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Research Article

GROWTH PROMOTING EFFECTS OF VERMIWASH AND PANCHAGAVYA ON *DOLICHUS LABLAB* UNDER FIELD 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 90 days. The exo-morphological characters such as shoot length, internode length, diameter of the internode, number of leaves, leaf surface area and chlorophyll content 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.

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 tested 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 (Varghese and Prabha, 2014). Recently, Chavan *et al.* (2015) have observed significant increase in the growth of cluster bean after treatment with vermicompost fertilizer.

Panchagavya is an organic product blended with five different cow products, commonly applied to crop plant 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 also 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 carbon 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 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 most effective and exhibited 82% of inhibition against *F. oxysporium*. With this background, the present study was aimed to evaluate the growth promoting effects of vermiwash and panchagavya on lablab beans under field conditions for 90 days.

Materials and Methods

Crop and Field Selection

The farm land was selected for the cultivation of *Dolichus lablab* near Vayanallur (70 to 255 Sq. Ft.) on the suburbs of Chennai. The field was cleaned well and ploughed uniformly. It also had adequate facilities to carry out the experiments.

Preparation of Vermiwash and Panchagavya

Vermicomposting unit (3×2×5 feet, lbh) was set up with layers of gravel, sand, garden soil, cowdung 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).

Fig. 1. Plant growth parameters – Field treatments – Exo morphological characters of *Dolichus lablab* A. Control; B. Vermiwash 5% panchagavya 2%; C. Vermiwash 10% panchagavya 3%; D. Vermiwash 15% panchagavya 4%; E. Chemical fertilizer.

Field Experimental Condition

Lablab seeds were bought from the Tamil Nadu Agricultural University, Coimbatore. The seeds were sown at regular intervals of 1 foot from each plant and were allowed to germinate. Initially, the plants were grouped into five categories. Group 1 was control plants and group 2 was chemical treatment group. Groups 3, 4 and 5 were treated with 5:2, 10:3 and 15:4% vermiwash and panchagavya, respectively (Fig. 1-2; Table 1). These organic foliar sprays were sprayed at regular intervals i.e. once in every week for 90 days. This was done at early morning or late evening; so that sprays were not dried up directly under sun light.

Fig. 2: Exo-morphological characters of *Dolichus lablab* after different treatments.

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

S. N.	Treatment	Organic plant growth promoters (PGP)	Concentration (PGP + water)
1	Control	-	Water
2	Vermiwash 5% panchagavya 2%	Vermiwash panchagavya	50 + 950 mL 20 + 980 mL
3	Vermiwash 10% panchagavya 3%	Vermiwash panchagavya	100 + 900 mL 30 + 970 mL
4	Vermiwash 15% panchagavya 4%	Vermiwash panchagavya	150 + 850 mL 40 + 960 mL
5	Chemical fertilizer	Virux	50 mL + 20 litre

Analysis of Exo-Morphological Characters

At the end of every week of spray and at zero hour, *i.e.* just before giving the spray application, the exo-morphological characters such as height of the plant, length of the internode, diameter of the internode, number of leaves and leaf surface area were recorded in vermiwash and panchagavya treated plants for 90 days and the results were compared with that of control and chemical treatment groups.

Estimation of Chlorophyll

Chlorophyll-a and b were determined according to the method of Arnon (1949). Fresh leaves (0.2 g) were taken and extracted overnight with 80% acetone at -4 °C. The extract was centrifuged at 10000x g for 5 min. The absorbance of the supernatant was read at 645, 663 and 480 nm using UV-visible spectrophotometer (Hitachi-220, Japan). The *Chlorophyll-a* and b were calculated by the following formulae:

Chl a (mg g^{-1} f.wt.) = [12.7(OD 663)-2.69(OD 645) ×V/1000×W]

Chl b (mg g^{-1} f.wt.) = [22.9(OD 645)-4.68(OD 663) ×V/1000×W]

Total Chl = Chl a + Chl b

Where,

V = volume of the sample

W = weight of fresh tissue

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 (Fig. 3). In case of vermiwash and panchagavya treatment, better growth effect was observed in 10:3% vermiwash and panchagavya treated plants; the shoot length was 60.35 cm after 90 days.

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 (Fig. 4). Better growth effect was found in 10:3% vermiwash and panchagavya treated plants. The internode length was increased almost three fold after 90 days.

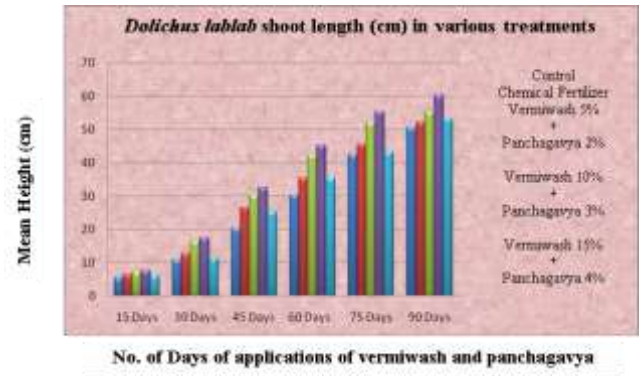

Fig. 3: Effect of panchagavya and vermiwash on shoot length of *Dolichus lablab.*

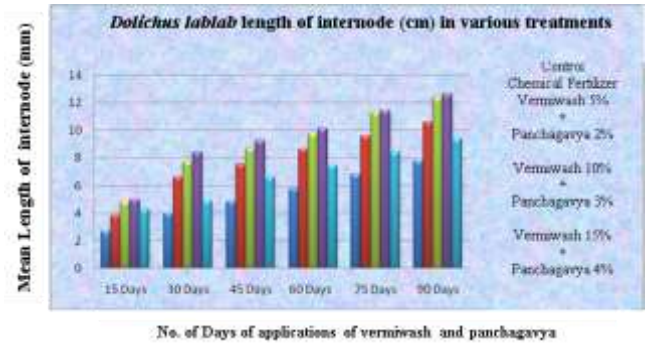

Fig. 4: Effect of panchagavya and vermiwash on internode length of *Dolichus lablab.*

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 (Fig. 5). The diameter of the internode was increased to 7.64 mm after 90 days.

