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Diversity, Species, and Plant Growth Regulator and Nutrient Content of Local Weeds in Tawaeli Sub-District, Palu City, Indonesia

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ABSTRACT

Each area has a variety and different types of weeds, the differences in each weed are caused by natural factors and human actions, including excessive pesticide spraying. This action can cause the chemical content, namely plant growth regulators and the nutrients in the weed plant to change and cause the quality of a soil to decrease. The research objective was to determine the level of diversity, species, and content of plant growth regulators and nutrient element measurements for local weeds. The research design was an exploration method in community agricultural land areas by recording the number of weeds found in agricultural land areas, trails, and irrigation edges in Tawaeli District, Palu City. Diversity analysis was using the exploration method, and the diversity index of medicinal plants was calculated using Shannon Wiener. The identification of weeds was carried out by UPT Herbarium (Tadulako University), plant growth regulators and nutrient content analysis were carried out using existing methods in the laboratory using local weed samples taken in the field. The results showed that there were 27 species of weeds grew on agricultural land in Tawaeli Sub-District, Palu City. These weed species belonging to 17 different plant families. Based on the category of diversity index, it was known that the biodiversity of weeds at the observation sites belongs to the low class (H' <1.00) and the medium class (H' >3.00). The conclusion was that in general, the high number of species and weed diversity were in the medium class H' category. Good nutrient content in weeds shows the potential of weeds as a source of important nutritional elements may benefit the growth and development of cultivated plants.

1. INTRODUCTION

Indonesia has a high opportunity to develop organic agriculture with the existing potential to be able to increase the production of food that is safe for consumption (food safety attributes), high nutritional content (nutritional attributes), and environmentally friendly (ecolabelling attributes), and can increase farmers' income and foreign exchange [1].

In Central Sulawesi Province, mainly in the Palu Valley, there are local superior shallot commodities that are well known. This onion is one of the horticultural vegetable commodities which is commonly used as a seasoning flavouring, raw material for the food industry. Currently, many local types of shallots are cultivated in the Palu Valley, but the product produced is still low [2]. The potential source of organic matter is weeds, which are varied and abundant in Indonesia [1]. Utilization of weeds as compost material has a double advantage. First, the use of weeds can reduce losses due to crop competition with weeds, and secondly, at the same time transforming weeds which previously harmful into something useful.

Every area has a variety, and different types of weeds, the differences in each weed are caused by natural factors and human actions [3]. One of the actions that cause a weed to evolve is the act of over-spraying herbicides [4-7]. This action can cause chemical content that plant growth regulator (PGR) and nutrients in weed changing. Apart from processing weed plants evolve, the action of spraying also makes the quality of a soil decrease. Excessive use of pesticides with the same type can cause weeds to become resistant. Weed resistance to the use of pesticides can cause changes in the chemical content, namely PGR and the nutrients in the weeds. In addition to making weeds evolve, the action of spraying also makes the quality of a soil decrease. The distribution of weeds from one area to another differs according to the factors that influence it. Weed identification and identification of dominant weed types is the first step in determining the success of weed control [8].

This research aimed to understand the diversity, species, and plant growth regulator and nutrient content of local weed in Tawaeli Sub-District, Palu City.

2. METHOD

The design of this study was an exploration method in community agricultural land areas by recording the number of weeds found in agricultural land areas, trails, and irrigation edges. The research was conducted from April 2020 to November 2020, at the Tawaeli Sub-District, Palu City.

Data collection was conducted by obtaining primary data and secondary data. Primary data was including types, characteristics/morphology, number, habitat conditions and secondary data was including humidity, temperature, and light intensity. A sampling of weeds was executed by taking all parts of the plant (leaves, stems and roots) then immersed into

a spritus solution to maintain the condition of the plants. The identification of weeds was carried out in UPT. Herbarium (Tadulako University), and Analysis of plant growth regulator (PGR) and Nutrient Content were carried out using existing methods in the laboratory.

