Use of MSG (Mono Sodium Glutamate) as Fertilizer in Kale Plants (*Brasicca oleraceae* var, Acephala)

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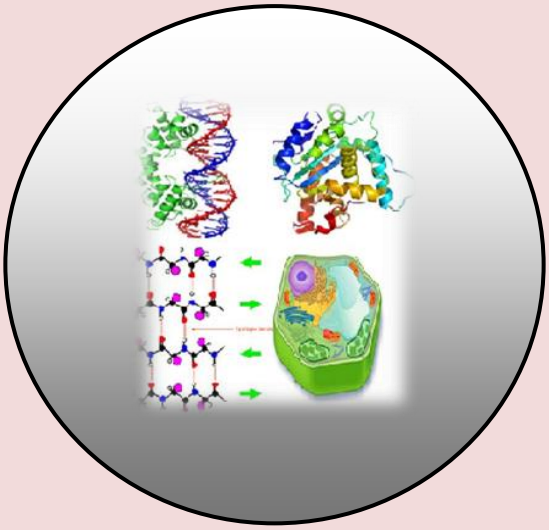
ISSN 2319-3077 Online/Electronic
ISSN 0970-4973 Print

UGC Approved Journal No. 62923
MCI Validated Journal
Index Copernicus International Value
IC Value of Journal 82.43 Poland, Europe (2016)
Journal Impact Factor: 4.275
Global Impact factor of Journal: 0.876
Scientific Journals Impact Factor: 3.285
InfoBase Impact Factor: 3.66



J. Biol. Chem. Research
Volume 36 (1) 2019, Part C, Pages No. 28-34

Journal of Biological and Chemical Research

An International Peer Reviewed / Referred Journal of Life Sciences and Chemistry

Indexed, Abstracted and Cited in various International and National Scientific Databases

Published by Society for Advancement of Sciences®

J. Biol. Chem. Research. Vol. 36, No. 1, Part C: 28-34, 2019
(An International Peer Reviewed / Refereed Journal of Life Sciences and Chemistry)
Ms 36/01/7004/2019

ISSN 2319-3077 (Online/Electronic)
ISSN 0970-4973 (Print)

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RESEARCH PAPER

Received: 02/03/2019 **Revised: 14/04/2019** **Accepted: 15/04/2019**

Use of MSG (Mono Sodium Glutamate) as Fertilizer in Kale Plants (*Brasicca oleraceae* var, Acephala)

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ABSTRACT

The purpose of this study was to determine the other benefits of MSG as a substitute for fertilizer combined with the number of plants on the growth and yield of kale plants. This experiment used a factorial randomized block design, which consisted of 2 treatment factors, namely the first factor was MSG dose with 4 levels, namely without MSG (M0), 5 g/polybag (M1), 10 g/polybag (M2), and 15 g/polybag (M3). The second treatment is the number of plants with 2 levels, namely 1 plant/polybag (J1), 2 plants/polybag (J2). The interaction of MSG dose interactions with the number of plants had no significant effect on all plant variables except for the fresh weight of economic yields and the total fresh weight of plants, which had a significant effect. Also, the interaction between the treatment of MSG 10 g/polybag and the treatment of 2 plants/polybag gave the highest fresh weight of economic yields of 141.50 g which was significantly different or increased by 122.48% when compared to the fresh weight of the lowest economic results in the interaction between treatments without MSG with treatment of 1 plant/polybag is 63.60 g.
Keywords: Kale plants, MSG and Number of plants.

INTRODUCTION

Monosodium glutamate (MSG) is a crystalline compound which is a type of sodium salt made from glutamate acid, has a lot of mineral content, is not dangerous to consume every day with the right amount and is not excessive. The availability of this food flavoring because MSG can react to a variety of flavors and can strengthen the taste of a dish. Other benefits that have recently been made by plant lovers are fertilizing plants, accelerating plant growth, speeding up the emergence of flowers, meeting the nutritional needs of plants, plants not easily dying, avoiding plants from dangerous chemical fertilizers, increasing water content in the summer, and can also be used as plant fertilizer.

Growth and yield of plants are expected to increase with the administration of MSG solutions. The solution can be used as a substitute fertilizer for various chemical fertilizers on the market. The results of the study stated that fertilizer plants using MSG had better fertility and growth rates in the third and fourth weeks compared to plants using ordinary chemical fertilizers. According to Musyassir (2006), high nitrogen content in MSG can stimulate the growth of peanut plants. This is supported by the content of MSG which consists of compounds C, H, O, N, and Na. The five elements contained in MSG are the five compounds needed for nutrition in plant development.

