI = Relative Density + Relative Dominance + Relative Frequency

f. Diversity Index (*H′*)

Analysis of weed species diversity was conducted using the Shannon-Wiener Index (1949), as expressed by the following formula:

$$H' = -\sum\left(\frac{ni}{N}\ln\frac{ni}{N}\right)$$

Description:

H’ = Diversity Index

Ni = IVI of the i-th species / number of individuals of the i-th species

N = Total IVI / total number of individuals

The H’ values were classified as follows:

< 1	: low diversity
1<H’< – 3	: medium diversity
H’>3	: high diversity

The collected data were subsequently processed using Microsoft Excel.

RESULTS AND DISCUSSION

Weed Composition in Peanut Planting Areas (Arachis hypogaea L.)

Weeds found on peanut plantations owned by farmer groups in Cipocok Subdistrict, Serang City, Banten. These are classified as grasses with broad leaves. The composition of broad-leaved weeds consists of 8 families, 10 species, and 336 individuals. Grass weeds comprise 1 families, 5 species, and 279 individuals. Meanwhile, weeds classified as sedges, ferns, and narrow-leaved plants were not found in the peanut fields. Thus, the total number of weed individuals found was 615. The entire composition and structure of these weed species can be seen more clearly in **Table 1**. There were 15 weed species found, namely *Richardia brasiliensis, Rottboellia cochinchinensis, Digitaria sanguinalis, Melochia corchorifolia, Ipomea triloba,, Mimosa pigra, Cynodon dactylon, Cerastium glomeratum, Croton hirtus, Cleome rutidosperma, Ehrharta erecta, Emilia sonchifolia, Bidens pilosa, Eleutheranthera ruderalis, Eriochloa.*

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Table 1. Weed composition in peanut plantations in Cipocok Jaya District, Serang City

No	Family	Species	Group	Individual (m^2)
1	Rubiceae	*Richardia brasiliensis*	Broadleaf	230
2	Poaceae	*Rottboellia cochinchinensis*	Grass	241
3	Poaceae	*Digitaria sanguinalis*	Grass	25
4	Malvaceae	*Melochia corchorifolia*	Broadleaf	34
5	Convolvulaceae	*Ipomea triloba*	Broadleaf	26
6	Cleomaceae	*Mimosa pigra*	Broadleaf	14
7	Cleomaceae	*Cleome rutidosperma*	Broadleaf	5
8	Poaceae	*Cynodon dactylon*	Grass	8
9	Poaceae	*Ehrharta erecta*	Grass	3
10	Caryophyllaceae	*Cerastium glomeratum*	Broadleaf	8
11	Euphorbiaceae	*Croton hirtus*	Broadleaf	9
12	Asteraceae	*Emilia sonchifolia*	Broadleaf	6
13	Asteraceae	*Bidens pilosa*	Broadleaf	2
14	Asteraceae	*Eleutheranthera ruderalis*	Broadleaf	2
15	Poaceae	*Eriochloa*	Grass	1
				614

Weed Vegetation Results (Density, Frequency, and Dominance)

Based on the results of weed vegetation analysis, the weed vegetation structure was obtained on peanut fields owned by farmer groups in Cipocok Jaya Subdistrict, Serang City, Banten. The highest absolute density (AD) value was found in the *Rottboellia cochinchinensis* species, at 241 individuals/m^2 with a relative density (RD) of 39.22%. Meanwhile, the lowest absolute density (AD) value was found in the *Eriochloa* species, at 1 individual with a relative density (RD) of 0.16%. The density value of a species in a given plot area is a representation of the species units in a planting area. It can be seen that the density of *Rottboellia cochinchinensis* weeds is very high, which is influenced by soil conditions and rainfall. According to Hamid et al. (2024), vegetation density values indicate the number of vegetation species in a particular area. This density indicates the number of vegetation types in each ecosystem. Differences in density values can be caused by variations in the reproductive capacity, distribution, and adaptation of vegetation to their respective ecosystems.