3. RESULTS & DISCUSSIONS

The initial stage of this research was to identify the weed diversity as the primary material of soil fertility enhancing organic fertilizers. In this study, a biodiversity exploration of the weeds grows in the northern agricultural area of Tawaeli Sub-District, Palu City was conducted. The result of this identification obtained from the observations is presented in Table 1.

The observations show that there were 27 species of weeds that grow on agricultural land in Tawaeli Sub-District, Palu City. The weed species belonging to 17 different plant families, viz. Convolvulaceae (1 spesies: *Sida acuta* Burm. F.*),* Compositae (3 spesies: *Chromolaena odorata* (L) R. M. King H Rob., *Eleutheranthera ruderalis (*Sw) Scnh.Bip, and *Chanthillium cinereum* (L) H, Rob.), Cyparaceae (1 spesies: *Ciperus SP.),* Verbenaceae (1 spesies: *Lantana cemara* L*),* Leguminosae (3 spesies: *Senna tora (L) Roxb, Senna occidentalis* (L.) Link, and *Mimosa pudica* L*),* Apocyceae (2 spesies: *Tabernaemntana divaricata (*L) R. Br. Ex Roem. *g Schult,* and *Calotropis gigantea* (L). Dryand), Poaceae (3 spesies: *unidentified spesies, Eleusine indica.*, and *Axonopus compressus* (Swartz) Beauv, Euphorbiaceae (1 spesies: *Croton bonpladianus* Baill*),* Acanthaceae (1 spesies: *Andrographis paniculate),* Rubiaceae (1 spesies: *Oldenlandia auricularia (*L)K. Schum.*),* Solanaceae (2 spesies: *Solanum SP.* and *Physalis angulate* L.*),* Cleomaceae (1 spesies: *Cleome rutidosperma* DC.*),* Ulmaceae (1 spesies: *Trema SP.),* Sepindaceae (1 spesies: *Cardiospermum halicocacabun* L.*),* Araceae (1 spesies: *Amorphophallus, SP.),* Cucurbitaceae (3 spesies: *Dichondra SP., Thlandiantha SP.*, and *Coccinia SP),* Lygodiceae (1 spesies: *Lygodium flexuosum* (L) Sw.*).* The growth of various weed species is supported by conditions of low land use and groundwater conditions which are in the poor to moderate range. The occurrence of weed eruptions of various species is also caused by uneven rainfall conditions throughout the year.

Based on the category of diversity index, it was known that the biodiversity of weeds at the observation location categorized into the low class (H' <1.00) and the medium class (H' > 3.00). A total of 8 species belong to the low-class category (H' 0.68 - 0.98) and 19 species categorized to the medium class (H' value 1.00 - 1.10). While the total individual score as a whole was 1301 individuals.

In this study, an analysis of growth regulators (GPR) and nutrients contained in the explored weed species were also carried out. There were 10 sample species analyzed, namely *Unidentified*, *Senna occidentalis* (L.) Link, *Tabernaemntana divaricata* (L) R. Br. Ex Roem. g Schult, *Senna tora (*L*)* Roxb, *Sida acuta* Burm. F., *Eleutheranthera ruderalis* (Sw) Scnh. Bip, *Lantana cemara* L., *Chromolaena odorata (*L) R.M. King g H Rob., *Mimosa pudica* L, and *Ciperus SP*. The 11 mineral nutrient content analyzed were N, P, K, Ca, Mg, Fe, Cu, Zn, Mn, B, and S. The results of the analysis of nutrient content in the ten samples of weed species are presented in Table 2.

Based on the results of the analysis, it was known that the weed samples contain N (1.24 - 1.85%), P (0.13 - 0.16%), K (0.41 - 1.00%), Ca (1.42 - 2.78%), and Mg (0.28. - 0.40%). Then, the sample also contains Fe (110, 99 - 1615.52 ppm), Cu (10.1 - 51.22 ppm), Zn (27.70 - 51.12 ppm), Mn (77.67 - 104.94 ppm), and B (23.29 - 28.71 ppm). Besides, the sample also contained S about 0.14 - 0.25% (Table 2).

