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Influence of Vermicompost and Vermiwash on Yield Attributes and Yield of Urdbean

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ABSTRACT: One of the foremost challenges at present in agriculture is the overreliance on synthetic chemical inputs such as fertilizers and pesticides. While these inputs have undoubtedly increased crop yields in the short term, they have also led to environmental degradation, soil erosion and water pollution, posing risks to biodiversity and human health. The utilization of organic amendments in agriculture has gained considerable attention due to their potential benefits in enhancing soil fertility, crop productivity and sustainability. This research was conducted at Agronomy Farm, SKNAU, Jobner in 2020 to investigate the Influence of Vermicompost and Vermiwash on Yield Attributes and Yield of Urdbean. The results revealed significant improvements in plant growth, yield attributes and overall yield, emphasizing the importance of vermicompost and vermiwash in sustainable agriculture. The application of vermicompost 6.0 t/ha resulted in highest yield attributes i.e. pods/plant (27.6), seeds/pod (7.71) and test weight (3.40 gm) and also recorded highest seed and stover yield of urdbean. While, the foliar application of vermiwash with different concentrations also resulted an increase in yield attributes *viz*., pods/plant, seeds/pod, test weight and seed and stover yield over the control treatment. However, the foliar application of vermiwash 15 % spray resulted to be the best treatment among the all.

Keywords: Organic amendments, Urdbean, Vermicompost, Vermiwash, Yield attributes.

INTRODUCTION

The urdbean (*Vigna mungo* L.), also known as black gram or black lentil, is an important legume crop cultivated primarily in South Asia. It belongs to the Fabaceae family and is known for its high nutritional value, adaptability to various agro-climatic conditions and multiple uses in culinary and medicinal practices. The urdbean is a warm-season pulse crop that plays a significant role in the agricultural economy of many countries, particularly in India, Pakistan, Bangladesh and Nepal. The urdbean is valued for its rich protein content, which makes it an essential dietary component, especially for vegetarian populations. It is also a good source of dietary fiber, vitamins and minerals, contributing to a healthy and balanced diet. Moreover, the crop has nitrogen-fixing capabilities, enhancing soil fertility and benefiting subsequent crops in crop rotation systems. In addition to its nutritional significance, urdbean cultivation offers economic benefits to farmers. The crop has a relatively short duration, allowing for multiple cropping cycles in a year. Its adaptability to diverse soil types, including marginal lands and tolerance to drought conditions make it a suitable choice for sustainable agriculture practices. Furthermore, various parts of the urdbean plant, such as the leaves, stems and pods, have traditional medicinal uses, adding value to the crop beyond its agricultural importance. Urdbean is an important leguminous crop widely cultivated for its high protein content and nutritional value. However, the productivity of urdbean is often limited by nutrient deficiencies, poor soil structure and suboptimal soil fertility. The use of organic amendments, such as vermicompost and vermiwash, presents a potential solution to address these challenges and improve crop yield.

Vermicompost, derived from earthworm-mediated decomposition of organic materials, is rich in essential nutrients, microbial activity and organic matter, making it an ideal soil conditioner. The vermicompost has a greater pH and electrical conductivity than the vermiwash. The vermicompost had a greater nitrogen and potassium content than the vermiwash by 57% and 79.6%, respectively. However, the vermiwash had an 84% greater phosphorus concentration than the vermicompost. In comparison to the vermicompost, the vermiwash was 89.1% and 97.6% richer in calcium and magnesium. In addition, the vermiwash contained

97.8% more sodium than the vermicompost Manyuchi, *et al.* (2013). Vermiwash boosts a crop's ability to fight illness Yadav *et al*. (2005). Vermiwash, the liquid runoff produced during vermicomposting, contains soluble nutrients, plant growth-promoting substances and beneficial microorganisms. Regarding its origin, cost-effectiveness, availability, repeatability and dependability as well as its capacity to act as a biopesticide and an environmental friendly soil conditioner, vermiwash demonstrates promising applications in sustainable development in agricultural biotechnology Verma *et al*. (2018).

MATERIAL AND METHODS

At the S.K.N. College of Agriculture's Agronomy Farm in Jobner (26°05' N, 75°28' E), Rajasthan, India, the field experiment was undertaken in 2020. The research location is situated 427 metres above mean sea level in Rajasthan's agroclimatic zone IIIa (Semi-Arid Eastern Plains Zone). The field study utilised a factorial randomised block design and contained 20 treatment combinations with three replications. It includes five treatments of vermicompost (control, 1.5 t/ha, 3.0 t/ha, 4.5 t/ha and 6.0 t/ha) and four applications of vermiwash foliar spray (control, 5 %, 10 % and 15 %). Vermicompost was used in line with the treatments for each plot prior to the last ploughing. Using a knapsack sprayer, vermiwash was applied to the leaves at the flower initiation stage. Five randomly selected plants were used for counting the number of pods per plant at harvest, average number of seeds per pod and test weight was calculated by counting one thousand seeds. Experimental data were analyzed using analysis of variance (ANOVA) as per Factorial Randomized Block Design (Gomez and Gomez, 1984). Significance of the treatments were tested using F test with 5% level of significance ($P< 0.05$).