The weed species *Rottboellia cochinchinensis* was found in large numbers in almost all research plots. Based on the research conducted, the soil conditions in peanut plantations have a clay soil structure, which is very fertile, resulting in rapid and diverse weed growth. Rainfall at the research site ranged from 150.30 mm/year. Therefore, based on the environmental factor analysis conducted, weed growth is greatly influenced by soil conditions and rainfall. *Rottboellia cochinchinensis* is a grass species from the Poaceae family. Based on its morphological characteristics, the *Rottboellia cochinchinensis* species has taproots, an upright stem that can grow tall, and leaves with broad midribs and rough edges. This weed is considered an invasive weed due to its ability to grow very quickly, which can cause crop failure on agricultural land. The rapid spread and high growth of weeds cause problems, especially as they are dominant weeds on agricultural land (Saroyo et al., 2022). In line with the research by Hassemer et al. (2016), the presence of *Rottboellia cochinchinensis* causes substantial crop yield losses. This species is considered an aggressive invader of important crops such as maize, soybeans, rice, and peanuts, causing significant economic losses because it is highly resistant to various control methods.

Climate change contributes to an overall increase in weed pressure while modifying the nature of competition within agroecosystems, with a shift from competition dominated by light competition towards competition more influenced by water and nutrient availability. Savic et al., (2025) Weed species with high ecological plasticity gain a competitive advantage due to their ability to adjust biomass allocation, growth patterns, and phenology, enabling them to survive and compete even when limiting resources change. This high plasticity explains why some weed species tend to become dominant under various agroecological conditions, while species with lower stress tolerance gradually decline in importance within agroecosystem communities.

The highest absolute frequency (AF) of weeds was found in two species, *Rottboellia cochinchinensis* and *Richardia brasiliensis*, with 20 individuals/m^2 and a relative frequency (RF) of 20.83%. The weed species *Rottboellia cochinchinensis* and *Richardia brasiliensis* were frequently found in every research plot. The potential for weeds in one place is very high due to many factors, including the soil cultivation system (Oksari, 2017). Meanwhile, the lowest weed frequency values were found in eight species, including *Cleome rutidosperma*, *Ehrharta erecta*, *Bidens pilosa*, *Eleutheranthera ruderalis*, and *Eriochloa* at 1 individual/m^2 with a relative frequency of 1.04%. The frequency value describes the life of a plant species in a particular area. Species that are evenly distributed have a high frequency value, while species with a low frequency value have an uneven distribution pattern (Dahlianah, 2019).

The highest dominance value was obtained for the weed species *Rottboellia cochinchinensis* with an absolute aominance (AD) value of 104.47 grams, and the lowest value was for the weed species *Eriochloa* with a value of 3.32 grams, while the highest relative dominance (RD) value was for *Rottboellia cochinchinensis* with a dominance value of 39.22%. and the lowest relative dominance was for the weed species *Eriochloa* with a value of 0.16%. Knowing the dominance values is useful for determining the most effective control method (Mawandha et al., 2019).

Based on Table 2. Values of Density, Frequency, and Dominance of Weeds in Peanut Fields, it shows that high density and dominance of a species can have a wide, rapid, aggressive spread and be difficult to control, so that the impact is very detrimental if left around cultivated plants. The dominant weed found in peanut fields is

Rottboellia cochinchinensis, which belongs to the Poaceae family. The Poaceae family are weeds that have a high adaptability, can grow in extreme conditions because they are fierce and aggressive weeds, spread widely, have strong roots and reproduce by stems, stolons, rhizomes and seeds. The presence of these weeds can dominate the growing space, giving them an advantage over peanut plants (Agus and Sarjiyah, 2021). Weed growth can be influenced by several factors, one of which is light intensity (Siregar et al., 2021). Light can affect the number of species living in a community, where light greatly influences the species and number of weed individuals that grow. In addition, high soil cultivation intensity during each planting affects the death of weed propagules such as seeds, shoots, stolons, rhizomes, and tubers due to ploughing (Firmansyah et al., 2020).

