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Influence of vermiwash and panchagavya on lablab beans under pot experimental conditions

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Abstract

The present study explores the growth promoting effects of vermiwash and panchagavya on *Dolichus lablab*. Vermiwash was obtained from the vermicomposting unit and panchagavya was prepared using cow products such as milk, curd, urine, ghee and dung. Different concentrations of vermiwash and panchagavya (5:2%, 10:3% and 15:4%) were applied to the bean plants once in every week for six weeks. The exo-morphological characters such as shoot length, internode length, diameter of the internode, number of leaves and leaf surface area were recorded prior to every treatment in all the groups. Interestingly, 10:3% vermiwash and panchagavya treated lablab beans showed better growth promoting effects than the other plants. Thus, the results of the present study clearly suggest that 10:3% vermiwash and panchagavya could be used as effective foliar spray in the near future.

Keywords: Vermiwash, Panchagavya, Foliar sprays, Lablab bean, Pot study.

Introduction

The compost prepared through the application of worms usually red wiggler (*Eisenia fetida*), African night crawler (*Eudrilus eugeniae*) and other earthworms is known as vermicompost and the technology of using such local species of earthworms for crop production or composting is called vermitech (Ismail, 2005). Vermicompost is usually a finely divided peat-like material with excellent structure, porosity, aeration, drainage and moisture holding capacity. Vermiwash is a liquid fertilizer collected after the passage of water through a column of worm activation. It is a collection of excretory and secretory products of earthworms along with major micronutrients of the soil and soil organic molecules (Ansari, 2008).

Recently, many studies have reported that vermiwash as foliar spray is effective. Different doses of vermiwash and vermicompost were used to study their effect on the growth and flowering of *Zinnia* sp. Among them, 20% vermicompost and vermiwash showed maximum positive effects than the other test

concentrations (Chattopadhyay, 2014). Vermiwash spray has significantly enhanced the growth (plant height and number of leaves) and yield (number of flowers and fruits per plant) parameters of *Solanum melongena*. Also, flowering and fruiting ratio was increased (Sundararasu and Jeyasankar, 2014). Vermiwash treatment elevated the levels of total macronutrients (N, P, K and C) and micronutrients (Fe, Cu, Mg and Zn). In addition, vermiwash treated *Capsicum frutescens* showed increased root and shoot length after 30 days. The number of leaves was also found to be increased than the vermiwash untreated plants (Subha Mary and Lakshmi Prabha, 2014). Recently, Chavan *et al.* (2015) have observed significant increase in the growth of cluster bean after treatment with vermicompost fertilizer. Similarly, Rekha *et al.* (2015) have observed increased shoot length, length of internode, number of leaves and number of branches in vermicompost 50% treated *Vigno mungo* crops.

Panchagavya is an organic product blended with five different cow products, commonly applied to crop plants in organic farming. It acts as growth promoter and immunity booster and also restricts the incidence of common diseases (Vallimayil and Sekar, 2012). Panchagavya is known to contain growth regulatory substances such as IAA, GA and cytokinin. Panchagavya was applied on southern sunnhemp mosaic virus infected plants as foliar spray; panchagavya treated plants showed better growth and lesser viral intensity than the control sunnhemp plants (Vallimayil and Sekar, 2012). Significant improvement in the growth and nutrient content of *Vitis vinifera* was observed using panchagavya along with microbial fertigation (Geetha and Aruna, 2013). Interestingly, panchagavya had the highest population of total bacteria, actinomycetes, phosphate solubilizers, fluorescent pseudomonads and nitrifiers. In addition, dehydrogenase activity and microbial biomass were also found to be higher in panchagavya (Amalraj *et al.*, 2013). Jandaik and Sharma (2016) have recently reported the antifungal activity of panchagavya against three plant pathogens *Rhizoctonia solani*, *Fusarium oxysporium* and *Sclerotium rolfsii*. In their study, panchagavya exhibited antifungal activity against all the three pathogens at three different concentrations i.e 5, 10 and 15%. However, 15% concentration was the most effective and exhibited 82% of inhibition against *F. oxysporium* (Jandaik and Sharma, 2016). With this background, the present study was aimed to evaluate the growth promoting effects of vermiwash and panchagavya on lablab beans under pot experimental conditions.

