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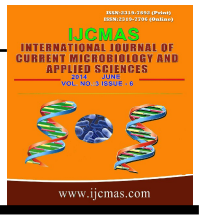

Original Research Article

Studies on Growth Promoting effects of Vermiwash on the Germination of Vegetable Crops

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Vermiwash, seed germination, *Hibiscus sabdariffa*, *Phaseolus vulgaris*

A B S T R A C T

Sustainable agriculture has become important in the present time owing to pollution and soil degradation. The use of organic manures and fertilizers which are of biological origin is one of the important practices in this form of agriculture. Vermiwash is biofertiliser that that is known to bring about growth enhancement in a wide variety of plants. The present study aimed at exploring the growth promoting effects of vermiwash in bringing about seed germination and seedling growth in common vegetable crops like *Hibiscus sabdariffa* and *Phaseolus vulgaris*. Vermiwash at two different concentrations of 10% and 20% was used along with Giberellic acid at100 µg/ml to compare its growth promoting effects. Distilled water was used as the control. The seeds were treated with the test solutions and the germination percentage and seedling characters were analysed. The study revealed that Vermiwash at lower concentrations was effective in bringing about seed germination and seedling growth. The germination percentage and seedling growth in terms of length of hypocotyl and radical was maximum in 10% vermiwash treatment in both the experimental plants but response to Gibberellic acid and 20%Vermiwash slightly varied between the two plants.

Introduction

Crop production by the use of sustainable methods in agriculture has become the order of the day as there is a growing concern to conserve the environment and make the earth last longer for posterity. Keeping this end in view there is a constant search for manures and fertilizers that are eco-friendly and biodegradable.

Vermicomposting is a novel method of decomposing organic matter and producing organic manure that was the best in all aspects including the nutrient level. It was far better than humus and was a lasting solution for sustainable agriculture.

The role of earthworm in soil formation and soil fertility has thus been well documented and recognized. An approach towards good soil management, with an emphasis on the role of soil inhabitants like earthworms, in soil fertility, is very important in maintaining the ecosystem. Application of vermicompost favourably affects soil pH, microbial population and soil enzyme activities (Shweta and Singh, 2006). The advantages of using vermicompost have been reported in the studies of Lalitha et al., (2000) and Ansari, (2008 a and b) in *A. esculentus.* Growth and development events in plants are controlled by growth regulators and these phytohormones are found naturally in plants.

Manufacturing and production of synthetic phytohormones is not economically feasible and the optimum conditions under which they can function efficiently is also difficult to ascertain (Ismail 2005).Due to health and environmental pollution problems and reactions caused by artificial growth regulators and their low biodegradability has urged us to search for new biofertilizers with growth regulating activity.

There are several organic fertilizers in the form of vermicompost, farmyard manure, press mud , coir pith compost that have been applied producing phenomenal increase in yield and quality. In recent years the use of liquid fertilizers given in the form of foliar sprays has gained importance. The advantages of using the liquid fertiliser especially the liquid sea weed fertilizer , has evoked the need for the production of several such materials to be used as foliar sprays. Vermiwash is a liquid fertilizer used in organic agriculture both as replacement and supplement for solids and for their unique capacity to provide nutrients effectively and quickly. Vermiwash (VW), generally used as a foliar spray, is a liquid bio fertilizer collected by the passage of water through a column of worm activation. There have been several reports on the use of Vermiwash and its growth promoting effects.

The plants used in the present investigation have been earlier used as experimental materials in studies on bioremediation of tannery effluents and effluents of the paper industry. One of the plants *Hibiscus sabdariffa* has been used for the study on the improvement of bast fibres by the use of plant growth regulators (Fathima and Balasubramanian, 2006).
There are reports by Lalitha *et al.,* (2000) ,Zambare *et al*., (2007), Ansari and Ismail (2001) and Shivasubramanian and Ganeshkumar (2004) for the effectiveness of vermiwash as a biofertiliser helping in organic farming. Moreover these authors have also investigated the composition of Vermiwash and substantiated its role in bringing about enhanced growth and development in crop plants

Materials and Methods

The plant species utilised in the present investigation is *Hibiscus sabdariffa* belonging to the family Malvaceae which is commonly used as a fibre crop, and *Phaseolus aureus* belonging to the Family Fabaceae which is commonly used as the vegetable crop. Authentic samples of seeds procured from National Seeds Corporation, Ambattur, Chennai were used to raise plants for the experiments. The experimental material was *Hibiscus sabdariffa* and *Phaseolus aureus* for germination studies.

