



EFFECTS OF VERMIWASH ON SEED GERMINATION AND SEEDLING GROWTH IN CATHARANTHUS ROSEUS – A POTENT BIOFERTILIZER

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ABSTRACT:

Catharanthus roseus (Linn.) G. Don is an important medicinal plant belongs to the Apocynaceae family grows wild in the Indian subcontinent in Southern Asia. Improvement of seed germination may enable commercial propagation of this plant. The experiment was carried out to study the effect of vermiwash on seed germination and seedling vigour of *Catharanthus roseus* during the two seasons of 2014–2015 and 2015–2016. Data based on various parameters like germination (%), root / shoot (R/S) ratio, Vigour Index (VI) was observed. The highest seed germination percentage, seedling characteristics (shoot length, root length), VI were obtained from treatment of soil with 80% vermiwash could be effective and hence used directly in soil for seed germination and seedling growth improvements in *Catharanthus roseus*.

Keywords: *Catharanthus roseus*, vermiwash, germination (%), Vigour Index, seedling growth.

INTRODUCTION:

Herbal medicine also known as phytomedicine because of using plant seeds, flowers, roots for medicinal purpose and play an important role in drug discovery. Popularity of herbal drugs is increasing all over day by day in the world because of their lesser side effects as compared to synthetic drugs (Rout and Ghadai, 2012). Medicinal and aromatic plants are known to be used by 80% of global population for their medicinal therapeutic effects (WHO, 2008).

Catharanthus roseus is an important medicinal evergreen herb of the family apocynaceae and generally known as Vincarosea. The plant is also found abundantly grown in the home gardens. Despite having common look it has very powerful medicinal properties which are due to the alkaloids present in it. Out of the several alkaloids found in it Vincristine and Vinblastine are commonly used in cancer therapy whereas ajmalicine and serpentine are used as antihypertensive and sedative compound (Gaines, 2004). *Catharanthus roseus* is an Indian originated herb which grows wild in the subcontinent in Southern Asia (Asheesh Kumar et

al., 2012). This species was selected for the present study because it has high medicinal value. Seed germination and early seedling growth are considered the most critical phases for establishment of any species and hence, it is commonly emphasized that tolerance of seeds to various stresses during germination should be maintained. The propagation of *Catharanthus roseus* generally occurs through seeds and can be grow in sandy, loamy soil rich in organic matter is good for its growth and yield.

There are several organic fertilizers in the form of Vermicompost and Farm yard manure that have been applied producing phenomenal increase in yield and quality. Recently the use of Liquid fertilizers given in the form of foliar sprays has gained tremendous importance. The advantages of using the liquid fertilizer, has increased the need for the production of several such materials & to be used as foliar sprays. Vermiwash in a liquid fertilizer used in organic agriculture both as replacement and supplement for solids and for their unique capacity to provide effective and quick nutrients. Vermiwash (VW), generally used as a

foliar spray, is a liquid biofertilizer collected by the passage of water through a column of worm activation. In recent years many studies have reported that vermiwash as foliar spray which was effective for growth. There are reports by Lalitha et.al. (2000), Zambare *et al.* (2007), Ansari and Ismail (2001) and Shiva Subramanian and Ganeshwar (2004) for the effectiveness of vermiwash as a biofertiliser helping in organic farming. Very scanty work is done on this aspect in *Catharanthus roseus*. In view, of the above, the present investigation conducted with an objective to assess the improvement of seed germination in *Catharanthus roseus*.

METHOD AND MATERIAL:

Collection of experimental material:

Seed germination was studied in pot under favourable atmospheric condition. Seeds of *Catharanthus roseus* were collected from local garden of Gadchiroli, India for germination studies and stored for a month in air tight plastic bags with BHC powder to protect them from insects and other infections at room temperature until used for experiment.

Preparation of Vermiwash:

About 1 litre of vermiwash was produced by the action of Earthworm (*Perionyx excavates*) was collected from Wakdi nursery, Gadchiroli, (M.S.), India for the experiment. Aqueous solution of various concentrations of Vermiwash (20%, 40%, 60%, 80%, 100%) was prepared. Control (water) was also maintained in parallel with treated material.

Germination studies:

To study the effect of vermiwash on germination of the seeds, thirty seeds were sown in each small pot containing field soil and treatments were given as per (Table-1) viz. field soil + 20% vermiwash, field soil + 40% vermiwash, field soil + 60% vermiwash, field soil + 80% vermiwash, field soil + 100% vermiwash (vw), field soil + water as Control.

