International Journal of Agriculture and Environmental Research

ISSN: 2455-6939

Volume: 11, Issue: 01 "January-February 2025"

THE USE OF *Sphagneticola trilobata* L. AND *Melastoma affine* D. COMPOSTS TO IMPROVE CERTAIN SOIL CHEMICAL PROPERTIES AND SWEET CORN GROWTH AND YIELD

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DOI: https://doi.org/10.51193/IJAER.2025.11112

Received: 05 Feb. 2025 / Accepted: 12 Feb. 2025 / Published: 15 Feb. 2025

ABSTRACT

Crop productivity can be limited by the poor availability of nutrients from soil degradation due to the prolonged and excessive use of synthetic fertilizers. Weed-based organic fertilizers offer a sustainable solution to improve soil fertility in degraded lands. This study was aimed to investigate the chemical properties of selected soils after weed compost application and determine the most effective type of weed-based compost and identify the optimal dose of compost made from *Sphagneticola trilobata* L. Pruski and *Melastoma affine* D. Don to improve growth and yield of sweet corn. The experiment was conducted using a Completely Randomized Design. The treatments were consisted of application dosages of weed-based compost *S. trilobata* L. (S) and *M. affine* D (M); S0 (control/no treatment), S1 (10 tons/ha), S2 (20 tons/ha), S3 (30 tons/ha), M1 (10 tons/ha), M2 (20 tons/ha), and M3 (30 tons/ha). Results indicated that applying weed compost significantly improved soil properties, including total N, organic C, available P, exchangeable Ca, and soil pH, compared to the unfertilized plot. Likewise, soil treated with *S. trilobata* L. compost (S) exhibited a higher content of total N, available P, exchangeable Ca, exchangeable Mg, and pH than soil treated with *M. affine* D. (M) compost. The use of weed composts also significantly enhanced sweet corn growth and yield and *S. trilobata* L. compost demonstrated superior performance over *M. affine* D. compost. A weed compost application rate of 10 tons/ha was sufficiently effective to increase sweet corn growth and yield. These findings highlighted the potential of utilizing weed-derived composts as a sustainable approach to soil fertility management and crop production.

Keywords: Compost, Inceptisols, *Melastoma affine, Sphagneticola trilobata,* Sustainable agriculture.

1. INTRODUCTION

Sweet corn (*Zea mays* L. var. saccharata) is widely cultivated for both direct consumption and as a raw material in the processed food industry. Consumers favor this crop due to its sweet taste and fragrant aroma, making it a promising market commodity (Swapna *et al*., 2020; Sabur *et al*., 2021). However, its growth can be hindered by nutrient deficiencies in the soil or land degradation caused by the excessive and continuous use of synthetic fertilizers, which ultimately reduce land productivity (Dewanto *et al*., 2017). Previous studies have shown that synthetic fertilizers lowered soil pH and increase aluminum (Al) saturation (Lungu and Dynoodt *et al*., 2008; Fageria *et al*., 2010; Wulandari *et al*., 2018), significantly depleted soil organic carbon content in soil (Su *et al*., 2006; Kumari *et al*., 2024). Additionally, the application of synthetic fertilizers has been reported to reduce soil enzyme activity (Dinca *et al*., 2022).

Organic fertilizers, derived from decomposed organic materials through microbial activity, serve as buffers for the physical, chemical, and biological properties of soil, improving fertilizer efficiency and land productivity (Habinsaran *et al*., 2018; Supartha *et al*., 2012). Application of organic fertilizers increased nutrients in the soil (Muktamar *et al*., 2016; Utami *et al*., 2023; Hakimi et al., 2024) and improved the physical properties of the soil such as reducing bulk density and increasing the ability to hold water, pore space and soil permeability (Apriliani *et al*., 2024; Castellinio *et al*., 2024). Application of organic fertilizers increased the growth and yield of sweet corn (Baharuddin and Tejowulan, 2021; Gosal *et al*., 2022; Nurmalasari *et al*., 2024).

When selecting organic materials as composting materials, it is crucial to consider their nutrient content, availability, and easiness of procurement. Weeds could serve as a valuable source of compost materials. Utilizing weeds as compost material reduced crop losses caused by weed competition while simultaneously converting harmful weeds into beneficial resources (Nugroho *et al*., 2019). Research has shown that green plants and weeds served as effective organic fertilizers. Wedelia weed (*Sphagneticola trilobata* (L.) Pruski), a broadleaf weed commonly found in plantation areas of Bengkulu Province, has significant potential as an organic material source. This weed contains 4.8% organic C, 3.2% total N, 0.38% P, and 4.33% K. Additionally, plants fertilized with composts derived from leaf litter, vermicompost, wedelia compost, and water hyacinth compost increased husked ear weight by 36.8%, 61.2%, 71.3%, and 54.3%, respectively, compared to control (Setyowati *et al*., 2014; Wijaya *et al*., 2017).

ISSN: 2455-6939

Volume: 11, Issue: 01 "January-February 2025"

Another type of weed that has potential to be used as composing material of organic fertilizer is Senduduk (*Melastoma affine* D. Don). This weed can thrive in open places, such as plantations, rice fields and bushes (Bakewell-Stone, 2024). Research by Syahid *et al*. (2020) suggested that *M. affine* D. contains 53.63% organic-C, 2.27% total N, a C/N ratio of 24, 92.78% organic matter, 0.29% phosphorus, 1.10% potassium, and 20.34% lignin. Compost derived from weeds can be effectively utilized in organic sweet corn cultivation. This study was aimed to investigate the chemical properties of selected soils after weed compost application and determine the most effective type of weed-based compost and identify the optimal dose of compost made from Sphagneticola trilobata L. Pruski and Melastoma affine D. Don to improve growth and yield of sweet corn.