Preparation of GA3 and Vermiwash

Gibberellic acid for the experiment was prepared as a 1000 µg/ml stock solution. For this 1g of gibberellic acid was dissolved in 1 litre of water. Gibberellic acid is insoluble in water and so it was first dissolved in 2 ml of ethyl alcohol and then made up to 1000 ml by adding distilled water to prepare a 1000µg/ml stock solution. 100 ml of stock solution was made up to 1 litre by using distilled water and this had a concentration of GA3 at 100µg/ml. The Vermiwash unit was set up by the method suggested by Ismail (1997). Vermiwash, a biofertilizer is produced by the action of epigeic (*Perionyx excavatus*) and anecic worms (*Lampito mauritii*) varieties (Ismail, 2005).

About two litres of vermiwash was collected and used for the experiment and used in two dilutions - Vw I- diluted '10' times with distilled water which is a 10% concentration and Vw II- diluted 5 times with distilled water which is 20 % in concentration (Table 1).

Germination Studies

To study the effect of vermiwash on germination of the plants investigated, the seeds were grown in petri plates and the treatments were given as per Table I for both the experimental plants. Three petri plates were maintained for each treatment of each material (*Hibiscus sabdariffa* and *Phaseolus aureus*). At the end of fifth day the germination rate, hypocotyl length and radical length were determined.

The effect of the treatment on seed germination of *Hibiscus sabdariffa* and *Phaseolus aureus* was studied by soaking the seeds in water for one set which served as the control, for other sets seeds were drenched in VwI , VwII and GA3 . After germination the petri plates were maintained at a temperature of 28 degree Celsius under natural light conditions in a temperature controlled lab and periodically observed. Then the total number of seeds germinated was calculated for the control and treated plants .From this the percentage of germination was calculated. There were three duplicates for each treatment and the mean was calculated.

Statistical Analyses

The results obtained were statistically analyzed according to Snedecor and William (1967). For seedling characters every treatment had ten samples analyzed for each parameter. These were randomly selected and numbered for analyses in further experiments and to maintain uniformity. The mean, standard deviation and standard error of means was calculated for each parameter according to standard methods.

Results and Discussion

The various aspects of study such as germination percentage, Hypocotyl length, radical length were done in the petriplate grown seeds of *Phaseolus aureus* and *Hibiscus sabdariffa.* Studies on germination were done to determine how vermiwash affects the germination rate and brings about enhancement of seedling growth.

Though the responses are positive there is variation in response to different concentrations of vermiwash in the two species investigated. So it is important to standardize the concentration based on the crop to which it is to be used.

Plate.1 Showing the effect of vermiwash on the rate of germination in the experimental plants *Hibiscus sabdariffa*

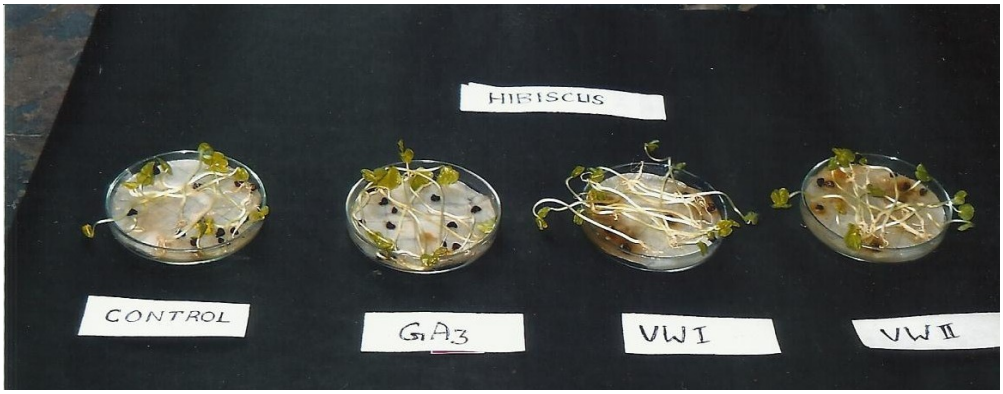


Table.2 Purification steps of lipase from *Staphylococcus* sp. SDMlip *Phaseolus vulgaris*