Table 1. Results of the weed diversity analysis in the northern part of Tawaeli Sub-District (B)

NO	Weed Species	Total	IVI	SDR	H'
1	*Sida acuta* Burm. F.	72	9.24	4.62	0.142
2	*Chromolaena odorata (*L) R.M. King g H Rob.	50	7.55	3.77	0.124
3	*Ciperus SP.*	37	6.55	3.27	0.112
4	*Lantana cemara* L.	56	8.01	4.00	0.129
5	*Senna tora (*L*)* Roxb	91	10.70	5.35	0.157
6	*Tabernaemntana divaricata* (L) R. Br. Ex Roem. g Schult	164	16.31	8.15	0.204
7	*Unidentified*	260	23.69	11.84	0.253
8	*Senna occidentalis* (L.) Link	230	21.38	10.69	0.239
9	*Croton bonpladianus* Baill	30	6.01	3.00	0.105
10	*Eleutheranthera ruderalis* (Sw) Scnh.Bip	57	8.08	4.04	0.130
11	*Andrographis paniculate*	11	4.55	2.27	0.086
12	*Chanthillium cinereum* (L) H, Rob	6	4.16	2.08	0.081
13	*Oldenlandia auricularia* (L) K. Schum.	21	5.32	2.66	0.096
14	*Solanum SP.*	36	6.47	3.24	0.111
15	*Mimosa pudica* L	40	6.78	3.39	0.115
16	*Cleome rutidosperma* DC.	8	4.32	2.16	0.083
17	*Calotropis gigantea (*L). Dryand	4	4.01	2.01	0.078
18	*Trema SP.*	18	5.09	2.54	0.093
19	*Cardiospermum halicocacabun* L.	5	4.09	2.04	0.080
20	*Eleusine indica* (L.) Gaertn.	16	4.93	2.47	0.091
21	*Amorphophallus SP.*	9	4.40	2.20	0.084
22	*Physalis angulate* L.	32	6.16	3.08	0.107
23	*Axonopus compressus* (Swartz) Beauv	18	5.09	2.54	0.093
24	*Dichondra* SP.	12	4.63	2.31	0.087
25	*Thlandiantha* SP.	7	4.24	2.12	0.082
26	*Coccinia* SP	3	3.93	1.97	0.077
27	*Lygodium flexuosum* (L) Sw.	8	4.32	2,16	0.083
	Total				3.122

Note: IVI = Important value index, SDR = summed dominance ratio, H' = shannon – Wiener diversity index

Table 2. Plant growth regulator and nutrient content of selected weed species

Species	N	P	K	Ca	Mg	Fe	Cu	Zn	Mn	B	S
			(%)					(ppm)			(%)
Unidentified	1.34	0.16	0.41	2.19	0.40	206.10	48.82	27.7	88.52	23.29	0.18
Senna occidentalis (L.) Link	1.60	0.15	0.71	2.12	0.35	279.02	30.34	36.89	90.67	24.19	0.22
Tabernaemntana divaricata (L) R. Br. Ex Roem. g Schult	1.85	0.14	1.00	2.05	0.31	351.94	11.86	46.08	92.82	25.10	0.25
*Senna tora (*L*)* Roxb	1.67	0.14	0.74	1.86	0.32	296.24	10.98	39.82	95.52	26.90	0.20
Sida acuta Burm. F.	1.48	0.13	0.47	1.67	0.32	240.54	10.10	33.56	98.22	28.71	0.14
Eleutheranthera ruderalis (Sw) Scnh.Bip	1.36	0.14	0.47	1.55	0.30	928.03	30.66	42.34	101.58	27.81	0.17
Lantana cemara L.	1.24	0.15	0.47	1.42	0.28	1615.52	51.22	51.12	104.94	26.90	0.19
*Chromolaena odorata (*L) R.M. King g H Rob.	1.27	0.14	0.51	2.10	0.29	863.26	30.98	47.16	91.31	25.10	0.18
Mimosa pudica L	1.28	0.14	0.53	2.44	0.29	487.12	20.85	45.18	84.49	24.19	0.17
Ciperus SP.	1.29	0.13	0.55	2.78	0.29	110.99	10.73	43.20	77.67	23.29	0.16