2. MATERIALS AND METHODS

2.1 Soil Sampling

This study was conducted from June to December 2024 at the Greenhouse of the Department of Crop Production, University of Bengkulu. The research started with soil sampling in Air Napal District, North Bengkulu Regency, an area dominated by oil palm plantations. The soil, classified as Inceptisols, was collected from a depth of 0–20 cm, totaling 150 kg. Additional soil samples were compositely collected from five points in a zigzag pattern using a soil probe for initial analysis. These samples were air-dried for two days, sieved through a 5 mm mesh for planting media and analyzed for total nitrogen, available phosphorus, pH, and texture. Undisturbed soil samples were also taken to determine bulk density. The planting media were prepared by mixing 10 kg of soil with weed compost according to the treatment plan, then placed into polybags and arranged randomly in the greenhouse.

2.2 Weed Biomass Collection and Compost Preparation

The composting process began with the collection of *S. trilobata* L. weeds from the Agricultural Zone Experimental Land at the University of Bengkulu and *M. affine* weeds from the Pantai Panjang area in the City of Bengkulu, Bengkulu Province. A total of 500 kg of each weed was collected, chopped into 3–5 cm pieces, and mixed with 5 kg of cattle manure, 100 cc of EM4 per liter, and additional water until the mixture reached a moist consistency. The composting materials were stacked in 15–20 cm layers, thoroughly mixed, and tightly covered with blue plastic for 6 weeks. The compost was turned and watered every three days. The composting process was considered complete when the compost matured, characterized by a dark brown color, a non-clumping texture, and the absence of unpleasant odors.

ISSN: 2455-6939

Volume: 11, Issue: 01 "January-February 2025"

The compost was analyzed for organic-C content using the Walkley and Black method, while total nitrogen, phosphorus, potassium, calcium, and magnesium were determined using the wet extraction method. The pH was measured using a pH meter with a 1:1 ratio of soil to distilled water. Additionally, compost nutrient contents were analyzed in terms of sulfur (S), iron (Fe), copper (Cu), zinc (Zn), manganese (Mn), C/N ratio, cellulose, lignin, and hemicellulose. The nutrient contents of weed biomass were analyzed similarly to the compost, except for pH and C/N ratio.

2.3 Experimental Design and Treatments

The study was conducted in the Greenhouse of the Department of Crop Production, Faculty of Agriculture, University of Bengkulu, from June to December 2024. The experiment used a Completely Randomized Design, with treatments involving *S. trilobata* L. Pruski (S) and *M. affine* D. Don (M) weed compost. The treatments were as follows: S0 (no treatment), S1 (10 ton/ha), S2 (20 ton/ha), S3 (30 ton/ha), M1 (10 ton/ha), M2 (20 ton/ha), and M3 (30 ton/ha). Each treatment was replicated three times, with two sub-samples per experimental unit, resulting in a total of 42 experimental units.

2.4 Cultivation Procedure

Two seeds of sweet corn (var. Bonanza) were planted into soil in each of polybag, approximately in the depth of 2 cm. The polybags were spaced 70 cm apart with a 25 cm away between each polybag. Replanting was conducted at 1 week after planting (WAP) and thinning was performed at 2 WAP. Fertilization was performed by mixing the soil with compost according to the treatments at one week before planting. The plant was watered daily and pest was controlled using neem (*Azadirachta indica* A. Juss.) leaf extract-based herbal pesticides, and weeds were manually removed from the polybags. Harvesting was conducted at 85 days after planting when 75% of the plants have reached maturity, indicated by the color and condition of the seeds, which release a thick white paste-like liquid when pressed. The cob hairs changed from white to brown, and when the cob was opened, the seeds were fully formed.

Growth variables of sweet corn included plant height, number of leaves, stem diameter, and leaf area, while yield variables were measured as shoot fresh and dry weight, root fresh and dry weight, husked and unhusked ear length, husked and unhusked ear diameter, husked and unhusked ear weight, and fruit sweetness. After harvesting, a soil sample was collected from each polybag, air-dried, and sieved through a 2 mm mesh. The soil was then analyzed for total-N content using the Kjeldahl method, available P using the Bray I method, exchangeable Ca and Mg using the EDTA method, and pH using a pH meter with a soil-to-distilled water ratio of 1:1.

ISSN: 2455-6939

Volume: 11, Issue: 01 "January-February 2025"

2.5 Data Analysis

The observation data were statistically analyzed with Analysis of Variance (ANOVA) using SAS Demand for Academic at 5% significance level. If significant differences were found, further analysis was conducted using Orthogonal Contrast at 5% level.

3. RESULTS AND DISCUSSION

3.1 Soil and Compost Characteristics

This study used Inceptisols collected from Air Napal District, North Bengkulu Regency, Bengkulu Province, with the initial soil characteristics as illustrated in Table 1. In general, the initial soil analysis showed that available phosphorus (P) and exchangeable potassium (K) content were low, exchangeable calcium (Ca) was very low, and nitrogen (N), organic carbon (C), exchangeable magnesium (Mg), electrical conductivity (EC) and cation exchange capacity (CEC) were also low. The texture of the soil was classified as clay loam with a bulk density of 1.14 g/cm^3.