These elements, especially N elements have good benefits to stimulate the growth of stems, branches, leaves, and the process of proteins and fats needed by plants in carrying out the growth process.
Kale can be consumed in raw form or salad, it can also be consumed in cooked or cooked form. Kale is very suitable to be processed into smoothies, juice, and diet foods, but the sulforaphane content will usually decrease if consumed in mature form. The carbohydrate content in kale averages around 10.14 g/100 g, as found in Polish biographical data the number of carbohydrates ranges from 1.8 to 6.1 g/100 g in vegetables (Kunachowicz *et al*., 2005). According to Rubatzky (1998), kale/kailan is a type of leaf vegetable plant. According to Pracaya (2005), kale plants (*Brassica oleracea var Acephala*) or often also called Kailan are vegetables that are still one species with cabbage or cabbage (*Brassica oleracea*). Kale includes seasonal vegetables and short-lived around 40-50 days after the seeds are planted. Kale plants grow in highland areas (Monica van Wensveen, 2009). Harvesting that is too old causes the leaves and stems to be hard so it is not comfortable to consume (Samadi, 2013). Market demand for your exports is quite large at 92 tons per year (BPS Jabar, 2014). The low level of your products is caused by several obstacles, including the lack of information on appropriate agricultural technology.
Vegetable plants are often planted by housewives in the yard or in the garden to meet daily needs or as an additional family income. Usually, they do fertilization using MSG for their plants, but how many doses and a number of seeds given there are no clear doses. Based on the description above, a study was conducted on the use of MSG as fertilizer in Kale plants. This study is expected to be useful to determine the dose of MSG and the number of seeds that are appropriate for the growth and yield of kale plants.

MATERIAL AND METHODS

The study was conducted at the Greenhouse of the Faculty of Agriculture, University of Warmadewa Denpasar, Bali. Research begins in July to September 2018. This experiment was carried out on polybags. The experiment used a factorial Randomized Block Design (RBD) consisting of two factors. The first factor is the MSG dose with 4 levels, namely without MSG (M0), 5 g/polybag (M1), 10 g/polybag (M2), and 15 g/polybag (M3). The second treatment is the number of plants with 2 levels, namely 1 plant/polybag (J1), 2 plants/polybag (J2). Thus there were 8 combination treatments, each treatment was repeated 3 times so that there were 24 trial polybags.
The material used in this experiment is kale seed (Nova variety), MSG (Ajinomoto's trademark) with the composition of Monosodium glutamate is sodium 12%; glutamate 78%; and 10% water, NPK fertilizer, compost and soil that have been sifted with the results of soil analysis.
Growth variables and kale yields observed in this study were maximum plant height, maximum leaf number, root fresh weight, economic yield fresh weight, total plant fresh weight, root oven-dry weight, oven dry weight economic yield, total oven dry weight of plants. The results of the research data were statistically analyzed using analysis of variance (ANOVA). For a single treatment that has a significant effect until very real, then it is followed by a BNT test of 5% level, while the interaction effect is continued with Duncan test at 5%.

RESULTS AND DISCUSSION

Research Results

The results of the statistical analysis of all variables observed in this study and. the significance of the effect of MSG (M) treatment and the number of plants (J) and their interactions (MxJ) on the observed variables are presented in Table 1.
Based on Table 1, it can be seen that MSG (M) treatment has no significant effect on all observed variables except for plant height. The treatment of the number of plants (J) showed a very significant influence ($P < 0.01$) on all plant variables except plant height and a maximum number of leaves. The interaction between the dose of MSG (M) and the number of plants (J) had no significant effect ($P \geq 0.05$) on all plant variables except the fresh weight of economic yields and the total fresh weight of the plant.

Table 1. The significance of the effect of giving MSG and the number of plants and their interactions with all observed variables.