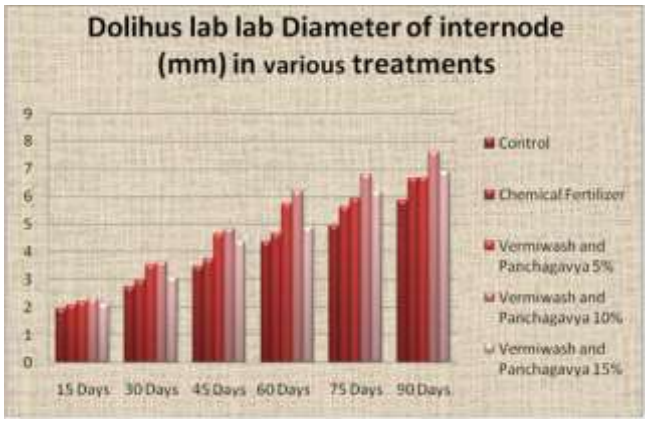

Fig. 5: Effect of panchagavya and vermiwash on diameter of internode of *Dolichus lablab.*

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 (Fig. 6). After 90 days, the number of leaves was increased to 42 from 11.

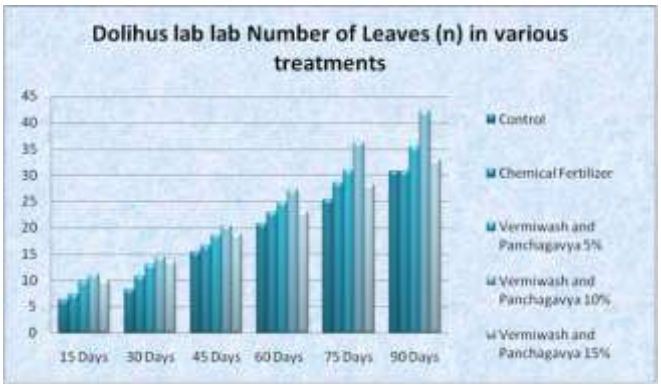

Fig. 6: Effect of panchagavya and vermiwash on number of leaves of *Dolichus lablab.*

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 (Fig. 7). Interestingly, they showed four fold increment of leaf surface area after 90 days.

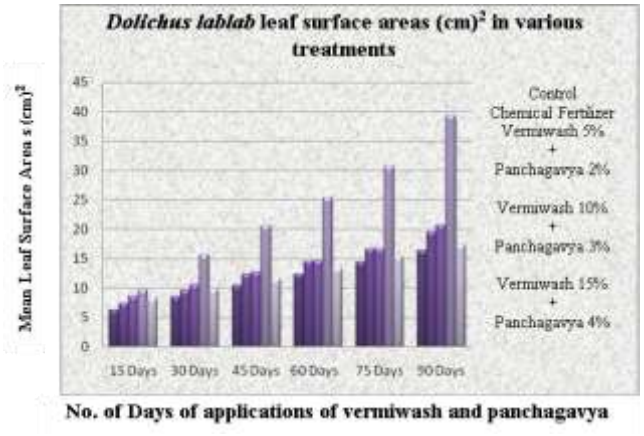

Fig. 7: Effect of panchagavya and vermiwash on the leaf surface area of *Dolichus lablab.*

Estimation of Chlorophyll

Increased chlorophyll content was observed in vermiwash and panchagavya treated plants than the control and chemical fertilizer treated groups (Table 2). Interestingly, in this study, 10:3% vermiwash and panchagavya treated plants showed 0.81 mg/g F.wt of *Chlorophyll-a,* and 0.75 mg/g F.wt of *Chlorophyll-b,* respectively.

Table 2: Estimation of chlorophyll content of *Dolichus lablab* under different treatment conditions

Pigment	Control plants	Chemical fertilizer treated plants	10:3% vermiwash and panchagavya treated plants
Chlorophyll-a (mg/g F.wt)	0.50	0.59	0.81
Chlorophyll-b (mg/g F.wt)	0.49	0.38	0.75
Total chlorophyll (mg/g F.wt)	0.98	0.92	1.7

Discussion

Organic farming alone could serve as the holistic approach towards achieving sustainable agriculture as it is eco-friendly and ensures the conservation of resource for the future. Earthworms and their vermicompost work like miracle growth promoter and are nutritionally better to the conventional compost and chemical fertilizers. Earthworm and its vermicast and vermiwash are scientifically proving as both growth promoters and protectors for crop plants. To the best 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 (Varghese and 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 biofertilizers like *Acetobacter*, *Azosprillum* and *Phosphobacterium* present in the panchagavya and vermiwash (Esakkiammal *et al.,* 2015; Somasundram *et al.,* 2004). In addition, panchagavya has also been reported to contain bacteria producing 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. Thus, it is obvious from these results that vermiwash promotes the growth of lablab beans radically along with panchagavya.

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 results obtained from the field experimental conditions 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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