RESULTS AND DISCUSSION

A. Yield attributes

Vermicompost: Increasing levels of vermicompost application significantly increased the number of pods/plant, number of seeds/pod and the test weight of urdbean crop over the control (Table 1). Application of vermicompost 6.0 t/ha resulted in the highest number of pods/plant (27.6) and number of seeds/pod (7.71) whereas vermicompost 4.5 t/ha was found to be at par with it. Significant increase was observed in the test weight of urdbean (34.0 gm) with the application of vermicompost 6.0 t/ha however, it was also found to be at par with vermicompost 3.0 t/ha and vermicompost 4.5 t/ha. Vermicompost enhanced source and sink interactions by increasing photosynthate translocation to reproductive organs and increasing pods/plant, seeds/pod and test weight. Vermicompost may also have a favourable effect on these parameters by increasing the solubility of native soil nutrients and providing additional plant nutrients. Another reason would involve better metabolite partitioning that is both efficient and effective, as well as proper nutrient transformation to growing plant structures. Further, results of present experiment corroborates with the findings of Chaudhari *et al*., 2013; Kumar *et al*., 2016; Ramawtar *et al*., 2013; Tyagi and Upadhyay 2013.

Vermiwash: Significantly higher number of pods per plant, number of seeds per pod and test weight was recorded by vermiwash 15% spray over control and vermiwash 5% spray. Highest number of pods/plant (27.1), number of seeds/pod (7.51) and test weight (33.8 gm) was observed with vermiwash 15 % spray however it was seen to be at par with the foliar spray of vermiwash 10 % (Table 1). The explanation for the higher yield quality may be related to the increased efficiency of foliar spraying nutrients and growth stimulants to plants as a result of vermiwash spraying. Smaller concentrations of the IAA and GA in vermiwash that were applied as foliar spray may have stimulated the plant system, increasing the production of growth regulators in the cell system, which in turn induced the necessary growth and development, resulting in a higher yield. The total number of pods/plant, straw weight/plot, seed weight, straw weight and harvest index of fenugreek were reported to be improved more effectively by foliar spraying of 2% vermiwash at 15, 30, and 45 DAS than controls Jadhav *et al*. (2014). Similar set of findings were also reported by (Kapase *et al*., 2011; Khairnar and Gunjal 2012; Sundararasu and Jeyasankar 2014).

Yield

Vermicompost: Higher yield of urdbean was recorded with application of higher doses of vermicompost over control treatment. Vermicompost 4.5 t/ha recorded significantly higher seed yield (9.40 q/ha), stover yield (19.20 q/ha) and biological yield (28.60 q/ha) over lower levels of vermicompost application (Table 1). Whereas, the application of vermicompost 6.0 t/ha was found to be at par with the application of vermicompost 4.5 t/ha. The large increase in seed production caused by vermicompost mainly came through improved growth, which led to improvements in several yield metrics as previously mentioned. Another reason would involve better metabolite partitioning that is both efficient and effective, as well as proper nutrient transformation to growing plant structures. These results are in line with those of (Kadam *et al*., 2011; Suchitra and Manivannan 2012; Yadav *et al*., 2019).

Vermiwash: Different doses of vermiwash have a substantial impact on seed and stover yield of urdbean. Vermiwash 15 % spray produced higher seed yield (9.10 q/ha) and stover yield (18.66 q/ha) over control and vermiwash 5 % spray (Table 1). However, it was found to be statistically at par with vermiwash 10 % spray. This could be linked to vermiwash's beneficial influence on vegetative development, such as the number of branches per plant and reproductive growth, such as pods (27.1/plant), seeds (7.51/pod) and test weight (33.8 g), which were essential yield parameters with a strong positive association with seed and stover yield. Similar set of findings were also reported by (Bhardwaj *et al*., 2016; Selvarani *et al*., 2020; Sundararasu *et al*., 2014).

Table 1: Effect of vermicompost and vermiwash on yield attributes and yield of urdbean.

Treatments	Yield Attributes			Yield (q/ha)		
	Pods/plant	Seeds/pod	Test weight (g)	Seed yield	Stover yield	Biological yield
Vermicompost levels						
Control	19.1	6.14	29.1	6.60	14.56	21.16
1.5 t/ha	22.2	6.63	31.0	7.70	16.73	24.43
3.0 t/ha	24.8	7.12	32.9	8.64	18.22	26.86
4.5 t/ha	26.6	7.59	33.7	9.40	19.20	28.60
6.0 t/ha	27.6	7.71	34.0	9.85	19.51	29.35
SEm±	0.58	0.15	0.65	0.22	0.28	0.48
CD (P = 0.05)	1.66	0.42	1.87	0.62	0.81	1.38
Vermiwash (Foliar Spray)						
Control	19.9	6.43	29.8	7.59	16.25	23.84
5%	23.2	6.88	31.7	8.20	17.34	25.54
10%	25.9	7.34	33.5	8.85	18.32	27.17
15%	27.1	7.51	33.8	9.10	18.66	27.77
SEm±	0.52	0.13	0.58	0.20	0.25	0.43
CD (P = 0.05)	1.48	0.38	1.67	0.56	0.72	1.23
CV (%)	8.33	7.29	7.03	8.95	5.52	6.39

CONCLUSION

Based on the results of one year experimentation, it may be inferred that application of vermicompost 6.0 t/ha and vermiwash 15 % were found the most superior treatments for obtaining higher seed and stover yield in urdbean. Increase in yield attributes were also observed with the application of different vermicompost doses and vermiwash sprays over the control.

FUTURE SCOPE

This paper is based on only one year data so further research experiments are encouraged to find out the suitable doses for a sustainable production.

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Conflict of interest. None.

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