Variable	Treatment		
	Dosage of MSG (M)	Number of Plants (J)	Interactions (MxJ)
1. Maximum plant height (cm)	**	ns	ns
2. Maximum number of leaves (strands)	ns	ns	ns
3. Fresh root weight (g)	ns	**	ns
4. Fresh weight of economic results (g)	ns	**	*
5. The total fresh weight of the plant (g)	ns	**	*
6. Dry oven root weight (g)	ns	**	ns
7. Economical oven-dry weight (g)	ns	**	ns
8. Total oven dry weight per plant (g)	ns	**	ns

ns = not significant (P≥0.05), * = Significant effect (P <0.05), ** = Very significant (P <0.01)

Plant Height

The results of statistical analysis of plant height found that MSG (M) treatment showed a very significant effect (P <0.01), while treatment of plant number (J) and interaction (MxJ) had no significant effect (P (0.05) on plant height maximum (Table 1). The average plant height in the MSG treatment and number of plants is presented in Table 2.

Based on Table 2 shows that the treatment of 15 g/polybag (M3) MSG gives the maximum plant height with the highest value of 13.91 cm which is significantly different from the lowest plant height in the treatment without MSG (M0) which is 10.98 cm. The treatment of 2 plants/polybag (J2) gave the maximum plant height with the highest value of 12.50 cm which was not significantly different from the lowest plant height in the treatment of 1 plant/polybag (J1) which was 12.21 cm.

Table 2. Average plant height and number of leaves in MSG treatment and number of plants.

Treatment	Maximum plant height (cm)	Maximum number of leaves (strands)	Fresh root weight (g)
The dosage of MSG/polybag			
0 g (M0)	10,98 b	8,42 a	5,27 a
5 g (M1)	12,58 ab	9,75 a	4,80 a
10 g (M2)	11,94 b	9,42 a	5,48 a
15 g (M3)	13,91 a	10,00 a	5,85 a
BNT 5%	1,50	-	-
Number of plants/polybag			
1 Plants (J1)	12,21 a	9,58 a	3,48 b
2 Plants (J2)	12,50 a	9,21 a	7,22 a
BNT 5%	1,06	-	1,52

Description: The average value received by the same letter in the session and the same, is not significantly different from the 5% BNT test

Number of Leaves

The results of the statistical analysis of the maximum number of leaves found that the MSG (M) and plant (J) and interaction (MxJ) treatments had no significant effect (P≥0.05) on the maximum number of leaves (Table 1). The average number of plant leaves in the MSG treatment and number of plants is presented in Table 2.

Table 2 shows that the treatment of 15 g/polybag (M3) MSG gave the maximum number of leaves with the highest value of 10.00 strands which were significantly different from the lowest number of leaves in the treatment without MSG (M0) which was 8.42 strands. In the treatment of 1 plant/polybag (J1) gave the maximum number of leaves with the highest value of 9.58 strands which were not significantly different from the lowest number of leaves in the treatment of 2 plants/polybag (J2) which was 12.21 strands.

Fresh Weight of Root

The results of statistical analysis of fresh root weight found that the number of plants (J) had a very significant effect (P <0.01), but the treatment of MSG (M) and interaction (MxJ) had no significant effect (P≥0.05) on the fresh weight of roots (Table 1). The average fresh weight of roots in the MSG treatment and number of plants is presented in Table 2.

Table 2 shows that the treatment of 15 g/polybag (M3) MSG gives the fresh weight of roots with the highest value of 5.85 g which is not significantly different from the lowest fresh weight of the root treatment 5 g/MSG polybag (M1) which is 4.80 g. In the treatment of the number of plants it was seen that with 2 plants/polybag (J2) giving the fresh weight of roots with the highest value of 7.22 g which was significantly different from the fresh weight of the lowest roots in the treatment of 1 plant/polybag (J1) which was 3.48 g.

Fresh Weight of Economic Results

The results of the statistical analysis of the fresh weight of economic results showed that the treatment of MSG (M) had no significant effect (P≥0.05), but the number of plants (J) had a very significant effect (P <0.01) and interaction (MxJ) had a significant effect (P <0.01) on the fresh weight of economic results (Table 1). The average fresh weight of economic results in the interaction of MSG treatment and the number of plants is presented in Table 3.

Table 3. Average fresh weight of economic results in the interaction between the MSG treatment and the number of plants.

Treatment	Number of plants/polybag	
The dosage of MSG/polybag	1 Plants (J1)	2 Plants (J2)
0 g (M0)	63,60 c	109,47 a
5 g (M1)	67,60 bc	113,43 a
10 g (M2)	64,93 c	141,50 a
15 g (M3)	106,60 ab	107,13 ab

Description: The numbers followed by the same lowercase letters in the same column differ not significantly at the Duncan test level 5%

Table 3 shows the interaction between the treatment of 10 g/polybag MSG with the treatment of 2 plants/polybag (M2J2) giving the fresh weight of economic results with the highest value of 141.50 g which is significantly different from the fresh weight of the lowest economic yield on the interaction between treatment without MSG number of 1 plant/polybag (M0J1) which is 63.60 g.