Materials and Methods

Preparation of vermiwash and panchagavya

Vermicomposting unit (3×2×5 feet, lbh) was set up with layers of gravel, sand, garden soil, cow dung parts and sufficient water for the growth of *Eudrilus eugeniae* as they produce compost quicker and multiply rapidly. About 1 kg of this species accounting 200 worms was added to the container. The water outlet tap was fixed at the bottom in order to collect the vermiwash after 45 days of composting. Panchagavya was prepared from cow products viz. cow milk (5 L), ghee (2 L), curd (2 kg), cow urine (5 L) and cow dung (5 kg); these ingredients were mixed together along with 15 kg of jaggery in a circular container. The mixture was added with 15 L of water and kept as such for 30 days. Fermentation took place by making the mixture to a fine concentrate giving out the sweet odour (Ismail, 2005).

Pot studies

Lablab seeds were bought from the Tamil Nadu Agricultural University, Coimbatore. The seeds were sown in pots containing soil. The pH of the soil was 7.4. Initially, the plants were grouped into five categories. Group 1 was control plants and group 2 was chemical (virux) treatment group. Groups 3, 4 and 5 were treated with 5:2, 10:3 and 15:4% vermiwash and panchagavya, respectively (Fig. 1 and Table 1). These organic foliar sprays were sprayed at regular intervals i.e. once in every week for six weeks. This was done at early morning or late evening; so that sprays were not dried up directly under the sun light. All these studies were done during the period of June 2014 - August 2014, where the temperature was found to be low while the humidity and rainfall were high.

Fig. 1. Pot experimental conditions - *Dolichus labab*

Table 1. Various concentrations of vermiwash, panchagavya and plant growth regulators used for the study

S. No	Treatment	Organic plant growth promoters (PGP)	Concentration (PGP + water)
1	Control	-	Water
2	Vermiwash 5% panchagavya 2%	Vermiwash panchagavya	5 + 95 mL 2 + 98 mL
3	Vermiwash 10% panchagavya 3%	Vermiwash panchagavya	10 + 90 mL 3 + 97 mL
4	Vermiwash 15% panchagavya 4%	Vermiwash panchagavya	15 + 85 mL 4 + 96 mL
5	Chemical fertilizer	Virux	5 mL + 2 L

Analysis of exo-morphological characters

At zero hour and at the end of every week of spray, *i.e.* just before giving the spray application, the exo-morphological characters such as shoot length, length of the internode, diameter of the internode, number of leaves and leaf surface area were recorded in vermiwash and panchagavya treated plants for six weeks and the results were compared with that of control and chemical treatment groups (Elumalai *et al.*, 2013; Rekha *et al.*, 2015).

Statistical analysis

The data were subjected to One-way Analysis of Variance (ANOVA) to determine the significance of individual differences at $p > 0.001$ level. Significant means were compared by the Duncan's multiple range test. All statistical analyses were carried out using SPSS statistical software package (SPSS, Version 10.0, Chicago, USA).

Results

Analysis of exo-morphological characters

Shoot length

The shoot length was found to be increased in chemical fertilizer as well as vermiwash and panchagavya treated plants compared to the control group. However, increased shoot length was found in vermiwash and panchagavya treated plants than the chemical fertilizer treated group (Table 2). In case of vermiwash and panchagavya treatment, better growth effect was observed in 10:3% vermiwash and panchagavya treated plants; the shoot length was increased to 56.24 cm after six weeks.