Table 3. Secondary data about parameter average of weather at meteorology station of Mutiara Palu by Month (Year 2010 - 2014)

Month		Temperature (°C)	Air Pressure (mb)	Humidity (%)	Length of Daylight (%)	Rainfall (mm)	Wind Speed (KNOTS)	The most Wind Direction
January		26.08	1 011.06	83.99	26.85	137.0	3.00	
February		26.67	1 011.44	77.72	80.18	34.8	5.00	*North*
March		27.90	1 011.31	74.08	76.41	33.4	4.00	*North*
April		24.41	1 010.78	75.67	75.00	42.2	3.00	*North West*
May		28.52	1 010.65	75.54	63.31	68.8	3.00	*North*
June		28.00	1 010.18	78.57	57.33	25.6	4.00	*North West*
July		28.15	1 011.19	75.91	69.11	41.9	4.00	*North West*
August		27.23	1 011.84	77.26	72.98	119.0	4.00	*North West*
September		27.60	1 011.90	78.01	58.83	30.8	4.00	*North West*
October		27.59	1 011.05	77.97	60.16	29.5	4.00	*North West*
November		27.59	1 010.72	78.01	58.71	37.1	4.00	*North West*
December		27.59	1 010.71	78.01	57.82	105	4.00	*North West*
	2014	27.28	1 011.07	77.88	63.06	58.76	3.83	*North West*
	2013	27.70	1 010.20	76.40	57.70	62.33	3.60	*North West*
Average	2012	27.70	1 010.30	76.00	62.90	63.38	3.80	*North West*
	2011	27.60	1 009.90	76.10	54.50	71.98	3.00	*North*
	2010	27.70	1 010.40	76.70	63.50	46.90	3.70	*North*

Source: Meteorology Station of Mutiara Palu [9]

Weeds can be defined as plants whose benefits still not yet known, usually, these plants will associate and develop around the main cultivated crop. Weeds may interfere with the growth of cultivated plants so that weeds are considered to be detrimental to farmers [10, 11]. Weeds that grow around cultivated plants will compete in absorbing nutrients needed for cultivated plants, so the presence of weeds is not expected. However, several studies have been carried out to find out the benefit of the weed community. Weeds that grow in unwanted places and whose benefits are not yet known, including as ingredients for making traditional herbal medicine [12]. A source of organic ameliorant material and as a source of organic material containing nutrients for plant growth. Several areas in Java Island have used weeds directly to be various kinds of economically valuable handicrafts [13].

There are many plant species categorized as weeds at this study site. The identification results of weed species on cultivated land in Tawaeli Sub-District, Palu City, found 27 species of weed species from 17 different families. A previous study showed that approximately 350 of weed species from 150 genera and 60 families were reported as rice weeds, of which, Poaceae spp, more than 80 species, and Cyperaceae spp. more than 50 species [14].

On agricultural land in the study location, a total of 1301 species were found that generally fall into the medium diversity (H ') category. The most dominant species was *Coccinia SP*. from the Cucurbitaceae family (H '= 1,10), and the least was *Amorphophallus SP*. from the Araceae family (H '= 0.68). In other agricultural areas in rice fields of Karya Mukti Village, Dampelas Sub-District, Donggala Regency, Mazidaturohmah et al. (2018) reported 14 types of weed plants with a total of 1,385 individuals consisting of 7 identified families in the agricultural area. The most dominant type was *Monochoria vaginalis (Burm.F.) C. Persal*, with an IVI value of 43.04%, while the species with the lowest IVI value was *Eclipta alba (L.) Hassk* with an IVI of 1.75%. The index diversity of species in the study was classified as moderate, about 2.14 [14]. Weed diversity is influenced by environmental factors as shown in Table 3, namely temperature, air pressure, humidity, length of daylight, rainfall, wind speed [15]. The diversity and large number of individuals in Central Sulawesi demonstrate the importance of weed management [16].