The total fresh weight of the plant

The results of the statistical analysis of the total fresh weight of the plants found that MSG (M) treatment had no significant effect (P≥0.05), but the number of plants (J) had a very significant effect (P <0.01) and interaction (MxJ) had a significant effect (P <0.01) for the total fresh weight of the plant (Table 1). The average fresh weight of the total plant in the interaction of the MSG treatment and the number of plants is presented in Table 4.

Table 4. Average total fresh weight of plants in the interaction between MSG treatment and number of plants.

Treatment	Number of plants/polybag	
Dosis MSG/polybag	1 Plants (J1)	2 Plants (J2)
0 g (M0)	67,07 d	116,53 ab
5 g (M1)	71,33 cd	119,30 ab
10 g (M2)	67,40 d	150,00 a
15 g (M3)	110,87 bc	114,57 ab

Description: The numbers followed by the same lowercase letters in the same column differ not significantly at the Duncan test level 5%

Table 4 shows the interaction between the treatment of 10 g/polybag MSG with the treatment of 2 plants/polybag (M2J2) giving the total fresh weight of the plant with the highest value of 150.00 g which was significantly different from the lowest total fresh weight of the plants in the treatment without MSG with treatment number of 1 plant / polybag (M0J1) which is 67.07 g.

Dry oven root weight

The results of statistical analysis of root oven dry weight found that the number of plants (J) had a very significant effect (P <0.01), but the treatment of MSG (M) and interaction (MxJ) had no significant effect (P≥0.05) on dry weight root oven (Table 1). The average root oven dry weight in the MSG treatment and the number of plants are presented in Table 5.

Table 5 shows that the 15 g/polybag (M3) MSG treatment gives the root oven dry weight with the highest value of 1.13 g which is not significantly different from the lowest root oven dry weight in the treatment of 5 g/MSG polybag (M1) which is 0.78 g. In the treatment of the number of plants, it was seen that with 2 plants/polybag (J2) giving root oven dry weight with the highest value of 1.45 g which was significantly different from the lowest root oven dry weight in the treatment of 1 plant/polybag (J1) which was 0.51 g.

Oven dry weight of economic results

The results of statistical analysis of oven dry weight of economic results showed that the number of plants (J) had a very significant effect (P <0.01), but the treatment of MSG (M) and interaction (MxJ) had no significant effect (P≥0.05) on weight Dry oven economic results (Table 1). The average oven dry weight of economic results in the MSG treatment and the number of plants are presented in Table 5.

Table 5. Average root oven-dry weight, oven dry weight of economic results, and total oven dry weight of plants in MSG treatment and number of plants.

Treatment	Dry oven root weight (g)	Oven dry weight of economic results (g)	Total oven the dry weight of plants (g)
The dosage of MSG/polybag			
0 g (M0)	1,06 a	9,48 a	10,55 a
5 g (M1)	0,78 a	9,41 a	10,18 a
10 g (M2)	0,93 a	10,13 a	11,06 a
15 g (M3)	1,13 a	11,75 a	12,88 a
BNT 5%	0,31	-	-
Number of plants/polybag			
1 Plants (J1)	0,51 b	7,53 b	8,03 b
2 Plants (J2)	1,45 a	12,86 a	14,30 a
BNT 5%	0,22	2,09	2,08

Description: The average value received by the same letter in the session and the same, is not significantly different from the 5% BNT test

From Table 5 shows that the 15 g/polybag (M3) MSG treatment gives the oven dry weight of the economic results with the highest value of 11.75 g which is not significantly different from the oven dry weight of the lowest economic yield at 5 g / MSG polybag (M1) treatment 9.41 g. In the treatment of the number of plants it was seen that with 2 plants/polybag (J2) giving oven dry weight the economic results with the highest value of 12.86 g which was significantly different from oven dry weight the lowest economic yield in the treatment of 1 plant/polybag (J1) was 7.53 g.

Total oven dry weight of plants

The results of statistical analysis of total oven dry weight found that the number of plants (J) had a very significant effect (P <0.01), but the treatment of MSG (M) and interaction (MxJ) had no significant effect (P (0.05) on dry weight total oven (Table 1). The average total oven dry weight in the MSG treatment and number of plants is presented in Table 5.