Table 1: Initial soil nutrient characteristics

Characteristics	Contents
Carbon (%)	0.29
Nitrogen (%)	2.29
Available phosphorus (ppm)	4.34
Exchangeable potassium (cmol/kg)	0.35
Exchangeable calcium (cmol/kg)	0.64
Exchangeable magnesium (cmol/kg)	0.44
Exchangeable Al (cmol/kg)	1.50
pH	4.54
EC (us/cm)	61.5
Clay (%)	60.32
Sand (%)	18.84
Silt (%)	20.84
Cation Exchange Capacity (cmol/kg)	15.89
Bulk Density (g/cm^3)	1.14
Field capacity (%)	22.65

Compost preparation for this study used weed species of *S. trilobata* and *M. affine*. The biomass and compost characteristics are presented in Table 2. The results indicated a decrease in the content of carbon (C), cellulose, lignin, hemicellulose, and the C/N ratio in the weed compost compared

ISSN: 2455-6939

Volume: 11, Issue: 01 "January-February 2025"

to the weed biomass. In contrast, the content of nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulphur (S), iron (Fe), and manganese (Mn) increased. This suggests that microbial decomposition occurred during the composting process, lowering organic matter weight.

Table 2: Characteristics of weed biomass and compost

Characteristics	Biomass		Compost	
	S	M	S	M
Carbon (%)	49.65	50.53	37.25	46.40
Nitrogen (%)	1.66	1.67	2.77	2.84
Phosphorus (%)	0.20	0.12	0.69	0.54
Potassium (%)	3.06	1	5.01	1.75
Calcium (%)	0.42	0.78	2.45	3.57
Magnesium (%)	0.35	0.36	0.97	0.58
Sulphur (%)	0.37	0.39	0.78	0.81
Iron (mg/kg)	545	588	4532	1858
Copper (mg/kg)	11.6	9.70	23.26	7.62
Zinc (mg/kg)	71.9	45.10	164.9	96.6
Manganese (mg/kg)	48.20	977	196	1720
C/N	29.91	30.26	13.45	16.34
Cellulose (%)	30	8	12	4
Lignin (%)	38	70	36	38
Hemicellulose(%)	20	20	2	6
pH	-	-	8.81	7.81

Caption: S = *Sphagneticola trilobata* L. Pruski, M = *Melastoma affine* D. Don

3.2 Effect of Weed-based Compost on Certain Soil Chemical Properties

Results indicated that, overall, after harvesting, organic-C ranged from 3.01% to 4.23% (medium to high), total N from 0.28% to 0.38% (medium), available P from 12.00 to 27.27 ppm (high), exchangeable Ca from 0.37 to 0.70 cmol/kg (very low), exchangeable Mg from 0.30 to 0.44 cmol/kg (low), and soil pH from 4.21 to 5.91 (acidic) (Balai Penelitian Tanah, 2009). Detail results are presented in Table 3.

ISSN: 2455-6939

Volume: 11, Issue: 01 "January-February 2025"

Table 3: Selected nutrient content in the soil after sweet corn harvesting

Treatment	Total-N (%)	Organic-C (%)	Available P (ppm)	Exch. Ca (cmol/kg)	Exch. Mg (cmol/kg)	pH
Control	0.28	3.01	12.00	0.37	0.44	4.21
S1	0.32	3.60	12.06	0.56	0.41	4.94
S2	0.38	3.61	23.42	0.57	0.38	5.64
S3	0.36	4.00	27.27	0.70	0.44	5.91
M1	0.29	3.39	17.86	0.47	0.30	4.82
M2	0.30	3.40	12.08	0.44	0.35	5.16
M3	0.33	4.23	14.98	0.64	0.35	5.39
Contrast			Probability			
Control vs Treatment	0.0163	0.0551	0.0009	0.0025	0.1484	<0.0001
S – M	0.0094	0.8138	<0.0001	0.0345	0.0301	0.0002
Control vs S1, M1	0.1970	0.4672	0.0885	0.0264	0.1175	<0.0001
S1, M1 – S2, M2	0.0865	0.9829	0.0530	0.7379	0.8644	<0.0001
S1, S3 – M1, M3	0.0621	0.0624	0.0004	0.0077	0.3343	<0.0001
S2, S3 – M2, M3	0.8564	0.0649	0.0228	0.0039	0.4227	0.0176

The very low and low levels of exchangeable Ca and Mg in the soil may negatively impact the growth and yield of sweet corn. Table 2 also showed that the type and dosage of weed compost had distinct effects on soil properties. Organic fertilization significantly increased the content of total total N, organic-C, available P, exchangeable Ca, and soil pH, but did not affect exchangeable Mg. The application of weed compost resulted in increases of 17.9%, 23%, 49%, 52%, and 26% in N-total, organic-C, available P, exchangeable-Ca, and pH, respectively, compared to no fertilization.

The compost treatments of *S. trilobata* and *M. affine* produced significantly different effects on the content of total-N, available P, exchangeable Ca, exchangeable Mg, and pH. However, organic-C content did not differ significantly between the compost treatments. Total N, available P, exchangeable Ca, exchangeable Mg, and pH in soil with *S. trilobata* compost were 17%, 40%, 20%, 24%, and 7.2% higher, respectively than those in soil treated with *M. affine* compost.