Table 2. Weed Density, Frequency, and Dominance Values in Peanut Fields

No	Spesies	AD	RD	AF	RF	AD	RD
1	*Richardia brasiliensis*	230	37.46	20	20.83	43.90	11.36
2	*Rottboellia cochinchinensis*	241	39.22	20	20.83	104.47	27.05
3	*Digitaria sanguinalis*	25	4.07	9	9.38	16.32	5.93
4	*Melochia corchorifolia*	34	5.54	9	9.38	40.43	10.47
5	*Ipomea triloba*	26	4.23	11	11.46	22.92	11.27
6	*Mimosa pigra*	14	2.28	7	7.29	32.49	8.41
7	*Cynodon dactylon*	8	1.47	4	4.17	43.54	4.23
8	*Cerastium glomeratum*	8	1.30	6	6.25	10.90	2.40
9	*Croton hirtus*	9	1.47	2	2.08	15.76	1.40
10	*Cleome rutidosperma*	5	0.81	1	1.04	9.27	2.82
11	*Ehrharta erecta*	3	0.49	1	1.04	5.40	4.08
12	*Emilia sonchifolia*	6	0.98	3	3.13	5.76	1.49
13	*Bidens pilosa*	2	0.33	1	1.04	2.30	0.60
14	*Eleutheranthera ruderalis*	2	0.33	1	1.04	3.93	1.02
15	*Eriochloa*	1	0.16	1	1.04	3.32	0.86
		614	99.81	96	224.8	360.71	93.39

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

The species dominating the research plot can be identified through an analysis of the Importance Value Index (IVI). The Important Value Index (IVI) is obtained from the relative density (RD) + relative frequency (RF) + relative dominance (RD) values used for analysis. To obtain the weed Summed Dominance Ratio (SDR) value, the final result is divided by 3. The Important Value Index (IVI) of a species is a value that describes the role of a species in a community. The higher the Important Value Index (IVI) of a species, the greater the role of that species in a community. Important Value Index (IVI) indicates the role of a species in an area (Kartikasari et al., 2023). The results of the Importance Index Value (IVI) and Weed Summed Dominance Ratio (SDR) on Peanut Fields can be seen in Table 3.

Based on the Table 3. Important Value Index (IVI) and Summed Dominance Ratio (SDR) Weed in Peanut Land, Importance Value Index (IVI) values it was found that the weed species *Rottboellia cochinchinensis* had the highest Importance Value Index (IVI) value of 87.10, while the lowest was *Eriochloa* With a value of 2.06. The Importance Value Index (IVI) describes the role of a species in its community. The level of the Importance Value Index (IVI) of a plant community depends on the number of species and the number of individuals of each species (Hidayat, 2017). The higher the Importance Value Index (IVI) of a species, the greater the competition between weeds and cultivated plants in an agricultural area (Saitun et al., 2024).

Table 3. IVI and SDR values Weed in Peanut Land

No	Spesies	IVI	SDR
1	*Richardia brasiliensis*	69.65	23.22
2	*Rottboellia cochinchinensis*	87.10	29.03
3	*Digitaria sanguinalis*	19.38	6.46
4	*Melochia corchorifolia*	25.39	8.46
5	*Ipomea triloba*	26.96	8.99
6	*Mimosa pigra*	17.98	5.99
7	*Cynodon dactylon*	9.87	3.29
9	*Cerastium glomeratum*	9.95	3.32
9	*Croton hirtus*	4.95	1.65
10	*Cleome rutidosperma*	4.67	1.56
11	*Ehrharta erecta*	5.61	1.87
12	*Emilia sonchifolia*	5.60	1.87
13	*Bidens pilosa*	1.97	0.66
14	*Eleutheranthera ruderalis*	2.39	0.80
15	*Eriochloa*	2.06	0.69

Based on the identification and calculation of Summed Dominance Ratio (SDR), the highest Summed Dominance Ratio (SDR) value was found in *Rottboellia cochinchinensis*, which was 29.03%. The lowest result was obtained from the weed species *Eriochloa* with a value of 0.69%. Based on the weed types and Summed Dominance Ratio (SDR) values obtained, each research plot produced different types of weed dominance, which can be influenced by various factors such as soil conditions and microclimate (Widiyani and Hartono, 2021). The magnitude of weed Summed Dominance Ratio (SDR) is determined by various factors. According to Yuliana & Ami (2020), in general, the Summed Dominance Ratio (SDR) value is determined by three main factors, namely density, frequency, and dominance. Density reflects the number of individuals of a species in a certain area, while frequency indicates how often the species appears in the sample plot. Dominance, on the other hand, measures the area controlled by the species in the ecosystem. These three factors play an important role in calculating the Summed Dominance Ratio (SDR), which is used to evaluate the relative role of a species in the community or ecosystem being studied.