From Table 5, the 15 g/polybag (M3) MSG treatment gave the total oven dry weight of the plant with the highest value of 12.88 g which was not significantly different from the lowest total oven dry weight of the treatment of 5 g/MSG polybag (M1) which is 10 , 18 g. In the treatment of the number of plants it was seen that with 2 plants/polybag (J2) giving the total oven dry weight of the plant with the highest value of 14.30 g which was significantly different from the oven dry weight of the lowest total plant treatment 1 plant/polybag (J1) ie 8.03 g.

DISCUSSION

The results showed that the interaction between the treatment of MSG 10 g/polybag with the treatment of 2 plants/polybag (M2J2) gave the highest fresh weight of the economic yield of 141.50 g which was significantly different or increased by 122.48% when compared to the fresh weight of the lowest economic yield on the interaction between treatments without MSG with the treatment of the number of 1 plant / polybag (M0J1) which is 63.60 g.

The increased fresh weight of economic results in the interaction between 10 g/polybag and 2 plants/polybag (M2J2) MSG treatment was supported by the existence of a real and positive correlation in the observed variables such as maximum plant height (r = 0.480 *), root fresh weight (r = 0.890 **), total plant fresh weight (r = 0.999 **), root oven dry weight (r = 0.817 **), oven dry weight economic results (r = 0.919 **), and total oven dry weight of plants (r = 0.911 **) (Table 6).

The high fresh weight of the economic results in the interaction between the treatment of 10 g/MSG polybag with 2 plants/polybag (M2J2) was caused because the nutrient content such as compounds C, H, O, N and Na contained in MSG can increase the growth and yield of kale plants. Compounds C, H, O, N, and Na contained in MSG are the five compounds needed for nutrition in plant development. Elemental element N in MSG to stimulate the growth of plant parts such as stems, branches, and leaves. While the elements C, H, O, and Na in MSG are needed in the process of plant metabolism to produce carbohydrates, proteins, and fats needed by plants for their development.

In this study, giving 10 g of MSG/polybag has been able to meet the nutritional needs of plants, stimulate growth, accelerate the emergence of flowers, and increase the yield of kale plants. Some of the results of MSG studies on agricultural crops, such as those carried out by Muyassir (2006), can improve the yield of maize crops, as well as Novi's (2016) study of MSG, can increase the response of pakchoy plant growth.

Table 6. Correlation coefficient value between variables observed due to the effect of interaction between MSG treatment and plant number (MJ).

	X1	X2	X3	X4	X5	X6	X7
X2	0.796**						
X3	0.271 ns	0.021 ns					
X4	0.480*	0.331 ns	0.890**				
X5	0.469*	0.311 ns	0.905**	0.999**			
X6	0.169 ns	-0.174 ns	0.967**	0.817**	0.834**		
X7	0.398 ns	0.047 ns	0.922**	0.919**	0.926**	0.937**	
X8	0.367 ns	0.014 ns	0.936**	0.911**	0.920**	0.954**	0.999**

r (0,05;22;1) = 0,423 r (0,01;22;1) = 0,537

Information:
X1 = Maximum plant height
X2 = Maximum number of leaves
X3 = Fresh root weight
X4 = Fresh weight of economic results
X5 = The total fresh weight of the plant
X6 = Dry oven root weight
X7 = Oven dry weight of economic results
X8 = Oven total dry weight of plants

CONCLUSIONS

MSG treatment has no significant effect on all variables observed except for plant height which is significantly influential. The treatment of the number of plants/polybag showed a very significant effect on all plant variables except for plant height and number of leaves which was not significantly affected. The interaction of MSG dose interactions with the number of plants had no significant effect on all plant variables except for the fresh weight of economic yields and the total fresh weight of plants, which had a significant effect.

The interaction between the 10 g/polybag MSG treatment with the treatment of 2 plants/polybags gave the highest fresh weight of the economic yield of 141.50 g which was significantly different or increased by 122.48% when compared to the fresh weight of the lowest economic yield on the interaction between treatments without MSG with treatment number of 1 plant/polybag is 63.60 g.

ACKNOWLEDGMENTS

Thank you for the manager of Warmadewa Research Center (WRC) and its staff who have funded this research. The author also thanked friends who have helped and supported this research.

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