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Enhancing Jowar and Mung Bean Growth with Spent Mushroom Substrate: A Sustainable Approach

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KEYWORDS

SMS (Spent Mushroom Substrate), Jowar, Mung bean, Treatment.

Abstract:

This study investigated the potential of spent mushroom substrate (SMS) as a growth promoter for Jowar (*Sorghum bicolor*) and Mung bean (*Vigna radiata*) plants. The experiment compared the height growth of these plants in growing media amended with varying levels of SMS to a control group grown in unamended soil.

The results demonstrated a significant positive effect of SMS on plant height for both Jowar and Mung bean. Plants grown with 20 grams of SMS exhibited the greatest increase in height, followed by those with 25 grams and 15 grams, respectively. These findings suggest that SMS can be a valuable tool for enhancing plant growth.

Furthermore, the observed growth promotion suggests that SMS has the potential to serve as an eco-friendly alternative to chemical fertilizers. The presence of residual nutrients and beneficial microbial communities within SMS may contribute to improved plant health and performance. Further research is needed to explore the optimal application rates and potential mechanisms behind the growth-promoting effects of SMS on various crops.

Introduction

Spent mushroom substrate (SMS) is the residual biomass generated after harvesting the mushroom. The spent mushroom substrate is rich in N, P, and K, which acts as a good growing medium for crop plants. The addition of spent mushroom substrate to the nutrient-poor soil leads to an improvement in soil texture, water holding capacity, and nutrient status. Application of SMS in agriculture decreases the amount of biodegradable waste disposed of in landfill sites and also transforms it into economically effective agricultural products (Szmidt, 1994).

Afagh *et al*. (2019) revealed that usage of SMC with 5, 10, and 15% in the growing media has significantly increased plant growth, flower yield, essential macro nutrient uptake, sodium concentration, proline, and soluble sugar content, as well as essential oil percentages, compared to the control. Spent mushroom substrate is a rich source of micro and macro elements for the growth of plants and microorganisms; hence, SMS can improve soil micro flora and soil biological activity (Debosz *et al*., 2002; Gonani, Riahi, and Sharifi, 2011). Different studies have been conducted studying the effects of SMC on the growth and yield of different plants, such as vegetables (Demir 2017; Gonani, Riahi, and Sharifi 2011; Marques *et al*. 2014; Wang, Lohr, and Coffey 1984; Wiafe-Kwagyan and Odamtten 2018) and ornamental plants (CicekAtikmen, Kutuk, and Karahan 2014). Roy *et. al*. (2015) studied the potential of spent mushroom substrate (SMS) of oyster mushrooms on the improvement of the growth of *Capsicum annuum* L. The analysis of growth parameters in terms of height, yield, number of branches, and number of leaf drops showed that the use of oyster mushrooms (SMS) had a positive effect on the overall growth of the tested plants. Courtney and Mullen (2008) and Hackett (2015) have shown the benefits of SMS as an organic fertilizer and soil conditioner. Siddhant and Ayodhya (2009) used SMS from three strains of oyster mushrooms as fertilizer for the growth of the plant *Spinacea oleracea*. The present investigation was performed to study the effects of spent mushroom substrate (SMS) as an organic fertilizer on the growth height of mung bean and jowar plants.

Material and Method:

Collection of Spent Mushroom Substrate SMS: Spent mushroom substrate of soybean straw was collected after the growth of *P. sajor-caju* (Patil and Baig, 2023).

Preparation of the growth media. 5 g of NPK fertilizer and spent mushroom substrates were weighed in different quantities (5 g, 10 g, 15 g, 20 g, and 25 g). Each of these quantities was properly mixed with 4 kg of depleted garden soil, which was collected from the local

Journal of Chemical Health Risks

www.jchr.org

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farm in Naigaon District, Nanded (India). Each mixture was packed into plastic pots of five-liter volume and adequately watered.