Weed Diversity Index (*H'*) In Peanut Fields

The species diversity of a community is categorised as high if the community consists of many species, while low species diversity is indicated by a community dominated by a limited number of species. Species diversity acts as an indicator of environmental stability in vegetation, where high levels of diversity reflect greater ecosystem complexity. This complexity encourages more intensive interactions between organisms, thereby increasing the community's ability to cope with and adapt to various forms of environmental disturbance (Anjani et al., 2023).

Based on Table 4, it can be seen that the Shannon-Wiener diversity index value for weed species obtained a value of H' = 1.5841, which is in the medium category. The agroecosystem conditions at the research site are not ye homogeneous. Based on interviews and identifications that have been carried out, the soil is very loose and fertile due to good and proper soil cultivation, which not only allows cultivated plants to grow well but also causes competition between weeds growing around the cultivated plants. Putri et al., (2024) medium diversity levels can be caused by several factors, including environmental factors such as light intensity, temperature and sunlight, which determine the presence or absence of a species based on its ability to grow and adapt in different ecosystems.

Table 4. Weed Diversity Index (*H'*) in Peanut Fields

Location	Diversity Index (*H'*)	Category
Peanut cultivation land in Link Beberan, Banjaragung Village, Cipocok Jaya Subdistrict, Serang City.	1.5841	Medium

Description: Low diversity (< 1), Medium diversity (1<H'< – 3), High diversity (H'>3)

Climate change plays a role in altering the dynamics of competition between cultivated plants and weeds, not only through changes in physiological processes such as photosynthesis and transpiration, but also through gradual shifts in the composition of vegetation communities. (Feeley et al., 2020) In various agroecosystems, there has been an increase in overall species diversity accompanied by the strengthening of the dominance of weeds that have high tolerance to environmental stress, ecological plasticity, and resource use efficiency in constantly changing environmental conditions. Climate change affects the relationship between plants and weeds through modifications in the phenology and spatial distribution patterns of species, which ultimately impact the structure and stability of vegetation communities.

The Effect of Weed Competition on Peanut Plant Growth

The presence of weeds on peanut plants can reduce yield and seed quality, which is influenced by weed type, population density, and the duration of competition between weeds and plants. Yield reductions due to weed competition are difficult to overcome because the interaction between weeds and plants occurs complexly throughout the growing season. The level of impact caused by weeds varies depending on land conditions, temperature, altitude, cropping patterns, water management, and the weed control techniques used (Ngawit et al., 2023). Weed competition can cause gradual losses through competition for nutrients, water, light, carbon dioxide, and growing space. Furthermore, losses can also occur due to allelopathy, which is the inhibition of plant growth by chemical compounds released by weeds (Oluwatobi & Olorunmaiye, 2021). This competition has the potential to inhibit the growth of the main crop, such as reducing plant height, leaf number, and branch number. This decline is caused by reduced photosynthetic capacity due to the blocking of light by weeds, thus inhibiting plant growth (Supriyadi et al., 2018).

CONCLUSION AND RECOMMENDATIONS

The results of this study indicate that weed community structure, based on Summed Dominance Ratio (SDR) and Importance Value Index (IVI) values, has important ecological relevance in understanding the dynamics of wet tropical agroecosystems. Weed species found in almost all sample plots were dominated by the Poaceae family, particularly *Rottboellia cochinchinensis*. Differences in the level of dominance between species reflect the relationship between the biological characteristics of weeds and local environmental conditions. These findings indicate that weed management cannot be applied uniformly, but needs to be adapted to the specific ecological characteristics of the area. The practical implication of this study is the need for an ecology based weed control strategy that focuses on identifying dominant weed species and their distribution patterns.

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