The soil analysis of different soil compositions used under present study was carried out at Agricultural Science Centre, Soil Testing Laboratory, Sonapur,

District – Gadchiroli, Maharashtra, India (Table-2). Three pots were maintained for each treatment. The effect of the vermiwash treatment on seed germination of *Catharanthus roseus* was studied by treating the seeds with water in field soil for one set which served as the control, for other sets, seeds were treated with various vermiwash concentrations depending upon the moisture condition of soil. Seeds were observed daily for the emergence of radical. The observations were done for 30 day. After 30 day of setting the experiment, seed germination percentage, root and shoot length of seedlings were recorded.

Statistical Analyses:

The results obtained were statistically analyzed according to the equation of ISTA.

Germination Percentage = (No. of germinated seeds)/(Total No.of seeds sown) x100

The seedling vigour index (VI) was calculated according to Abdul-Baki and Anderson (1973) following formula:

VI = percentage of germination X seedling length (cm)

Where, seedling lengths are the sum of root and shoot length.

The mean values of data obtained from six replicates during the both years and statistically analyzed by One Way ANOVA as suggested by Gomez and Gomez (1984).

RESULT AND DISCUSSION:

The various aspects of study viz-germination percentage, Root/Shoot ratio, root length, shoot length, Vigour Index (VI), Germination Value (GV) were done in soil with vermiwash grown seeds of *Catharanthus roseus*. Studies on germination were done to determine how vermiwash affects the germination rate and brings about enhancement of seedling growth. Seed germination results of *Catharanthus roseus* in soil conditions with vermiwash (Table-1) shows that the 1st and 2nd season seeds exhibited 100% seed germination in soil + 80% vermiwash (T4) and soil + 100% vermiwash (T5). 93.34%, 96.66%, and 86.67%, 96.66% were also noticed in seeds sown with soil + 20% vermiwash (T1) and soil + 40% vermiwash (T2).

The soil + 60 % vermiwash (T3), treated seeds had a 76.67% and 80.00% of germination. The minimum germination percentages 56.67% and 60.00% were recorded in control (T0) respectively. Fathima and Malathy (2014) observed that vermiwash along with GA3 resulted higher seed germination and seedling growth in *Hibiscus sabdariffa* and *Phaseolus vulgaris*. In addition to this, Lalitha et.al. (2000) also given earlier reports on productivity and growth in *Abelmoschus esculentus*. Joshi and Vig (2010) reported the positive effects of 15% vermiwash on germination percentage was found to be best and significantly enhanced the yield and quality of *Lycopersicum esculentum* (L.).

Seedling Growth Characters:

The seedling characters observed were root length and shoot length. The results showed that, root length was observed to be maximum 7.98 cm and 7.85 cm in seeds sown with soil + 80% vermiwash (T4) while, the minimum root length 4.41 cm and 4.38 cm were recorded in soil + 20 % vermiwash (T1) as compared to 5.07 cm and 5.13 cm. in control (T0) respectively in the 2nd and 1st season. These results clearly indicate that vermiwash can be exploited as a potent biofertilizer and foliar spray. However Kaur *et al.* (2015) recorded the maximum root length and plant biomass in *Abelmoschus esculentus* after using 15% vermiwash similarly Varghese and Prabha (2014) who reported that vermiwash treated *Capsicum frutescens* showed increased root, shoot length and number of leaves after 30 days than the vermiwash untreated plants. It was also found that Mujeera Fathima and Malathy Sekar (2014) conducted a study to evaluated the growth promoting effect of 10 % and 20 % vermiwash was effective in bringing about seed germination and seedling growth in *Hibiscus sabdariffa* and *Phaseolus vulgaris*. The results obtained in the present study are in accordance with the earlier observations of Adil Ansari and Kumar Sukhraj (2010), Lalitha *et al.* (2000) and Ansari (2008 a and b).

The results showed maximum shoot length (4.29cm, 4.24cm) while, minimum shoot length (3.52 and 3.49cm) were observed in seeds sown with soil + 80% vermiwash (T4) and soil + water in control (T0), respectively in 2nd and 1st season. It was also observed that Sundararasu *et al.* (2014) conducted a study to evaluate the effect of vermiwash on growth and productivity of brinjal plants.

The maximum R/S ratio 2.043cm and 2.053 cm was observed in soil + 80 % vermiwash (T4) as compared to other treatments while minimum R/S ratio 1.202cm and 1.194 cm was recorded in soil + 20% vermiwash (T1), as compared to control (T0) during 1st and 2nd season.

The maximum VI (1261.9cm) and minimum VI (431.4cm) was recorded in seeds with soil + 60 % vermiwash (T3) and soil + water in control (T0) while, 1227cm was recorded in seeds with soil + 80% vermiwash (T4) and 519 cm in seeds with soil + water as control (T0) respectively, in the 1st and 2nd season. Furthermore, from above observations the maximum GV (22.42cm, 22.41cm) and minimum GV (6.25cm, 6.25cm) were observed in soil +20%, 40% vermiwash and soil + 80 %, 100% vermiwash respectively, in the 1st and 2nd season.