Jowar and Mung bean varieties: seeds of the Jowar variety PVK-801 and the Mung bean variety BM 2003-2 were used in this experiment, collected from the local market in Naigaon District, Nanded (MS), India.

Treatments and experimental design: There were seven treatments in the experiment, and each treatment was replicated three times. Treatments were defined according to the different levels of SMS concentrations and inorganic fertilizer as basal applications.

The treatments were as follows:

C (control): No fertilizer and SMS application in soil (control)

T1 = 5 g of NPK fertilizer in the soil.

T2 = 5 g of SMS compost in the soil.

T3 = 10 g of SMS compost in the soil.

T4 = 15 g of SMS compost in the soil.

T5 = 20 gm of SMS compost in the soil.

T6 = 25 g of SMS compost in the soil.

A randomized complete block design (RCBD) with three replications of each treatment was laid out. Each pot has 4 kg of soil and was placed in open field conditions. The plants were watered at regular intervals, and the growth parameters were studied. Growth promotion was recorded at 2, 4, 6, 8, 10, and 12-week intervals in terms of plant height in centimeters (cm) using a scale.

Statistical analysis: The recorded data on the growth in height of plants in the present study was subjected to statistical analysis as per the procedure recommended by Panse and Sukhatme (1978) for a two-way ANOVA.

Results and Discussion:

For many reasons the Mushrooms especially Pleurotus genus have been intensively studied in many different parts in the world as they require shorter growth time as compare to other edible mushroom, they demand few environmental controls, and their fruiting bodies are not very often attacked by cultivated in a simple and cheap way (Telang *et al.*, 2010). They are often grown on various substrate and after growth the substrate could offer an inexpensive soil conditioner (Shinde *et al.*, 2010). The spent mushroom substrate was used as soil conditioner. The results are presented as the effect of the SMS as soil conditioner and its effect of growth of plants.

This table summarizes the average height (in centimetres) of Mung bean plants grown under different conditions over a 12-week period. The table compares the effect of Spent Mushroom Substrate (SMS) applied at various quantities (5gm, 10gm, 15gm, 20gm, 25gm) to a control group (Untreated), a group receiving a standard NPK fertilizer (NPK 5gm), and a standard error term (SE ±).The table shows plant height measurements taken at different time internal throughout the experiment: 2 weeks, 4 weeks, 6 weeks, 8 weeks, 10 weeks, and 12 weeks. Each cell within the table represents the average height of Mung bean plants for a specific treatment and week. For example, the value 4.0 in the "2 weeks" row under "5 gm SMS" indicates the average height of Mung bean plants that received 5 grams of SMS after 2 weeks of growth.

By analyzing the values in this table, it shows the impact of different SMS application rates on Mung bean growth compared to the control and NPK fertilizer groups. The SE ± and CD values allow them to determine if the observed differences in height are statistically significant.

Table 1. Effect of SMS on growth of Mung bean plants as presented height in cms.

	Weeks					
Treatment	2	4	6	8	10	12
5 gm SMS	4.0	9.3	10.5	12.2	15.0	17.8
10 gm SMS	3.9	8.9	12.7	15.2	16.5	18.8
15 gm SMS	4.2	9.6	13.2	16.5	19.8	22.7
20 gm SMS	4.5	10.0	14.2	19.8	22.4	25.8
25 gm SMS	4.8	10.8	15.2	20.5	22.6	24.2
NPK 5 gm	4.0	9.8	11.6	14.2	16.5	19.6
Untreated	3.8	8.4	9.5	11.2	12.6	15.2
SE ±	0.12	0.20	0.23	0.41	0.56	0.62
CD	0.37	0.57	0.68	1.22	1.66	1.84

Journal of Chemical Health Risks

www.jchr.org

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The table summarizes the results of an experiment that studied the effect of Spent Mushroom Substrate (SMS) on the growth of plants. The table compares the effect of SMS applied at various quantities (5gm, 10gm, 15gm, 20gm, 25gm) to a control group (Untreated), a group receiving a standard NPK fertilizer (NPK 5gm), and a standard error term (SE ±). The table shows plant height measurements taken at different time internal throughout the experiment: 2 weeks, 4 weeks, 6 weeks, 8 weeks, 10 weeks, and 12 weeks. Each cell within the table represents the average growth of plants for a specific treatment and week. By analyzing the values in this table, it can be stated how different SMS application rates affect plant growth compared to the control and NPK fertilizer groups. The SE ± and CD values allow them to determine, if the observed differences in growth are statistically significant.