The application of 10 ton/ha weed compost did not affect total-N, organic-C, available P, or exchangeable Mg, but significantly increased exchangeable Ca and soil pH compared to the control. Additionally, the content of total N, organic C, available P, exchangeable Ca and Mg in soil treated with 10 ton/ha compost were similar to those in soil treated with 20 ton/ha. However, soil pH was 11% higher with the 20-ton/ha dose compared to the 10-ton/ha dose.

ISSN: 2455-6939

Volume: 11, Issue: 01 "January-February 2025"

Furthermore, the content of total N, organic C, and Mg did not differ between the 10 and 30 tons/ha doses, or between the 20 and 30 ton/ha doses. On the other hand, available P, exchangeable Ca, and pH in soil fertilized with 20 tons/ha compost were 41%, 31%, and 16% higher, respectively, compared to 10 tons/ha. Moreover, soil treated with 30 ton/ha compost had available P, exchangeable-Ca, and pH levels 19%, 34%, and 4.7% higher, respectively, than soil treated with 20 tons/ha. The results of this study suggest that the application of compost up to 30 tons/ha continues to increase available P, exchangeable Ca, and soil pH.

3.3 Effect of Weed-based Compost on Sweet Corn Growth and Yield

The study results revealed that sweet corn fertilized with weed-based compost exhibited better growth compared to those without fertilizer (Tables 4 and 5). Weed compost significantly increased plant height, number of leaves, stem diameter, and leaves area by 126%, 69%, 188%, and 376%, respectively, compared to no fertilization (Table 4). Additionally, Table 4 shows that *S. trilobata* compost resulted in higher plant height, number of leaves, stem diameter, and leaves area by 20%, 18%, 35%, and 34%, respectively, compared to *M. affine* compost. The application of 10 tons/ha of weed-based compost significantly improved plant height, leaf number, stem diameter, and leaves area compared to control. However, plants treated with *S. trilobata* and *M. affine* compost at 10 tons/ha, 20 tons/ha, and 30 tons/ha did not show significant differences between doses.

Table 4: Effect of weed-based compost on plant height, number of leaves, stem diameter, and leaf area of sweet corn

Treatment	Plant height (cm)	Number of leaves	Stem diameter (mm)	Leaves area (cm)
Control	54.66	6.00	5.00	86.60
S1	135.90	10.33	15.90	500.72
S2	135.75	11.33	17.53	446.99
S3	133.40	11.33	16.50	427.75
M1	98.00	8.66	10.43	272.18
M2	113.23	9.33	12.06	317.07
M3	126.80	10.00	14.06	437.30
Contrast	Probability			
Control – Treatment	<0.0001	<0.0001	<0.0001	<0.0001
S - M	0.0017	0.0045	0.0001	0.0187
Control Vs S1, M1	<0.0001	0.0003	<0.0001	0.0004
S1, M1 – S2, M2	0.3037	0.1895	0.1352	0.9354
S1, S3 – M1, M3	0.0834	0.0740	0.0591	0.4044
S2, S3 – M2, M3	0.4393	0.5899	0.6461	0.3620

ISSN: 2455-6939

Volume: 11, Issue: 01 "January-February 2025"

The results showed that weed-based compost significantly increased shoot weight (Table 5). The application of organic fertilizer from weed compost resulted in increases of 558% in fresh shoot weight, 581% in dry shoot weight, 382% in fresh root weight, and 868% in dry root weight compared to no fertilization. Additionally, *S. trilobata* compost led to increases of 69%, 75%, 87%, and 72% in fresh shoot weight, dry shoot weight, fresh root weight, and dry root weight, respectively, compared to *M. affine* compost.

Table 5: Effect of weed-based compost on shoot and root weights of sweet corn

Treatment	Shoot fresh weight (g)	Shoot dry weight (g)	Root fresh weight (g)	Root dry weight (g)
Control	17.79	4.13	10.82	1.99
S1	125.17	38.08	58.06	26.20
S2	159.33	35.12	64.29	21.41
S3	153.33	34.30	81.67	25.51
M1	73.60	18.12	36.52	12.40
M2	89.58	19.05	34.50	13.56
M3	96.04	24.04	37.82	16.51
Contrast	Probability			
Control - Treatment	<0.0001	<0.0001	<0.0001	<0.0001
S - M	<0.0001	<0.0001	<0.0001	0.0002
Control vs S1, M1	<0.0001	<0.0001	0.0003	<0.0001
S1, M1 – S2, M2	0.0186	0.7049	0.7371	0.4924
S1, S3 – M1, M3	0.0178	0.6884	0.0626	0.5154
S2, S3 – M2, M3	0.9809	0.4393	0.1150	0.1916

Table 5 also shows that applying 10 tons/ha of weed-based compost significantly increased shoot fresh and dry weight, as well as root fresh and dry weight. However, shoot weight did not differ between the 10 and 20 ton/ha doses, except for shoot fresh weight, which was 25% higher at 20 tons/ha compared to 10 tons/ha. A similar pattern was observed between the 10 and 30 ton/ha doses, where shoot weight remained unchanged, except for shoot fresh weight, which was 25% greater at 30 ton/ha than at 10 ton/ha. Additionally, there was no significant difference in shoot weight between the 20 and 30 tons/ha doses. These findings suggest that, overall, shoot weight is similar at dosages of 10, 20, and 30 tons/ha (Tables 4 and 5).

