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The Effect of Liquid Organic Fertilizer from Cow Urine with Monosodium Glutamate Dosage on the Growth of Cening and Bululawang Sugarcane Bud Sets

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Abstract

Background: The excessive use of chemical fertilizers can lead to a decline in soil quality. One of the efforts to improve soil fertility is by using bio-fertilizers. An alternative fertilizer that can be used is liquid fertilizer derived from cow urine.
Aims: The study aimed to determine the optimal concentration of Monosodium Glutamate (MSG) added to liquid cow urine fertilizer for the growth of sugarcane bud set varieties Cening and Bululawang.
Methods: The research was conducted in Jarak Village, Plosoklaten District, Kediri Regency, East Java, from May to July 2023. The design used was a Randomized Complete Block Design (RCBD) with a factorial arrangement, consisting of 5x2 = 10 treatments, repeated 3 times as blocks, resulting in 30 experimental units. The observed variables included plant height, number of tillers, number of leaves, fresh weight, and dry weight. Data analysis was performed using analysis of variance (ANOVA) at a 5% significance level, followed by Duncan's Multiple Range Test (DMRT) if significant differences were found.
Result: The results showed a significant interaction effect of bio-fertilizers cow urine and msg on plant height, number of leaves, number of tillers, fresh weight of leaves, fresh weight of stems, fresh weight of roots, and dry weight of roots.

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1. Introduction

Sugarcane (*Saccharum officinarum* L.) is the primary source of white sugar in Indonesia, but domestic sugar production has not been able to meet the increasing domestic demand, which grows in line with the population increase. One indicator of the issues in Indonesia's sugar industry is the growing import volume, increasing at a rate of 16.6% per year, due to the rising consumption rate of 2.96% per year, while domestic sugar production is declining at a rate of 6.14% per year (Ardana *et al.,* 2016).

Low seed availability is one of the reasons for the low productivity of sugarcane. Seed provision is still largely done conventionally using the setts method, which is costly. Besides the seed provision issue, there is also limited availability of seedling land. Consequently, to address these problems, a faster, more space-efficient seed provision method than the setts method is needed. This method uses single-eye sets (bud sets) (Putri *et al.,* 2015). The advantage of using bud set seedlings for this research is that there will be no contamination between different treatments. According to Marjayanti & Pudjiarso (2014), the bud set technique involves propagating sugarcane from cane stalk cuttings with a single node, about 5 cm in length, with the bud positioned in the middle of the cutting.

The decline in soil fertility is often due to improper land management that does not adhere to soil conservation principles. Farmers frequently use excessive chemical fertilizers to enhance soil fertility. Unbeknownst to them, the excessive use of chemical fertilizers can negatively impact the quality and quantity of groundwater. One effort to improve soil fertility is by using bio-fertilizers.

An alternative fertilizer that can be used is liquid fertilizer derived from cow urine. The availability of cow urine, often overlooked, poses an environmental issue, while the substantial cattle farming potential in East Java necessitates the development of this resource. Liquid cow urine fertilizer contains significant nutrients that can support the growth of sugarcane. Transforming cow urine into liquid fertilizer facilitates its dissolution in the soil and provides essential elements for soil fertility. However, this cow urine-based liquid organic fertilizer also has drawbacks, such as the incomplete nutrient profile compared to commercial synthetic fertilizers (Sutanto, 2002). Cow urine contains macro and micronutrients needed by plants, although in lower concentrations than conventional fertilizers (Purwanto *et al.,* 2014). According to Alfarisi & Manurung (2015), cow urine contains nutrients such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg), which are essential as organic materials that improve soil quality. These nutrients are found in concentrations of Nitrogen 1.00%, Phosphorus 0.50%, Potassium 1.50%, and Water 92%. All plants require adequate nutrient intake, particularly essential elements like nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg). Considering the deficiencies of certain elements in liquid cow urine fertilizer, it is important to supplement its nutrient content. One additional nutrient that needs to be incorporated is sodium (Na). Sodium plays a crucial role in supporting vegetative growth in plants.

MSG (Monosodium Glutamate), commonly known as "Mecin," is a widely available and affordable culinary additive. The sodium content in MSG plays a significant role in the vegetative and reproductive development of plants. According to Wakeel *et al.* (2011), sodium can serve as a substitute for potassium during the vegetative phase of plants in small doses. Since MSG is a type of salt containing sodium, its application to plants can be beneficial, provided that the dosage is carefully controlled. The presence of sodium in MSG has the potential to enhance plant development during potassium deficiency. The sodium (Na) content in MSG is necessary to support plant growth in both vegetative and generative phases (Marshella *et al.,* 2017).