The results of soil testing in Table-2 indicate the variation in soil parameter viz. EC (dsm-1), Organic carbon, Nitrogen, Phosphate and Potassium with various concentrations of vermiwash. The germination percentage, R/S ratio and VI varied in different soil types. The data were significant at 95% probability level.

CONCLUSION:

Amongst all concentrations 80% vermiwash gave better response for seed germination, root length, shoot length, R/S ratio during 1st and 2nd season. Vigour index (VI) increases in 2nd season. 40% vermiwash gave better response to germination value (GV) during both the seasons. Hence the findings of the present study concluded that, vermiwash can be used as a powerful biofertilizer to

improve the germination and seedling growth rates in *Catharanthus roseus*.

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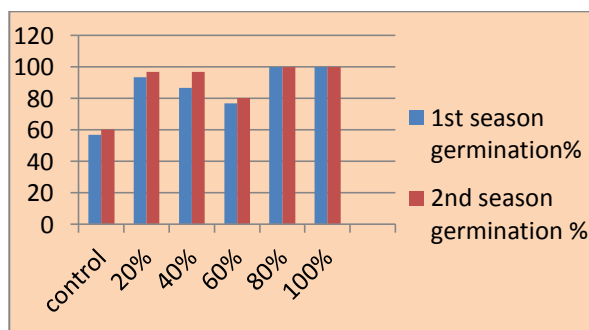


Figure-(1&2) showing seed germination improvement in diff Figure- (3&4) showing growth of 30 days old seedlings and showing length of root and shoot.

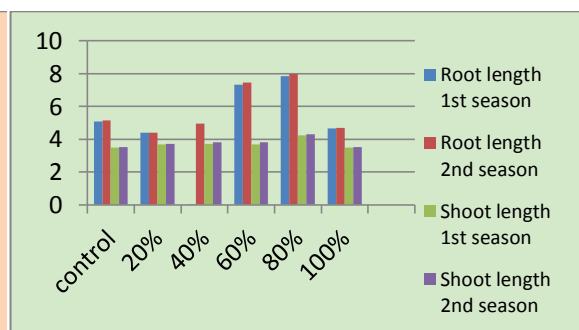
Table-1: Effects of different concentrations of vermiwash on seed germination and seedling growth in *Catharanthus roseus*

Sr. No.	Treatments	Vermiwash Concentration (%)	Germination (%)		Root Length (cm)		Shoot Length (cm)		R/S Ratio		VI	
			1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd
1.	T0	Control	56.67	60.00	5.07	5.13	3.49	3.52	1.454	1.459	431.469	519
2.	T1	S+20%vw	93.34	96.66	4.38	4.41	3.68	3.72	1.202	1.194	752.320	785.84
3.	T2	S+40%vw	86.67	96.66	4.78	4.95	3.72	3.81	1.284	1.302	736.695	844.330
4.	T3	S+60%vw	76.67	80.00	7.31	7.44	3.69	3.8	1.994	1.967	1261.921	899.2
5.	T4	S+80%vw	100	100	7.85	7.98	4.24	4.29	2.043	2.053	1205.000	1227
6.	T5	S+100%vw	100	100	4.65	4.69	3.49	3.53	1.336	1.333	579.000	822
		CD	0.010256*	0.00001*	0.00001*	0.00001*	0.02802*	0.009926*	0.00001*	0.00001*	0.00001*	0.00001*

S=soil, vw= vermiwash, R/S ratio= Root/Shoot ratio, VI=Vigour Index, * = Significant at (P<0.05) Level, ns= non-significant



Vermiwash Concentration (%)
Fig-5:Effect of vermiwash on seed germination



Vermiwash Concentration (%)
Fig-6: Effect of vermiwash on root and shoot length (cm) of *C. roseus*

Table 2. Physiochemical characteristics of vermiwash treated soil used in the study.

Sr. No.	Treatments	Soil	PH	EC (dsm ⁻¹)	Organic carbon	Nitrogen	Phosphate	Potash
1	T0	Control	6.3	0.25	0.87	304	75.96	274.4
2	T1	S+20%vw	8.7	0.35	0.96	324	45.58	266.1
3	T2	S+40%vw	6.6	0.53	0.80	290	78.65	271.6
4	T3	S+60%vw	8.6	0.36	0.89	309	63.45	270.2
5	T4	S+80%vw	8.5	0.42	1.50	438	89.37	274.4
6	T5	S+100%vw	6.6	0.41	1.07	347	55.41	267.4

EC = Electrical Conductivity, S= Soil Sample, VW= Vermiwash