Table 2. Effect of vermiwash and panchagavya on the shoot length (cm) of lablab beans

TREATMENTS	I - WEEK	II - WEEK	III - WEEK	IV - WEEK	V - WEEK	VI - WEEK
Control	5.44 ± 0.17	9.72 ± 0.13	19.23 ± 0.13	29.33 ± 0.13	38.32 ± 0.17	48.78 ± 0.17
Chemical Fertilizer	6.49 ± 0.16	10.38 ± 0.14	21.68 ± 0.21	31.69 ± 0.20	40.14± 0.20	50.23 ± 0.14
Vermiwash (5%) and Panchagavya (2%)	6.79 ± 0.16	12.59 ± 0.19	25.24 ± 0.14	35.30 ± 0.16	42.26 ± 0.20	52.77 ± 0.15
Vermiwash (10%) and Panchagavya (3%)	8.32 ± 0.17	15.13 ± 0.14	30.20 ± 0.13	42.27 ± 0.17	51.55 ± 0.28	56.24 ± 0.14
Vermiwash (15%) and Panchagavya (4%)	7.30 ± 0.17	13.26 ± 0.21	26.24 ± .337	35.84 ± 0.16	43.84 ± 0.15	53.70 ± 0.17
F-VALUE	1008.794	4344.350	18695.337	21881.920	15524.730	8956.549
P-VALUE	** < 0.001	** < .0.001	** <. 0.001	** <.0.001	** <0.001	** <0.001

** Denotes, significance at 1% Level

Length of the internode

Internode length was increased in chemical fertilizer as well as vermiwash and panchagavya treated plants than the control plants; but, increased length was observed in vermiwash and panchagavya treated groups than the chemical fertilizer treated plants (Table 3). Better growth effect was found in 10:3% vermiwash and panchagavya treated plants. The internode length was increased more than three folds after six weeks.

Table 3. Effect of vermiwash and panchagavya on the length of internode (cm) of lablab beans

TREATMENTS	I - WEEK	II - WEEK	III - WEEK	IV – WEEK	V - WEEK	VI - WEEK
Control	1.00 ± 0.14	2.00 ± 0.15	2.62 ± 0.17	3.38 ± 0.18	4.30 ± 0.16	5.22 ± 0.15
Chemical Fertilizer	1.98 ± 0.15	2.66 ± 0.21	3.60 ± 0.19	4.54 ± 0.25	5.55 ± 0.24	6.32 ± 0.25
Vermiwash (5%) and Panchagavya (2%)	2.20 ± 0.14	3.20 ± 0.14	4.11 ± 0.14	5.10 ± 0.16	6.10 ± 0.16	7.06 ± 0.19
Vermiwash (10%) and Panchagavya (3%)	3.16 ± 0.14	4.95 ± 0.17	5.98 ± 0.25	7.47 ± 0.15	8.47 ± 0.15	9.40 ± 0.17
Vermiwash (15%) and Panchagavya (4%)	2.72 ± 0.12	3.95 ± 0.19	4.90 ± 0.16	5.89 ± 0.18	6.86 ± 0.17	7.52 ± 0.14
F-VALUE	857.210	1087.433	1154.657	1667.583	1883.245	1752.467
P-VALUE	** < 0.001	** < .0.001	** <. 0.001	** <.0.001	** <0.001	** <0.001

** Denotes, significance at 1% Level

Diameter of the internode

The diameter of the internode was found to be increased in chemical fertilizer as well as vermiwash and panchagavya treated groups than the control. Interestingly, better effect was found in 10:3% vermiwash and panchagavya treated group than the other plants (Table 4). The diameter of the internode was increased to 6.78 mm after six weeks.

Table 4. Effect of vermiwash and panchagavya on the diameter of internode (mm) of lablab beans