Monosodium Glutamate (MSG) has the potential as a plant growth stimulant because it contains components that support plant development. This compound is naturally found in various organisms and is produced by most living organisms as part of metabolic processes and as an energy source. When used in plant fertilization practices, MSG can stimulate faster growth and result in denser foliage (Qi et al., 2019). MSG appears white crystals and is water-soluble. It consists of 12.2% sodium, 78.2% glutamate, and 9.6% H_2O (Nur'aini, 2020).

The use of Monosodium Glutamate as a growth stimulant has broad applications across various plant varieties. MSG can be included as a component in liquid organic fertilizers made from cow urine, ensuring the nutritional needs of the fertilizer are met, and optimizing the growth of sugarcane plants. According to Hutasoit (2019), there is a significant difference in sugarcane growth response when using cow urine liquid fertilizer with different MSG doses. Therefore, research is needed to determine the effect of MSG application in cow urine liquid fertilizer on the growth of sugarcane bud set seedlings in different varieties and to identify the optimal MSG concentration for enhancing the growth of sugarcane bud set seedlings.

2. Methods

2.1 Study site

The research was conducted in Jarak Village, Plosoklaten District, Kediri Regency, East Java, from May to July 2023. The tools used in this study included hoes, soil sieves, watering cans, buckets, jerry cans, stirrers, measuring glasses, writing instruments, rulers, digital scales, and mobile phone cameras. The materials used were Bululawang and Cening sugarcane seedlings, EM4, water, soil, polybags, molasses, MSG, and cow urine. The design used was a Randomized Complete Block Design (RCBD) with a factorial arrangement, involving 10 treatment variations repeated 3 times in blocks, resulting in a total of 30 experiments.

Table 1. Treatment information

Code	Factor 1	Factor 2
V1A0	Cening Variety	500ml cow urine
V1A1	Cening Variety	500ml cow urine + 1g MSG
VIA2	Cening Variety	500ml cow urine + 2g MSG
V1A3	Cening Variety	500ml cow urine + 3g MSG
V1A4	Cening Variety	500ml cow urine + 4g MSG
V2A0	Bululawang Variety	500ml cow urine
V2A1	Bululawang Variety	500ml cow urine + 1g MSG
V2A2	Bululawang Variety	500ml cow urine + 2g MSG
V2A3	Bululawang Variety	500ml cow urine + 3g MSG
V2A4	Bululawang Variety	500ml cow urine + 4g MSG

2.1 Preparation stage

The cow urine used was obtained from a cattle farmer located in Jarak Village. A total of 20 liters of cow urine was used, along with 1 liter of molasses and 1 liter of EM4. All ingredients were mixed in a ratio of 20 liters of cow urine: 1 liter of molasses: 1 liter of EM4. The mixture was stirred evenly for 2 minutes, then sealed tightly and ready to undergo the fermentation process.

Fermentation was carried out for 14 days under anaerobic conditions. This anaerobic condition was designed as a process of decomposing organic materials without using oxygen. During the fermentation process, the jerry can should not be opened, and it should be stirred every 3 days by gently shaking the jerry can to ensure that fermentation occurs in a homogeneous state.

The physical characteristics of quality fertilizer include a yellowish-brown color and a mild aroma. This statement is supported by Kurniadinata (2008), who indicated that good cow urine liquid fertilizer has a dark color and a mild odor. In the final stage, the fermented cow urine fertilizer was filtered before being used in the sugarcane plant experiments.

2.2 Implementation stage

The sugarcane seedlings were obtained from Jarak Village, Plosoklaten District, Kediri Regency, East Java, with good quality. The area prepared for planting sugarcane is located in Jarak Village, Plosoklaten District, Kediri Regency, East Java. This area was treated by cleaning it with hoes and brooms to remove interfering weeds, and a net was added around the field to provide protection from pest threats.

Mulching was applied to the surface of the soil to protect the land from heavy rain and termite attacks. Polybags measuring 25 x 25 cm were filled with a mixture of compost, soil, and cocopeat in a 1:1:1 ratio. The use of polybags aims to facilitate land maintenance, monitor plant growth, and reduce weed growth around the sugarcane plants.