Results also indicated that fertilized plants produced significantly higher sweet corn yields compared to those without fertilizer (Table 6). Compost fertilization increased unhusked ear diameter by 251% and unhusked ear diameter by 320%, while unhusked ear length increased by

ISSN: 2455-6939

Volume: 11, Issue: 01 "January-February 2025"

81% and husked ear length by 217%. In addition, sweet corn plants fertilized with *S. trilobata* compost had husked ear diameter, unhusked and husked ear length comparable to those fertilized with *M. affine* compost. However, *S. trilobata* compost resulted in a 17% greater unhusked ear diameter, an 80% higher unhusked ear weight, and an 86% higher husked ear weight compared to *M. affine* compost.

Table 6: Effect of weed-based compost on yield components of sweet corn

Treatment	Unhusked ear diameter (mm)	Husked ear diameter (mm)	Unhusked ear weight (g)	Husked ear weight (g)	Unhusked ear length (cm)	Unhusked ear length (cm)
Control	11.20	8.93	5.68	1.74	11.00	4.36
S1	42.53	37.23	127.86	91.72	22.26	17.83
S2	43.16	37.96	112.63	83.51	19.43	11.50
S3	41.56	41.43	116.84	85.36	22.16	14.46
M1	32.03	32.53	47.18	31.50	17.66	11.56
M2	35.83	35.60	58.57	39.21	18.93	13.63
M3	41.06	40.53	92.01	69.02	19.33	14.10
Contrast	Probability					
Control - Treatment	<0.0001	<0.0001	0.0005	0.0011	0.0012	0.0003
S - M	0.0085	0.3029	0.0028	0.0049	0.1369	0.3381
Control vs S1, M1	<0.0001	0.0001	0.00023	0.00052	0.0031	0.0004
S1, M1 – S2, M2	0.3801	0.5421	0.9164	0.9871	0.7058	0.2687
S1, S3 – M1, M3	0.1214	0.0646	0.3629	0.3094	0.7085	0.8253
S2, S3 – M2, M3	0.4699	0.1888	0.3127	0.3022	0.4580	0.3698

Table 6 also shows that applying compost at a rate of 10 tons/ha significantly increased unhusked and husked ear diameters, unhusked and husked ear weight, and unhusked and husked ear length compared to the control. However, no significant differences were observed between the 10, 20, and 30 tons/ha doses. These findings suggest that a weed compost positively affects at dose of 10 tons/ha.

4. DISCUSSION

The study demonstrated that applying organic fertilizers derived from weeds effectively increased total N, organic C, available P, exchangeable Ca, and the pH of Inceptisols. This nutrient enhancement was attributed to the additional nutrients provided by weed compost (Table 2). The rise in soil pH following compost application was due to the formation of Al-organic complexes in the soil (Spark, 2003), which reduced H ion release from Al hydrolysis (Ifansyah *et al*., 2013) and eventually increased pH. Previous studies have indicated that mature compost increases soil organic matter (SOM) more effectively than immature compost due to its higher carbon content (Adugna, 2016). Additionally, Muktamar *et al*., (2022) concluded that Wedelia compost application improved total N, available P, exchangeable K, Ca, Mg, and soil pH in acidic soils.

Weed-based compost of *M. affine* contained higher levels of N, C, K, and Ca than *S. trilobata* compost, however, its application in soil resulted in lower nutrient levels compared to *S. trilobata*. This result could be attributed to the faster decomposition rate of *S. trilobata* compost, as indicated by its lower C/N ratio (13.4) compared to *M. affine* (16.3). A lower C/N ratio, particularly in the range of 1–15, accelerates the decomposition of organic matter and enhances nitrogen release (Brust, 2019; Domouso et al., 2024). Likewise, *S. trilobata* compost had a higher cellulose content, whereas *M. affine* compost contained slightly more lignin. Since cellulose decomposes more readily than lignin, this further explains the faster nutrient release from *S. trilobata* compost. A study by Burhenne *et al*., (2013) confirms that biomass with higher cellulose and hemicellulose content decomposes more rapidly than materials with greater lignin content.

Enhancement of sweet corn growth and yield due to application of *S. trilobata* and *M. affine* composts compared to unfertilized plants, might have attributed to increased soil fertility, particularly higher levels of N, C, P, Ca, and pH (Table 3), brought about these nutrients more available for plant uptake. Soil nutrient availability has a positive correlation with plant nutrient absorption (Kumar *et al*., 2017), which in turns is positively linked to plant growth and yield (Fahrurrozi *et al*., 2017; Agegnehu *et al*., 2016). Furthermore, enhanced root development also contributed to better plant growth by improving the soil physical properties. Research by Widodo (2018) confirmed that applying compost at a rate of 25.5 kg/plot increased soil aggregate stability, improved soil porosity, and reduced soil bulk density compared to unfertilized soil.

Better growth and yield of sweet corn fertilized with *S. trilobata* compost compared to those treated with *M. affine* compost might have resulted from higher content of N, P, Ca, Mg, and pH in the soil amended with *S. trilobata* compost. Setyowati (2008) found that planting media enriched with 70 g/plant and 57 g/plant of *Wedelia* compost exhibited higher N content and a lower C/N ratio compared to *Chromolaena* compost. Additionally, the application of *S. trilobata* and *M. affine* compost at rates of 10, 20, and 30 tons/ha resulted in comparable sweet corn growth and yield. Moreover, *S. trilobata* compost proved to be more effective than *M. affine* compost in promoting crop performances.