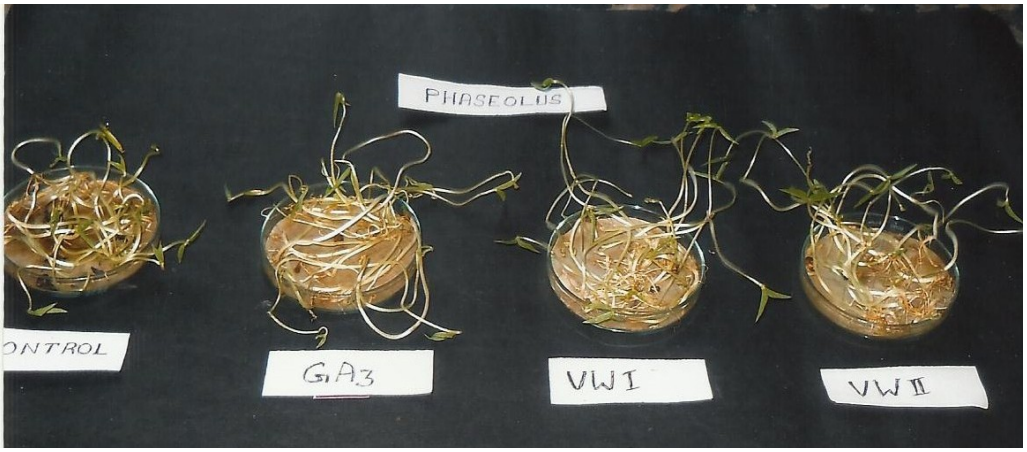
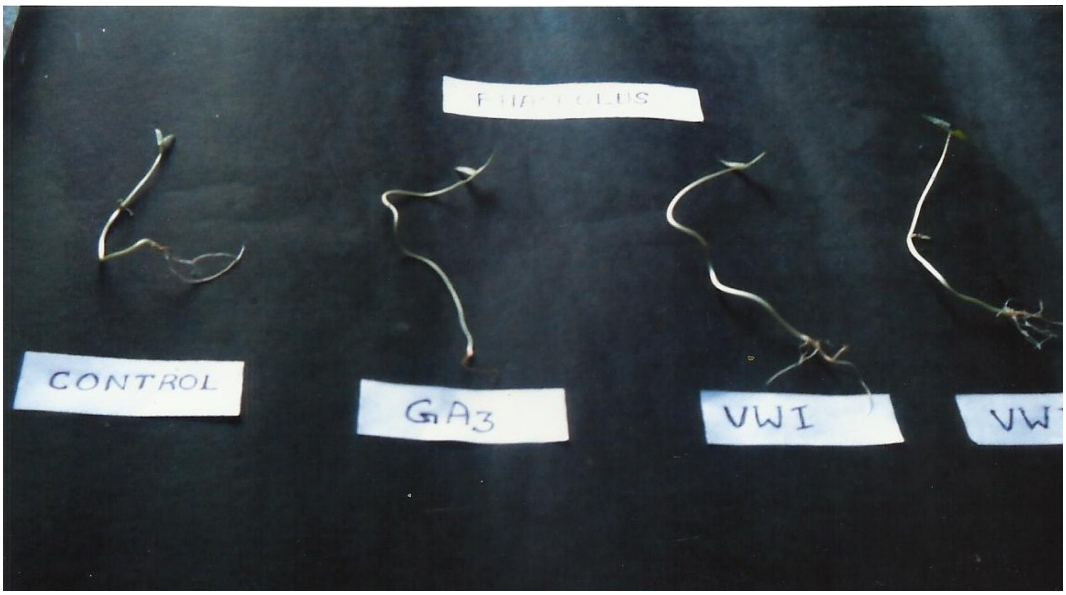


Plate.2 Showing the effect of vermiwash on the seedling characters of the experimental plants *Hibiscus sabdariffa*