The prepared sugarcane seedlings were then placed into the polybags filled with the growing medium. Each polybag was planted with one sugarcane seedling, but additional reserve seedlings were also included in each experiment as replacements. The total number of polybags filled with sugarcane seedlings was 40, consisting of 30 polybags for the experiment and 10 polybags as reserves.

The observed parameters included plant height, number of leaves, number of tillers, fresh weight, and dry weight. Data analysis was performed using ANOVA with a 5% F-test, followed by Duncan's Multiple Range Test (DMRT) for treatments that showed significant differences.

3. Results and Discussion

3.1 Plant Height

Measurements were taken after a 4-week seed adaptation period following planting. The height was measured once a week for 2 months. Measurements were taken using a ruler from the soil surface to the plant tip. The observation data from each observation block were averaged, and analysis of variance (ANOVA) was conducted for each treatment.

Table 2. Effect of liquid cow urine fertilizer and MSG application on sugarcane height.

Cening	Observation Week of-							
	4 WAP	5 WAP	6 WAP	7 WAP	8 WAP	9 WAP	10 WAP	11 WAP
	cm							
VIA0	24.6a	39.3a	46.6a	73.3a	82.3a	103.3a	114.6a	127.6a
V1A1	43.6bc	60.3b	67.3b	96.6a	108.6b	123.6b	145.6b	160b
V1A2	45.3c	60b	66.6b	96.6a	112b	118.6b	128.8ab	153.3ab
V1A3	34.6b	57.3b	66.3b	98.3a	106b	118b	134ab	152ab
V1A4	35b	52.3ab	58.6b	78.3a	95ab	116.3b	125.6ab	138ab
Bululawang								
V2A0	26.7a	39.0a	39.0a	74.0a	86.7a	105.3a	119.0a	134.3a
V2A1	38.3ab	64.7b	64.7b	104.0b	114.7b	124.7a	137.7a	163.3a
V2A2	41.7b	65.0b	65.0b	110.0b	123.0b	132.0a	161.0a	165.3a
V2A3	44.3b	63.3b	84.0c	111.0b	123.0b	131.0a	142.3a	166.3a
V2A4	45.7b	65.0b	77.3bc	107.0b	118.7b	133.7a	157.7a	170.7a

Numbers followed by the same letter indicate no significant difference in the 5% DMRT test.

Based on Table 2, the treatment on plant height for V1A0 did not show significant differences from week 4 to week 11. For the V1A1 treatment, significant differences were observed from week 4 to week 6, while in week 7, plant height did not show significant differences. However, from week 8 to week 11, significant differences were observed. In the V1A2 treatment, significant differences in plant height were observed, but in weeks 11 and 12, no significant differences were found. For the V1A3 treatment, significant differences were found from week 4 to week 6, but in week 7, no significant differences were observed. In weeks 8 and 9, significant differences were noted, although in weeks 10 and 11, no significant differences were observed again. Finally, for the last treatment in the Cening variety, V1A4, significant differences were observed in weeks 4, 6, and 8, while no significant differences were found in weeks 5, 7, 9, 10, and 11.

In the Bululawang variety, the V2A0 treatment showed no significant differences in plant height from week 4 to week 11. For the V2A1 treatment, no significant differences were observed in week 4, but significant differences were found from week 5 to week 8. However, from week 9 to week 11, no significant differences were observed. In the V2A2 treatment, significant differences were found from week 4 to week 8, but no significant differences were observed in weeks 9 to 11. For the V2A3 treatment, significant differences were observed in plant height from week 4 to week 8, but no significant differences were found in the subsequent weeks, including the last week. Lastly, in the V2A4 treatment, significant differences were found from week 4 to week 8, but no significant differences were observed from week 9 to week 11.

In the Cening variety, the tallest plants were obtained from the V1A2 treatment, with an average plant height reaching 160, while the lowest average plant height was 127.5 in the V1A0 treatment. These results show significant differences between the treatments. On the other hand, in the Bululawang variety, no significant differences were observed, but the average plant height was higher than that of the Cening variety, with an average of 170.7 in the V2A4 treatment. In terms of growth potential, this late-maturing sugarcane variety shows excellent growth and is widely cultivated by farmers in the working area of PTPN X (Zainuddin & Wibowo, 2019).

Both varieties showed that plant height had significantly different results in the Cening variety with the application of 1g MSG dosage. Sodium can substitute potassium in the vegetative phase of plants at small doses, and considering that MSG salt contains sodium, it can be applied to plants, provided that the dosage is carefully monitored (Wakeel *et al.,* 2011).