Overall, the growth and yield of sweet corn in this study were lower than the yield potential of the Bonanza variety. This reduced growth may be attributed to certain limiting factors. As shown in

Table 3, exchangeable Ca and Mg levels in the soil after harvesting remained within the very low to low range. This condition likely restricted the availability of these essential nutrients for plant growth. A study by Gatti *et al*., (2023) concluded that calcium deficiency in corn significantly reduces root length, turning roots dark brown and causing early symptoms of chlorosis. Additionally, insufficient Ca can limit cell development, while low Mg availability can hinder photosynthesis, as Mg is a key component of chlorophyll. According to Wang *et al*., (2020), exchangeable Mg levels below 120 mg/kg, or approximately 1 me/100g, are considered deficient. In this study, exchangeable Mg levels in the soil were recorded at 0.44 me/100g or lower, indicating a critically deficient condition.

Another possibility is the presence of residual allelochemicals from the composting process of weed biomass. These compounds can inhibit seed germination and early-stage crop growth. Previous studies have suggested that allelochemical water extracts suppress seed germination and seedling growth in sorghum (Susilo *et al*., 2023; Susilo et al., 2024). Further research is necessary to determine the specific effects of residual allelochemicals in weed compost on the germination and growth of sweet corn.

5. CONCLUSIONS

The application of weed compost can enhance soil properties, including total N, organic-C, available P, exchangeable Ca and Mg, as well as pH in Inceptisols. Soil fertilized with *S. trilobata* compost exhibited superior properties compared to that fertilized with *M. affine* compost. Improvements in soil quality contributed to increased sweet corn growth and yield, as reflected in plant height, leaf number, stem diameter, shoot weight, ear diameter, ear length, and ear weight. The use of *S. trilobata* compost resulted in better sweet corn growth and yield than *M. affine* did. The highest growth and yield were observed with a compost application rate of 10 tons/ha. These findings are valuable for optimizing fertilization strategies on marginal soils such as Inceptisols.

ACKNOWLEDGEMENTS

Sincerely appreciation goes to the Directorate General of Research and Community Service, Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, for providing financial support for executing this research project through contract No. 3937/UN30.15/PT/2024.

REFERENCES

[1]. Swapna, G., G. Jadesha, and P. Mahadevu. (2020). Sweet corn–a future healthy human nutrition food. Int. *J. Curr. Microbiol. App. Sci*, 9(7), 3859-65. DOI: https://doi.org/10.20546/ijcmas.2020.907.452

[2]. Sabur, A., L. Pramudyani., M. Yasin, and J. Purnomo. (2021). Application of biological fertilizers on growth and yield of sweet corn (*Zea mays saccharata* Sturt) in dry land. In *IOP Conference Series: Earth and Environmental Science* (Vol. 807, No. 4, p. 042024). IOP Publishing. DOI: https://doi.org/10.1088/1755-1315/807/4/042024

[3]. Dewanto, F. G., J. J. M. R. Londok, R. A. V. Tuturoong, and W. B. Kaunang. (2017). Pengaruh pemupukan anorganik dan organik terhadap produksi tanaman jagung sebagai sumber pakan. *Zootec, 32*(5), 1–8. https://doi.org/10.35792/zot.32.5.2013.982

[4]. Lungu, O. I. M, and R. F. P. Dynoodt. 2008. Acidification from long-term use of urea and its effect on selected soil properties. *African Journal of Food Agriculture Nutrition and Development 8*(1): 63-76. https://www.ajfand.net/Volume8/No1/Obed2470.pdf

[5]. Fageria, N. K., A. B. Dos Santos, dan M. F. Moraes. (2010). Influence of urea and ammonium sulfate on soil acidity indices in low land rice production. *Communications in Soil Science and Plant Analysis*, 41(13):1565–1575. https://doi.org/10.1080/00103624.2010.485237

[6]. Wulandari, J., Z. Muktamar, dan Widodo. (2018). Perubahan beberapa sifat kimia tanah Ultisol dan pertumbuhan jagung manis (*Zea mays* Saccharata Sturt L.) akibat aplikasi pupuk organik dan pupuk nitrogen. Prosiding Seminar Nasional dan Rapat Tahunan Dekan Bidang Ilmu Pertanian BKS PTN Wilayah Barat. Balunijuk, Babel, 20-21 Juli 2017. pp. 400-407. https://www.researchgate.net/publication/338864568_Prosiding_BKS_PTN_UBB_2017_di_Bangka_Belitung

[7]. Su, Y. Z., F. Wang, D. R. Suo, Z. H. Zhang, and M. W. Du. (2006). Long-term effect of fertilizer and manure application on soil carbon sequestration and soil fertility under the wheat-wheat-maize cropping system in northwest China. Nutr Cycl Agroecosyt 75: 285-295. https://link.springer.com/article/10.1007/s10705-006-9034-x

[8]. Kumari, M., S. Sheoran, D. Prakash, D. B. Yadav, P. K. Yadav, M. K. Jat, Ankit, and Apurva. (2024). Long-term application of organic manure and chemical fertilizers improve the organic carbon and microbiological properties of soil under pearl millet cropping system in North Western India. *Heliyon* 10 (2024) e254333. https://www.cell.com/action/showPdf?pii=S2405-8440%2824%2901364-1

[9]. Dinca, L.C., P. Grenni, C. Onet, and A. Onet. (2022). Fertilization on soil microbial community: A review. *Applied Science 12*(3) 1198. https://www.mdpi.com/2076-3417/12/3/1198

[10]. Habinsaran, D. H., Hendarto, K., Elzhivago, S. R., and Yulistiani, A. (2018). The effect of organic fertilizer and urea fertilizer on growth, yield and quality of sweet corn and soil health. *Asian Journal of Agriculture and Biology*, *6*(3), 335–344.