Table 2: Effect of SMS on Growth of Jowar plants as presented height in cms.

	Weeks					
Treatment	2	4	6	8	10	12
5 gm SMS	10	20.6	30	38.2	48	53.9
10 gm SMS	10.2	22.5	30.3	39	49.5	54.7
15 gm SMS	13.5	34.7	40.2	52	61.5	64.3
20 gm SMS	15.5	36.7	45.2	58	66.3	68.5
25 gm SMS	15.5	36.6	45	57	65.9	67.5
NPK 5 gm	11.4	27.8	37.4	49.6	58.2	62.1
Untreated	8.5	19.2	28.7	37.5	47.3	52.4
SE ±	0.37	0.84	1.17	1.25	1.82	1.97
CD	1.1	2.50	3.57	3.70	5.41	5.85

Application of spent mushroom substrate (SMS) greatly affects the growth in height of the mung bean plants (Table 1).The results revealed that the height of Mung bean plants between 5 and 10 gm SMS treatment in soil had no significant differences. Significantly, the highest growth in height of plants was observed when 20 gm of SMS was mixed in the soil (25.8 cm) during a 12-week-old plants. Application of 5 gm NPK fertilizer in the soil showed 19.6 cm growth in height of the plant. Addition of 25 gm SMS in soil at a 12-week-old plant showed 24.2 cm growth in height of plants. Control plants had minimum growth in all experimental setups during all the stages of growth. Earlier Michael, et al, (2022) also reported with the addition of 5 to 25 % SMS in growing media promote the growth and with addition of SMS beyond 30 %, exhibit stunted growth of cowpea (*Vigna unguiculata*).

Table 2 reveals the data for growth in height of the Jowar plant under different treatments from 2- to 12-week-old plants. Significantly, maximum growth in the height of plants was observed with the addition of 20 gm of SMS, followed by the addition of 25 gm of SMS and 15 gm of SMS in the soil. During 12-week-old plants, with the addition of 20 gm SMS in soil showed 68.5 cm growth in height of the plant, followed by 67.5 cm height of plant with 25 gm SMS in soil. Addition of 5 gm NPK fertilizer with soil showed 62.1 cm height of plants and the addition of 5 gm SMS in soil showed 53.9 cm growth in height of plant. Wang, Lohr and Coffey (1984) reported increased plant growth was obtained with addition of 20 and 30 % of SMS and those grown at 50 % SMS exhibit stunted growth. The limiting factor in the use of SMS appeared to be its high soluble salt content.

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References:

1. Afagha, H. V., Saadatmanda, S., Riahib,H. and R. A. K. Nejad. (2019). Influence of spent mushroom compost (SMC) as an organic fertilizer on nutrient, growth, yield, and essential oil composition of German chamomile (Matricaria recutita L.). Communications in Soil Science and Plant Analysis: 1-10. doi.org/10.1080/00103624.2019.1568450.
2. CicekAtikmen, N., C. Kutuk, and G. Karahan. (2014) Response of chrysanthemum (Chrysanthemum morifolium) to fresh and exhausted mushroom compost substrates in greenhouse conditions. Bulletin of University of Agricultural Sciences and Veterinary Medicine

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 450-454 | ISSN:2251-6727

Cluj-Napoca Horticulture 71 (2):233–39. doi:10.15835/buasvmcnhort:10353.