3.2 Number of leaves

Observations were made when the plants were 4 weeks old. Observations were made once a week for 2 months by counting the number of leaves per plant. Observation data from each observation block were averaged. and analysis of variance was carried out for each treatment.

Table 3. Effect of liquid cow urine fertilizer and MSG application on the number of sugarcane leaves

Cening	Observation Week of-							
	4 WAP	5 WAP	6 WAP	7 WAP	8 WAP	9 WAP	10 WAP	11 WAP
A0	3.3a	3.3a	5.0a	6.3a	7.3a	10.3a	13.0a	22.3a
A1	4.3a	5.0b	5.3a	7.7ab	9.7b	15.0bc	24.7c	33.3c
A2	4.0a	6.0b	6.0a	8.0b	9.7b	16.0d	19.3b	27.7b
A3	3.7a	4.7ab	5.7a	7.3ab	9.0ab	13.0bc	20.0bc	28.0b
A4	3.7a	5.7b	5.7a	7.3ab	7.7a	11.0ab	16.0ab	25.3ab
Bululawang								
A0	3.3a	4.7a	4.7a	7.3a	9.3a	11.7a	16,7a	22.7a
A1	4.0ab	6.0b	6.0ab	7.7a	9.3b	15.7b	24,0ab	33.7ab
A2	4.7bc	6.0b	6.0ab	8.0a	12.3ab	17.0b	27,3b	36.0b
A3	5.3c	6.3b	7.0bc	8.3a	13.0b	16.7b	25,0ab	35.0b
A4	4.0ab	7.0b	8.3a	8.3a	11.0ab	17.7b	25,7ab	35.0b

Numbers followed by the same letter indicate no significant difference in the 5% DMRT test.

Based on Table 3, observations on the number of leaves in the Cening variety in the V1A0 treatment showed no significant differences from the first week of observation until the end. In the V1A1 treatment, there were no significant differences in weeks 4, 6, and 7, but significant differences were observed in weeks 5, 8, 9, 10, and 11 regarding the number of leaves. In the V1A2 treatment, significant differences were found except in weeks 4 and 6. In the V1A3 treatment, there were no significant differences in the number of leaves from week 4 to week 8, but significant differences were found from weeks 9 to 11. In the V1A4 treatment, significant differences were observed only in week 5.

In the Bululawang variety, in the V2A0 treatment, no significant differences were found. In the V2A1 treatment, no significant differences were observed in weeks 4, 6, 7, 10, and 11, but significant differences occurred in weeks 5, 8, and 9. Significant differences were found in weeks 4 and 5 in the V2A2 treatment, and no significant differences were observed from weeks 6 to 8, followed by significant differences in weeks 9 to 11. In the V2A3 treatment, significant differences were found except in weeks 7 and 10, while in the V2A4 treatment, there were no significant differences in weeks 4, 6, 7, 8, and 10, but significant differences were observed in weeks 5, 9, and 11.

Based on the average increase in the number of leaves, the results varied across treatments. The greatest increase in the number of leaves in the Cening variety was observed with the application of cow urine and 1g of MSG, with an average of 33.3, followed by the treatments with 3g and 2g doses of MSG, and then the 4g dose. The lowest increase in the number of leaves was observed in the control treatment, with an average of 22.3. According to Triyani *et al.* (2013), excessive sodium in the soil has a negative impact on plant growth, such as reducing leaf growth, which leads to a decrease in photosynthesis. Therefore, the application of 1g Monosodium Glutamate (MSG) is considered more beneficial than the 4g dose, especially regarding the number of leaves.

Both varieties showed significant differences in comparison to the control/no MSG treatment, with doses under 4g/A4 resulting in better leaf numbers. High concentrations of Na can cause ionic toxicity in plants, requiring the cells to pump more energy to avoid stress due to high Na concentrations. This imbalance in physiological reactions leads to reduced leaf growth (Hutasoit, 2019).

3.3 Number of Sugarcane Tillers

Observations were conducted by counting the number of tillers around the parent plant once a week for 2 months. The data from each observation block were averaged and analyzed using analysis of variance (ANOVA) for each treatment.