[11]. Supartha, I. Y., G. Wijaya, & G. M. Adnyana. (2012). Aplikasi jenis pupuk organik pada tanaman padi sistem pertanian organik. *E-Jurnal Agroekoteknologi Tropika*, *1*(2), 98–106.

[12]. Muktamar, Z., B. Justisia, anlungd N. Setyowati. (2016). Quality Enhancement of Humid Tropical Soils after Application of Water Hyacinth (*Eichornia crassipes*) Compost. Journal of Agricultural Technology 12(7.1): 1715-1727. http://www.aatsea.org/images/conference_publications/pdf/v13_n7_2_2017_December/19_IJAT_13(7.2)_2017_Muktamar%20Zainal_Environmental%20Science,%20Soil%20and%20Water%20Conservation.pdf

[13]. Utami, K., E. I. A. Sari, Z. Muktamar, and Y. H. Bertham. (2023). Peran Vermikompos Kotoran Sapi Terhadap Peningkatan Hara di Tanah Inceptisol dan Ultisol Bengkulu. Prosiding Seminar Nasional dan Lokakarya Lembaga Akreditasi Mandiri Pendidikan Tinggi Ilmu ilmu Pertanian (LAM-PTIP) 7(1): 465-473. https://proceeding.uns.ac.id/semnasfp/article/view/250/206

[14]. Hakimi, F., A. Sebbar, R. Bouamri, A. A. H. Sidikou, M. EL Janati, and A. Bouaziz. (2024). Effects of Compost and Compost Tea on Soil Properties and Nutrient Uptake of the Moroccan Date Palm Cultivar "Mejhoul" under Organic Cultivation. *Journal of Ecological Engineering*, *25*(7), 224–240. https://doi.org/10.12911/22998993/188334

[15]. Apriliani, R., B. Sulistyo, and Z. Muktamar. (2024). *Improvement of Selected Soil Physical Properties and Mustard Yield After the Application of Tithonia Compost in Ultisols*. *7*(2), 66–71. https://doi.org/10.31186/terra.7.2.66-71

[16]. Castellinio, M., C. Bondi, L. Giglio, and M. Iovino. (2024). Impact of vermicompost addition on water availability of different texture soils. *Heliyon 10* (2024) e35699. https://doi.org/10.1016/j.heliyon.2024.e35699

[17]. Baharuddin, A. B., and R. S. Tejowulan. (2021). Improving Maize (*Zea mays* L.) growth and yield by the application of inorganic and organic fertilizers plus. In *IOP Conference Series: Earth and Environmental Science* (Vol. 712, No. 1, p. 012027). IOP Publishing. https://doi.org/10.1088/1755-1315/712/1/012027

[18]. Gosal, M., D. Rayer, and S. Gedoan. 2022. The effect of water hyacinth (*Eichhornia crassipes*) organic fertilizer on the vegetative growth of Manado strain yellow maize (*Zea mays* L.). *World Journal of Advanced Research and Reviews*.

[19]. Nurmalasari, A. I., Supriyono, F. Linda, and Sukaya. (2024). Analysis of sweet corn growth and yield with the use of organic cow manure fertilizer. *Ilmu Pertanian (Agricultural Science)* *9*(3): 173-180. *https://jurnal.ugm.ac.id/jip/article/view/94315/40818*

[20]. Nugroho, B., W. Mildaryani, and D. S. H. C. Dewi. (2019). Potensi gulma siam (*Chromolaena odorata* L.) sebagai bahan kompos untuk pengembangan bawang merah organik. *Jurnal Agronomi Indonesia (Indonesian Journal of Agronomy)*, *47*(2), 180–187. https://doi.org/10.24831/jai.v47i2.23440

[21]. Setyowati, N., Z. Muktamar, B. Suriyanti, & M. Simarmata. (2014). Growth and yield of chili pepper as affected by weed based organic compost and nitrogen fertilizer. *International Journal on Advanced Science*, *Engineering and Information Technology*, *4*(2), 121. https://doi.org/10.18517/ijaseit.4.2.382

[22]. Wijaya, R., Setyowati, N., dan Masdar, M. (2017). Pengaruh jenis kompos dan waktu pengendalian gulma terhadap pertumbuhan dan hasil tanaman jagung manis secara organik. Dalam Prosiding Seminar Nasional: Inovasi Teknologi Pertanian Modern Mendukung Pembangunan Pertanian Berkelanjutan**.** **https://doi.org/10.31227/osf.io/39jzb**

[23]. Bakewell-Stone, P. (2024). Melastoma malabathricum (*Banks melastoma*).

[24]. Syahid, A., B. Prasetya, and L. Q. Aini. (2020). Physical and chemical characteristics during composting on different types of compost materials. *EurAsian Journal of BioSciences Eurasia J Biosci*, *14*(December), 7921–7928.