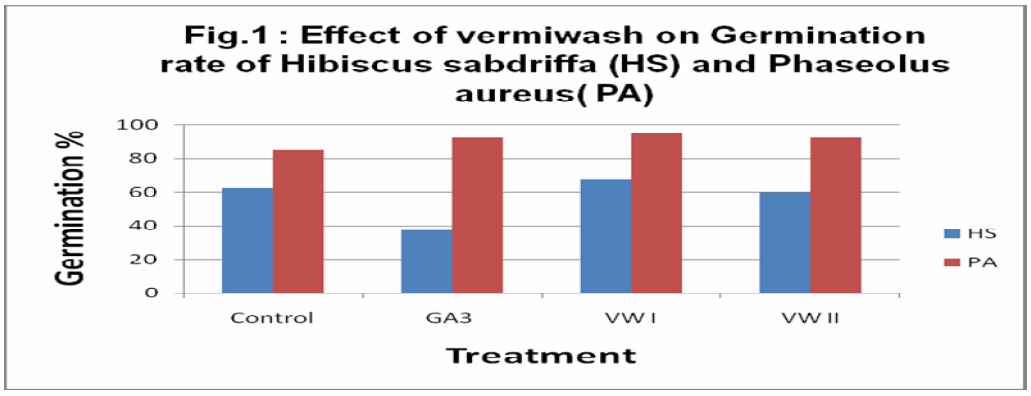


Table.1 Showing the various concentrations of vermiwash and plant growth regulators (PGRs) used for the study

S. No	Treatment	PGRS Used	Concentration
1.	Control	-	100ml distilled water
2.	Gibberellicacid (100 µg/ml)	GA_3	GA 10 + 90ml
3.	Vermiwash-I (10%)	Vermiwash-I	10 ml vermiwash + 90 ml distilled water
4.	Vermiwash-II (20%)	Vermiwash-II	20 ml vermiwash + 80ml distilled water

Table.2 Effect of Vermiwash on Seedling characters

S.No.	Treatment	Root Length (cm) ± SE		Hypocotyl length (cm) ± SE	
		H.sabdariffa	*P.aureus*	*H.sabdariffa*	*P.aureus*
1	Control	3.04 ±0.11	4.3± 0.61	7.52 ± 0.37	11.94 ± 0.53
2	GA3	3.32 ±0 .34	4.88 ± 0.40	9.78 ±0.17	16.58 ± 1.36
3	Vermiwash I	4.58 ± 0.16	6.56 ± 1.26	9.38 ± 0.34	17.36 ± 0.5
4	Vermiwash II	3.8 ± 0.12	5.98 ± 0.64	9.22 ± 0.35	18.14 ± 0.91

Germination Percentage

The germination percentage was determined for the control, GA, Vw I and Vw II. It was found to be maximum in seeds that were treated with Vw I and was minimum in the control (for both the investigated plants viz. *Phaseolus aureus* and *Hibiscus sabdariffa*). The GA treated seeds had a moderate percentage of germination (Plate 1,and Fig-1).and those treated with Vermiwash II showed a germination percentage that was a higher than that of GA but lesser than that of the control.

The results obtained in the present study are in accordance with the earlier reports by Lalitha et al (2000) in *Abelmoschus esculentus*.

Seedling Characters

The seeding characters observed were hypocotyl length and radical length. Hypocotyl length was observed to be maximum in Vermiwash- II followed by Vermiwash- I then GA and minimum in control plants in both the experimental materials. The extent of response was high for *Phaseolus aureus* when compared to *Hibiscus sabdariffa*.

Radical length was maximum in Vermiwash- I followed by Vermiwash- II, then GA and minimum in control plants. (Plate 2, Table 2)

The above results are in accordance with the observations of Adil Ansari and Kumar Sukhraj (2010), Lalitha *et al*., (2000) and Ansari (2008 a and b)

The present study that has been conducted on two vegetable crop plants to determine the potential of Vermiwash in bringing about seed germination and seedling growth in comparison with a growth promoter like Gibberellic acid has revealed that Vermiwash at a higher dilution is able to bring about increased germination rate and enhanced seedling growth in both the plants studied. The degree of response of the two plants has varied and this could be attributed to the physiology of the plants under consideration and the concentration of vermiwash needs to be standardized to suit the plant to which it is applied. The results obtained in the present study have corroborated the results of Shivasubramanian and Ganeshumar (2004) on marigold and those of Lalitha et al (2000) and Anari and Sukhraj (2010) on Okra.

These effects can be attributed to the biofertiliser capability of vermiwash as it possesses growth promoting effects and so it is able to mimic Gibberellic acid and in

fact the present study shows that it has produced an effect that is better than gibberellic acid in Phaseolus vugaris at lower concentration (10%). This shows that vermiwash can be used as a potent biofertiliser to improve the germination and seedling survival rates in crop plants growing on nutrition depleted soils thus paving the way for sutainable agriculture using organic farming practices.

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