Table 4. The Effect of Liquid Cow Urine Fertilizer and MSG on the Number of Sugarcane Tillers

Cening	Observation Week of-							
	4 WAP	5 WAP	6 WAP	7 WAP	8 WAP	9 WAP	10 WAP	11 WAP
A0	0.0a	0.0a	0.7a	2.0ab	3.3b	3.7ab	4.0a	5.0ab
A1	0.0a	0.0a	1.0ab	3.0b	3.0ab	5.0c	5.0a	5.3b
A2	0.0a	0.0a	2.3b	2.3ab	2.7ab	4.3bc	4.3a	5.0ab
A3	0.0a	0.0a	0.7a	1.7a	2.7ab	3.3a	3.7a	5.0ab
A4	0.0a	0.0b	1.0ab	2.3ab	2.3a	3.0a	3.7a	4.3a
Bululawang								
A0	0.0a	0.7a	0.7a	2.0a	2.7a	3.7a	3.7a	4.3a
A1	0.0a	1.7a	1.7ab	2.0a	3.0ab	3.7a	3.7a	5.0a
A2	0.0a	1.3a	1.3ab	2.3a	3.3ab	4.3a	4.3a	5.7a
A3	0.0a	1.7a	2.7b	3.3ab	3.7ab	4.3a	4.3a	5.7a
A4	0.0a	1.0a	3.0b	4.3b	4.3b	4.7a	4.7a	5.3a

Numbers followed by the same letter indicate no significant difference in the 5% DMRT test.

Based on Table 4, the observation of the number of tillers in the Cening variety with treatment V1A0 showed no significant difference. However, in treatment V1A1, a significant difference was observed in weeks 7, 9, and 11, while no significant difference was noted in weeks 4, 5, 6, 8, and 10. In treatment V1A2, a significant difference occurred only in weeks 6 and 9. Treatment V1A3, similar to V1A0, showed no significant difference, whereas treatment V1A4 showed a significant difference only in week 5.

For the Bululawang variety, treatment V2A0 did not show any significant difference, followed by treatments V1A1 and V1A2, which also showed no significant differences. However, in the count of the number of leaves, treatment V1A3 showed a significant difference in week 6, and treatment V1A4 showed significant differences in weeks 6, 7, and 8, but not in weeks 4, 5, 9, 10, and 11.

In the Cening variety, the observation of the number of tillers showed a significant difference, with the highest average being 5.3 in treatment V1A1, followed by an average of 5.0 in treatments V1A0, V1A2, and V1A3, and the lowest average of 4.3 in treatment V1A4.

In the Bululawang variety, there was no significant difference. The highest number of leaves was obtained in treatments V1A2 and V1A3, with an average of 5.7, followed by treatment V1A4 with an average of 5.3, then treatment V1A1 with an average of 5.0, and finally treatment V1A0 with an average of 4.3.

The results indicate that although there was a significant difference in the Cening variety with treatment V1A1, almost all treatments had similar average values. This is possibly due to the lack of nitrogen (N) elements, resulting in a low number of tillers. This is supported by Permana *et al.* (2015), who showed that the higher the nitrogen content, the greater the number of tillers.

3.4 Wet Weight of Plants

The observation was conducted once, at the final observation, when the plants were 11 weeks old. The observation involved weighing the plants after they were uprooted using a digital scale. The results were averaged and subjected to analysis of variance (ANOVA) and continue DMRT analysis.

Table 5. The effect of applying liquid fertilizer from cow urine and MSG (monosodium glutamate) on the fresh weight of sugarcane plants.

Treatment	Wet Weight (g)		
	Leafs	Stalk	Roots
V1A0	36.7a	24.3a	64.7a
V1A1	60.7ab	37.3ab	61.0ab
V1A2	60.7ab	30.0ab	64.3ab
V1A3	80.3b	48.7b	117.0b

V1A4	44.7ab	27.3ab	52.3ab
V2A0	47.7a	30.3a	62.7a
V2A1	85.0a	58.3ab	91.0a
V2A2	92.0a	87.7b	69.7a
V2A3	78.3a	51.3a	65.3a
V2A4	80.7a	58.0a	75.7a

Numbers followed by the same letter indicate no significant difference in the 5% DMRT test.

Based on Table 5, it is known that the fresh weight of the leaves of the Cening variety sugarcane showed a significant difference in treatment V1A3, with an average of 80.3, while the other treatments did not show significant differences. In contrast, for the Bululawang variety, there were no significant differences among the treatments.

The results of the fresh weight of the leaves were closely related to the plant height at the time of observation. In the observation of plant height, treatments below the dose of 4g, except for the control, had superior heights, and the highest average fresh weight of the leaves was obtained in treatment V2A2, reaching an average of 90.0, with a significant difference noted in treatment V1A3.