TREATMENTS	I - WEEK	II - WEEK	III - WEEK	IV - WEEK	V - WEEK	VI – WEEK
Control	1.12 ± 0.13	1.90 ± 0.09	2.54 ± 0.13	3.43 ± 0.19	4.09 ± 0.14	4.68 ± 0.21
Chemical Fertilizer	2.05 ± 0.14	2.86 ± 0.20	3.50 ± 0.19	4.51 ± 0.25	5.40 ± 0.21	6.14 ± 0.18
Vermiwash (5%) and Panchagavya (2%)	2.23 ± 0.15	3.24 ± 0.16	4.15 ± 0.14	4.85 ± 0.12	5.73 ± 0.12	6.43 ± 0.13
Vermiwash (10%) and Panchagavya (3%)	2.32 ± 0.13	3.48 ± 0.13	3.97 ± 0.20	4.86 ± 0.33	5.85 ± 0.33	6.78 ± 0.35
Vermiwash (15%) and Panchagavya (4%)	2.07 ± 0.11	3.30 ± 0.14	3.85 ± 0.11	4.74 ± 0.18	5.82 ± 0.11	6.53 ± 0.13
P-VALUE	327.975	464.888	407.597	175.674	345.235	367.054
F-VALUE	** < 0.001	** < .0.001	** <. 0.001	** <.0.001	** <0.001	** <0.001

** Denotes, significance at 1% Level

Number of leaves

Number of leaves was found to be increased in chemical fertilizer as well as vermiwash and panchagavya treated groups than the control plants. However, better effect was noticed in 10:3% vermiwash and panchagavya treated plants (Table 5). After six weeks, the number of leaves was increased to 20.

Table 5. Effect of vermiwash and panchagavya on the leaves (n) of lablab beans

TREATMENTS	I - WEEK	II - WEEK	III – WEEK	IV - WEEK	V - WEEK	VI - WEEK
Control	2.76 ± 0.44	4.36 ± 0.49	5.52 ± 0.51	9.08 ± 0.91	13.04 ± 0.93	15.72 ± 0.94
Chemical Fertilizer	4.44 ± 0.51	6.40 ± 0.50	8.40 ± 0.50	12.48 ± 0.71	15.40 ± 0.50	18.36 ± 0.49
Vermiwash (5%) and Panchagavya (2%)	5.44 ± 0.51	8.40 ± 0.50	10.52 ± 0.71	13.48 ± 0.51	16.36 ± 0.49	19.40 ± 0.50
Vermiwash (10%) and Panchagavya (3%)	6.44 ± 0.51	9.48 ± 0.51	12.16 ± 0.37	14.64 ± 0.64	17.52 ± 0.51	20.88 ± 1.01
Vermiwash (15%) and Panchagavya (4%)	5.52 ± 0.51	8.84 ± 0.62	11.20 ± 0.71	13.52 ± 0.77	16.72 ± 0.46	19.52 ± 0.17
F-VALUE	200.738	395.583	527.831	218.780	202.767	160.181
P-VALUE	** < 0.001	** < .0.001	** <. 0.001	** <.0.001	** <0.001	** <0.001

** Denotes, significance at 1% Level

Leaf surface area

Increased leaf surface area was observed in chemical fertilizer as well as vermiwash and panchagavya treated groups than the normal control plants. Better growth effect was observed in 10:3% vermiwash and panchagavya treated plants (Table 6). Interestingly, they showed almost two folds increase of leaf surface area after six weeks.

Table 6. Effect of vermiwash and panchagavya on the leaf surface area $(cm)^2$ of lablab beans

TREATMENTS	I - WEEK	II - WEEK	III - WEEK	IV - WEEK	V - WEEK	VI - WEEK
Control	5.42 ± 0.17	7.42 ± 0.21	9.33 ± 0.23	11.31 ± 0.25	13.49 ± 0.38	15.46 ± 0.33
Chemical Fertilizer	6.38 ± 0.22	8.38 ± 0.24	11.36 ± 0.25	13.58 ± 0.25	15.61 ± 0.27	17.39 ± 0.27
Vermiwash (5%) and Panchagavya (2%)	7.57 ± 0.23	9.54 ± 0.24	12.62 ± 0.25	14.58 ± 0.26	15.64 ± 0.23	16.61 ± 0.25
Vermiwash (10%) and Panchagavya (3%)	9.63 ± 0.24	11.62 ± 0.24	14.60 ± 0.25	16.59 ± 0.24	17.59 ± 0.24	18.59 ± 0.24
Vermiwash (15%) and Panchagavya (4%)	8.62 ± 0.22	10.68 ± 0.44	12.61 ± 0.25	15.65 ± 0.34	16.57 ± 0.24	17.58 ± 0.38
F-VALUE	1297.428	869.021	1553.532	1424.902	744.959	383.492
P-VALUE	** < 0.001	** < .0.001	** <. 0.001	** <.0.001	** <0.001	** <0.001