3. Courtney RG, Mullen G.J.(2008) Soil quality and barley growth as influenced by the land application of two compost types. Bioresour.Technol. 99, 2913-2918.
4. Debosz, K., S. O. Petersen, L. K. Kure, and P. Ambus. (2002). Evaluating effects of sewage sludge and household compost on soil physical, chemical and microbiological properties. Applied Soil Ecology 19:237–48. doi:10.1016/S0929-1393(01)00191-3
5. Demir, H. (2017). The effects of spent mushroom compost on growth and nutrient contents of pepper seedlings. Mediterranean Agricultural Sciences 30 (2):91–96.
6. Gonani, Z., H. Riahi, and K. Sharifi. (2011). Impact of using leached spent mushroom compost as a partial growing media for horticultural plants. Journal of Plant Nutrition 34 (3):337–44. doi:10.1080/01904167.2011.536876.
7. Hackett R. (2015) Spent mushroom compost as a nitrogen source for spring barley. Nutr. Cycl. Agroecosys 102, 253-263
8. Marques, E. L. S., E. T. Martos, R. J. Souza, R. Silva, D. C. Zied, and S. E. Dias. (2014). Spent mushroom compost as a substrate for the production of lettuce. Proceedings Journal of Agriculture Science 6 (7):138–43. doi:10.5539/jas. v6n7p138.
9. Michael, W. K. , Tawia, O. G. and Korley, K. N.(2022) Effect of Spent Mushroom Compost of Pleurotus eous Strain P-31 on Growth Performance and Nodulation ff Cowpea (Vigna unguiculata Walp.). Tropical Life Sciences Research, 33(3), 129–149.
10. Panse VG and Sukhatme PV. (1978). Stat. Math. Agri. work. ICAR publication, New Delhi.
11. Patil, S. S. and M.M. V. Baig (2023) Yield performance of Pleurotus sajor- caju on different agro- wastes. Journal of Emerging Technologies and Innovative Research, 10, (4): 702-705
12. Roy, S., B. Shibu, U. Chakraborty, and B. Chakraborty. (2015). Evaluation of spent mushroom substrate as bio-fertilizer for growth improvement of *Capsicum annuum* L. Journal of Applied Biology and Biotechnology 3 (3):022–027. doi:10.7324/JABB.2015.3305.
13. Siddhant CSS, Ayodhya F. (2009) Recycling of spent oyster mushroom substrate to recover additional value. Kathmandu Univ. J. Sci. Eng. Technol. 5(2), 66-71.
14. Szmidt, R. A. K. (1994). Recycling of spent mushroom substrates by aerobic composting to produce novel horticultural substrates. Compost Science & Utilization 2:63–72. doi:10.1080/1065657X.1994.10757936.
15. Wang, S. H. L., V. I. Lohr, and D. L. Coffey. (1984). Growth response of selected vegetable crops to spent mushroom compost application in a controlled environment. Plant and Soil 82 (1):31–40. doi:10.1007/BF02220767.
16. Wiafe-Kwagyan, M., and G. T. Odamtten. (2018). Use of Pleurotus eous strain P-31 spent mushroom compost (SMC) as soil conditioner on the growth and yield performance of *Capsicum annuum* L. and *Solanum lycopersicon* L. Seedlings under greenhouse conditions in Ghana. Tropical Life Science Research 29 (1):173–94. doi:10.21315/ tlsr2018.29.1.12.
17. Telang, S.M., Patil, S.S. and Baig, M.M.V.,(2010). Comparative study on yield and nutritional aspect of *Pleurotus eous* mushroom cultivated on different substrate. Food Sci. Res. J, 1(2): 60-63.
18. Shinde, S.A., Telang, S.M., Patil, S.S. and Baig, M.M.V., (2010). Effect of clinoptilolite zeolite on mushroom growth. Asian Journal of Soil Science, 5(1): 68-69.

Journal of Chemical Health Risks

www.jchr.org

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Figure 1: Effect of 20 gm of SMS on growth of Jowar plants after 6 weeks.

Figure 2 : Effect of 25 gm of SMS on growth of Mung bean plant after 08 weeks.