[25]. Balai Penelitian Tanah. (2009). *Petunjuk Tehnis Analisis Kimia Tanah, Tanaman, Air, dan Pupuk* Second ed. Balai Penelitian Tanah, Balai Besar Litbang Sumberdaya Lahan Pertanian. Departemen Pertanian. 234 p.

[26]. Spark, D.L. (2003). Environmental Soil Chemistry. Second ed. *Academic Press*. New York. The USA.

[27]. Ifansyah, H., Yani, J. A., 36 Banjarbaru, K., & Selatan, K. (2013). Soil pH and Solubility of Aluminum, Iron, and Phosphorus in Ultisols: the Roles of Humic Acid. *J Trop Soils*, *18*(3), 203–208. https://doi.org/10.5400/jts.2013.18.3.203

[28]. Adugna, G. (2016). A review on impact of compost on soil properties, water use and crop productivity. *Academic Research Journal of Agricultural Science Research*, *4*(March), 93–104. https://doi.org/10.14662/ARJASR2016.010

[29]. Muktamar, Z., N. Setyowati, and E. Wiyanti. (2022). The Improvement of Selected Soil Chemical Properties Using Singapore Daisy Based Compost in Ultisols. *International Journal of Agriculture and Biological Sciences 6* (Jan-Feb.): 41-48. https://zenodo.org/record/6596782#.ZB6sPS8RpQJ

[30]. Brust, G. E. (2019). Management strategies for organic vegetable fertility in Safety and Practice for Organic Food ed. Biswas, D. and Micallef, S.A. p:193-212. *Academic Press*. https://www.sciencedirect.com/science/article/abs/pii/B978012812060600009X

[31]. Domouso, P., E. P. Sanchez, J. Calero, and R. G. Ruiz. (2024). Carbon and nitrogen mineralization of common organic amendments in Olive Grove soils. *Agriculture 14*, 1923. https://www.mdpi.com/2077-0472/14/11/1923

[32]. Burhenne, L., J. Messmer, T. Aicher, and M. P. Laborie. (2013). The effect of biomass component lignin, cellulose, and hemicellulose on TGA, and fixed bed pyrolysis. *Journal of Analytical and Applied Pyrolysis 101*: 177-184. https://www.sciencedirect.com/science/article/abs/pii/S0165237013000168

[33]. Kumar, M., V. Kumar, R. Kumar and R. Pratap. (2017). Correlation between soil nutrient and plant nutrient concentration in mustard Journal *of Pharmacognosy and Phytochemistry 6*(4): 751-754. https://www.phytojournal.com/archives/2017/vol6issue4/PartK/6-4-154-565.pdf

[34]. Fahrurrozi, F., Z. Muktamar, S. Sudjatmiko, M. Chozin, and N. Setyowati. (2019). Phosphorus uptakes and yields of sweet corn grown under organic production system. *IOP Conference Series: Earth and Environmental Science* 347 012006. https://iopscience.iop.org/article/10.1088/1755-1315/347/1/012006/pdf

[35]. Agegnehu, G., P. N. Nelson, and M. I. Bird. 2016. Crop yield, plant nutrient uptake, and soil physicochemical properties under organic soil amendments and nitrogen fertilization on Nitisols. *Soil and Tillage Research 160*: 1-13. https://www.sciencedirect.com/science/article/abs/pii/S0167198716300149

[36]. Widodo, K. H., dan Z. Kusuma. (2018). Pengaruh kompos terhadap sifat fisik tanah dan pertumbuhan tanaman jagung di inceptisol. *Jurnal Tanah dan Sumberdaya Lahan*, *5*(2), 959-967.

[37]. Setyowati, N., Nurjanah, U., & Haryanti, D. (2008). Gulma Tusuk Konde (*Wedelia trilobata*) dan Kirinyu (*Chlomolaena odorata*) sebagai Pupuk Organik PadaSawi (*Brassica chinensis* L). *Akta Agrosia*, *11*(1), 47-56.

[38]. Gatti, V. C. M., Barata, H. S., Silva, V. F. A., Cunha, F. F., Oliveira, L. A., Oliveira, J. T., and Silva, P. A. (2023). Influence of calcium on the development of corn plants grown in hydroponics. *AgriEngineering*. 5(1):623-630. *https://www.mdpi.com/2624-7402/5/1/39*

[39]. Wang, Z., M. U. Hassan, F. Nadeem, L. Wu, F. Zhang, and F. Li, F. (2020). Manesium Fertilization Improves Crop Yield in Most Production Systems: A Meta-Analysis. *Frontiers in Plant Science* 13: https://www.frontiersin.org/journals/plant-science/articles/10.3389/fpls.2019.01727/full

[40]. Susilo, E., N. Setyowati, U. Nurjanah, Riwandi, and Z. Muktamar. (2023). Inhibition of seed germination under water extracts of sorghum (*Sorghum bicolar*, L.) and its ratoon cultivated in swamp land. *IJAT* 19(3):1337-1346. http://www.ijat-aatsea.com/pdf/v19_n3_2023_May/36_IJAT_19(3)_2023_Susilo,%20E.(22).pdf

ISSN: 2455-6939

Volume: 11, Issue: 01 "January-February 2025"

[41]. Susilo, E., N. Setyowati, and H. Pujiwati. (2024). Potential of sorghum water extract as bioherbicide under different varieties and water stresses. *International Journal of Integrative Sciences* 3(11): 1255-1264. https://journal.formosapublisher.org/index.php/ijis/article/view/12129