** Denotes, significance at 1% Level

Discussion

The organic manure is eco-friendly and economically viable and has played a significant role in soil biology, chemistry and physics. Nowadays, organic farming practices are gaining importance as farmers have realized the benefits of organic farming in terms of soil fertility, soil health and sustainable productivity. It is interesting to note that human livestock and crop produce approximately 38 billion metric tons of organic waste each year and this may be an efficient source of organic matter supply in soils. According to a conservative estimation, around 600-700 million tons of agriculture wastes (including 272 million tons of crop residues) are available in India but most of it remains unutilized. This huge quantity of wastes can be converted into nutrient rich bio-fertilizer (vermicompost) for sustainable land restoration practices (Suthar, 2008; Elumalai *et al.,* 2015). Earthworm and its vermicast and vermiwash are scientifically proving as both growth promoters and protectors for crop plants. To the best of our knowledge, this may be the first study in which both vermiwash and panchagavya were used as foliar spray to evaluate their growth promoting effects on lablab beans. In this study, three different concentrations of vermiwash and panchagavya (5:2%, 10:3% and 15:4%) were tested on lablab beans. Of these, 10:3% vermiwash and panchagavya treated plants showed better growth promoting effects in terms of exo-morphological characters such as shoot length, internode length, diameter of the internode, number of leaves and leaf surface area. On the other hand, 5:2% and 15:4% vermiwash and panchagavya treated plants showed better effects than the chemical fertilizer treated group.

These results were found to be consistent with the studies of Rajan and Murugesan (2012) and Nath and Singh (2012); however, they have observed the growth promoting effects using vermiwash only. In another study, 15% vermiwash exhibited better growth promoting effects on *Abelmoschus esculentus* (Elumalai *et al.,* 2013). Vermiwash treated *Capsicum frutescens* showed increased root, shoot length and number of leaves after 30 days than the vermiwash untreated plants (Subha Mary and Lakshmi Prabha, 2014). Vermiwash along with gibberellic acid was used to bring about seed germination and seedling growth in *Hibiscus sabdariffa* and *Phaseolus vulgaris* (Fathima and Malathy, 2014). The enhanced growth may be due to the presence of growth regulatory substances such as IAA, GA, cytokinin, essential plant nutrients, effective microorganisms and bio-fertilizers like *Acetobacter*, *Azosprillum* and *Phosphobacterium* present in panchagavya and vermiwash (Esakkiammal *et al.*, 2015; Somasundram *et al.*, 2004). Sreenivasa *et al.* (2011) have observed mostly nitrogen fixers and

P-solubilizers in four different organic liquid manures such as panchagavya, beejamrutha, jeevamrutha and biodigester. Presence of naturally occurring beneficial microorganisms predominantly bacteria, yeast, actinomycetes, photosynthetic bacteria and certain fungi were detected in organic liquid manures (Swaminathan, 2005). Papen *et al.* (2002) have reported that panchagavya contains *Azotobacter*, *Azospirillum* and *Phosphobacteria*. In addition, panchagavya has also been reported to contain plant growth promoting substances as well as bacteria having biological activities. Presence of such beneficial microbial biomass resulted in enhanced seed germination, seedling length and seed vigor in wheat.

Conclusion

In this study, better growth effects were observed in vermiwash and panchagavya treated plants than the chemical fertilizer and control lablab plants. Interestingly, remarkable growth promoting effects were recorded only in 10:3% vermiwash and panchagavya treated group. Thus, the obtained results clearly suggest that 10:3% vermiwash and panchagavya could be explored as effective foliar spray for the better growth of vegetable crops in the near future.

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