For the fresh weight of the stems in the Cening variety, there was a significant difference in treatment V1A3, while no differences were observed in the other treatments. In the Bululawang variety, a significant difference occurred in treatment V2A2, while no significant differences were found in the other treatments.

The presence of sodium (Na) plays a significant role in stimulating plant growth, particularly in the development of stems and leaves, and contributes importantly to protein formation and various other organic compounds in plants (Fitri, 2017). The stem serves as a bridge in measuring plant height, as these two components determine the height of the plant; thus, it can be assured that the fresh weight of the stem and plant height yield similar results. Treatments with doses below 4g showed better fresh weight based on the previous height measurements. In both varieties, significant differences in the fresh weight of the stems were observed, specifically in V1A3 for the Cening variety and V2A2 for the Bululawang variety, with the highest average obtained in the Bululawang variety in treatment V2A2, averaging 87.7, and the lowest average in the Cening variety in treatment V1A0.

In the observation of the fresh weight of the roots, the Cening variety showed a significant difference in treatment V1A3, while no significant differences were observed in the other treatments. In the Bululawang variety, there were no significant differences.

Between the two varieties, Cening and Bululawang, a significant difference was observed in the Cening variety in treatment V1A3. The results indicated that the Cening variety in treatment V1A3 had the highest average, while treatment V1A4 had the lowest average in the observation of the fresh weight of the roots. Excessive sodium levels in the soil can inhibit root growth, as indicated by the reduction in root length, root mass, and root function (Cassaniti & Flowers, 2012).

3.7 Dry Weight of Plants

The observation was conducted once after measuring the fresh weight and after drying. The observation involved weighing the plants after they were uprooted using a digital scale; however, they had to be oven-dried or sun-dried first to remove the moisture contained in the plants before weighing.

Table 8. The effect of applying liquid fertilizer from cow urine and MSG (monosodium glutamate) on the dry weight of sugarcane plants.

	Dry weight (g)		
Treatment	**Leafs**	**Stalk**	**Roots**
V1A0	13.7a	8.7a	12.0a
V1A1	16.3a	11.7a	14.3ab
V1A2	12.0a	10.0a	12.3a
V1A3	21.7a	16.3a	23.3b
V1A4	13.0a	9.3a	10.0a
V2A0	14.3a	12.3a	10.3a

V2A1	22.3a	18.7a	16.0a
V2A2	24.0a	34.3ab	15.0a
V2A3	19.3a	17.0ab	14.3a
V2A4	25.3a	27.3ab	17.0a

Numbers followed by the same letter indicate no significant difference in the 5% DMRT test.

In the observation of the dry weight of leaves, there were no significant differences among the treatments for both the Cening and Bululawang varieties. The highest average dry weight of leaves was found in the Bululawang variety with treatment V1A4, which was 25.3, while the lowest average was obtained in the Cening variety with treatment V1A0. The drying process removed the moisture content in the sugarcane, which resulted in a decrease in the weight of the plants. In the Cening variety, no significant differences were observed, and the same was true for the Bululawang variety in the observation of the dry weight of the stems, where no significant differences were found. The highest average fresh weight of the stems in the Bululawang variety was superior in treatment V2A4, with an average of 27.3, while the lowest average was obtained in the Cening variety in treatment V1A0.

In the Cening variety, a significant effect was observed in treatment V1A3, while in the Bululawang variety, there was no significant effect among the treatments. A significant difference occurred in the Cening variety in treatment V1A3, which had an average of 23.3, making it the highest average, while the lowest average was found in the Cening variety in treatment V1A4, with an average of 10.0. In the parameter of fresh weight of the roots, treatment V1A3 had the heaviest fresh weight, thus dominating the parameter of dry weight of the roots.

4. Conclusions

There were significant interactions effect between liquid fertilizer and msg observed in plant height, number of leaves, number of tillers, fresh weight of leaves, fresh weight of stems, fresh weight of roots, and dry weight of roots. The application of a 4-gram dose of MSG resulted in the best outcomes for plant height. In contrast, the optimal results for the number of leaves, number of tillers, fresh weight of leaves, fresh weight of stems, dry weight of leaves, and dry weight of stems were achieved with a 2-gram dose. Additionally, a 3-gram dose yielded the best results for both fresh weight and dry weight of the roots.

5. References

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