Weeds are organic materials known to have many bio-components and nutrients. The results of the nutrient evaluation show that the weed species in our observation area contained several nutrients that can be used to improve soil fertility, including Nitrogen (N), Phosphorous (P), Potassium (K), Calcium (Ca).), Magnesium (Mg), Iron (Fe), Cuprum (Cu), Zinc (Zn), Manganese (Mn), Boron (B), and Sulfur (S). Species "*Unidentified"* contained the highest P element at 0.16%. *Tabernaemntana divaricata* (L) R. Br. Ex Roem. g Schult was known to have the highest N, K, and S elements compared to other species, was 1, 85%, 1.00%, and 0.25%,

respectively. *Sida acuta* Burm. F. contained the highest element B, which was 28.71 ppm. Then, weed species *Lantana cemara* L. has the highest elements of Fe, Cu, Zn, and Mn, was 1615.52 ppm, 51.22 ppm, 51.12 ppm, and 104.94 ppm, respectively. While *Ciperus SP*. contained the highest Ca element, about 2.78%.

Currently, the development of growth-supporting fertilizers has been deep by utilizing organic waste materials and other unmanaged natural materials. Akanbi and Togun [17] studied that the high content of natural nutrients in corn waste compost combined with urea fertilizer was able to increase the growth of *Amaranthus cruentus L.* Also, Zhang et al. [18] found the potential for using organic fertilizers to support the growth of ginger rhizome. These organic fertilizers can supply nutrients as well as suppress the development of microbes *Fusarium oxysporum f. sp. zingiberi (Foz),* which destroys the rhizome.

Organic fertilizers are known able to increased soil fertility and are environmentally friendly compared to inorganic fertilizers [19-22]. The use of fertilizers from natural materials such as compost can be an alternative in improving crop cultivation production, also reducing the costs [23, 24]. Utilization of waste and unmanaged natural materials such as weeds is one way out for farmers. The growth-supporting nutrients contained in weeds is very beneficial for the growth of cultivated plants. Several studies on weeds also show the inline results with this study. A study conducted by Nugroho et al. (2019) [1] on the compost of Siamese weed *(Chromolaena odorata l.)* grows in the agricultural area of the Special Region of Yogyakarta, proven that this weed contains nutrients of N, P, and K valued 2.56%, 0.38%, and 2.41 %, respectively, and was able to stimulate an increase in the leaves number on shallots compared to an-organic fertilizer. Meanwhile, rice weeds grow in coastal areas, Sungai Berut Sub-District, Bengkulu contains calcium 0.02 - 0.13%, protein 5.28 - 7.39%, and phosphorus 0.16 - 0.33% [25].

The diversity and total of individuals are quite large in Central Sulawesi, demonstrating the importance of weed management. Weed management can increase the value of benefits and reduce the level of losses due to weed growth around cultivated plants. Utilization of weeds may clear the agricultural land from competing for crops that can take up important soil nutrients for cultivated crops. Also, the potential for the use of plants that disturb these cultivated plants is a good value of nutrients. The minerals contained can be used as a source of nutrients for cultivated plants. So, it can help in increasing agricultural output.

4. CONCLUSIONS

In general, the high number of species and the level of weed diversity were in the medium class H' category. The good nutrient content in weeds shows the potential as a source of essential nutritional elements that can benefit the growth and development of cultivated plants. The recommendations for manual weed control techniques using static tools such as hoes, sickles and other tools can be recommended compared to chemical control or using herbicides.

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