



EFFECTS OF VERMIWASH ON SEED GERMINATION AND SEEDLING VIGOUR IN VARIETY OF WITHANIA SOMNIFERA (L.) DUNAL

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ABSTRACT

The Present article deals with an evaluation of its seed germination behaviour and seedlings growth performance during the two seasons of 2014-2015 and 2015-2016. Data on various parameters such as seed germination percentage, root/shoot (R/S) ratio, vigor index (VI) were observed. Maximum germination percentage (%), Seedlings shoot length and vigor index were obtained when seeds were sown in field soil with 80% vermiwash. Thus, the result of the present study clearly suggest that 80% vermiwash could be used directly in soil for improvement in seed germination and seedling growth.

Keywords: Withania somnifera, seed germination, vigor index, seedling growth.

I. INTRODUCTION

Ashwagandha [*Withania somnifera* (L.) Dunal] is an important medicinal plant, has been used for centuries in ancient Hindu system of medicine 'Ayurveda' to increase longevity and vitality. *Withania somnifera* belongs to Solanaceae family as a small woody shrub or herb that grows usually 30 to 50 cm height (Maximum of 150cm). It is a subtropical plant of great value, which plays an important role in health improvement around the world.

Ashwagandha grows primarily in Madhya Pradesh, Rajasthan, Punjab, Uttar Pradesh, Haryana, Gujarat, Karnataka and Maharashtra among which Madhya Pradesh alone is having more than 4000 ha. area (Mishra *et. al.* 1997).

According to the estimate the annual requirement of the drug in India is about 9127.5 tons for exceeds the annual production of about 5905.1 tons under cultivation. *W.somnifera* has been identified by the National Medicinal Plant Board of India as one of the thirty two selected priority medicinal plants, which are in great demand in the domestic and international markets (Prajapati *et. al.* 2003.) A large no of withanolides have been identified in *Withania* roots and leaves (Glatter *et. al.* 1973). The study of seed germination is a fundamental concept for understanding the growth & development of plants. Traditionally *W. Somnifera* is propagated from seeds but the germination is very slow (Vakeswaran *et. al.* 2003). There may be possibility of dormancy in the seeds that prevent germination immediately. Different report on this species suggests that germination percentage can be improved by the application of presowing chemical treatment (Kattimani *et. al.* 1999). Hot water soaking (80°C for 5 min) resulted highest seed germination percentage in *Rauvolfia serpentine* (Bhuyar *et. al.* 2000). 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 which was effective for growth. Different doses of vermiwash and vermicompost were used to study their effects on the growth and flowering of *Zinnia*. sp. Vermiwash treatment elevated the levels of total macronutrients (N,P,K and C) and micronutrient (Fe, Cu, Mg, and Zn). Very scanty work is done on this aspect in *Withania*. Due to over exploitation, the species is now widespread to high market demand. Hence appropriate agrotechnology needs to be developed for wider cultivation of the species. Taking into consideration all this it is intended to undertake the present investigation with an objective increase seed germination and vigour index (VI) by use of various concentrations of vermiwash.

I. METHODS AND MATERIAL

The seeds of *Withania somnifera* (L.) Dunal variety Jawahar Asgand-20 (JA-20) were collected from AICRP, MAP unit, College of Horticulture, RVSKVV, Mandasaur (M.P.) during the two seasons of mid June to August 2014-2015, 2015-2016 and kept in air tight plastic bags with BHC and Bavistin powder to protect them from insects and other infections at room temperature for a maximum period of fortnight until used for experiment. Aqueous solution of various concentrations of vermiwash i.e. 20%, 40%, 60%, 80%, 100% was prepared separately, control was also maintained in parallel with treated material. Thirty seeds were sown in the small pots of root trainer containing field soil viz. field soil + 20% vermiwash, field soil + 40% vermiwash, field soil + 60% vermiwash, field soil + 80% vermiwash, field soil + 100% vermiwash (vw). 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. There were three replicates for each set, all sown seeds were irrigated regularly with various concentration of vermiwash depending upon the moisture condition of soil. Seeds were observed daily for the emergence of radical. The observations were done for 30 days. After 30 days of setting the experiment, seed germination percentage and root and shoot lengths of seedling were recorded. Seed germination percentage was calculated according to the equation of ISTA :

$$\text{Germination percentage} = \frac{\text{No. of germinated seeds}}{\text{Total No. of seeds sown}} \times 100$$

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

$$\text{VI} = \text{percentage of germination} \times \text{seedling length (cm)}$$

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

The mean values of data obtained from six replicates during the both years for each parameter were executed using CRD design and statistically analyzed by One Way ANOVA as suggested by Gomez and Gomez (1984).

II. RESULT AND DISCUSSION

It is evident from data in Table-1 indicated that the maximum germination percentages (78.50 and 76.60 %) were noticed in seeds treated with field soil + 80% vermiwash (T4) and seed with field soil + 100% vermiwash (T5) which gave 75.40% and 73.30 % in 1st and 2nd seasons, respectively. On the contrary, the minimum germination percentages 42% and 40% were recorded in control (T0) and seeds with field soil + 20% vermiwash showed 49% and 46 % germination (T1) in 1st and 2nd seasons, respectively. Fathima and Malathy (2014) reported that vermiwash along with gibberellic acid was used to bring about seed germination and seedling growth in *Hibiscus sabdariffa* and *Phaseolus vulgaris*. The result showed that the maximum length for shoot in seedlings (6.64

and 6.46 cm) were observed in seeds with field soil + 80% vermiwash (T4), 6.38 and 6.31 cm in seeds with field soil + 40% vermiwash (T3). While, minimum length for shoot in seedlings (4.216 and 4.012 cm) were observed in control (T0), respectively, in 1st and 2nd season. Elumalai *et. al.*, (2013) reported that 15% vermiwash exhibited better growth promoting effects on *Abelmoschus esculentus*. However, Varghese and Prabha (2014) reported that vermiwash treated *Capsicum frutescens* showed increased root, shoot length and no. of leaves after 30 days than the vermiwash untreated plants. Furthermore, Samadhiya *et al.*, (2013) studied the effect of vermiwash on the growth and development of leaves and stem of tomato plants.

The maximum length for root in seedling (10.598 and 10.498 cm) were recorded in seeds with field soil + 20% vermiwash (T1), 7.8 and 7.6 cm in seeds with field soil + 80% vermiwash (T4). While, minimum length for root in seedling (5.773 and 5.225 cm) were observed with control (T0), respectively, in 1st and 2nd season. Hatti *et al.*, (2010) reported that the seedlings of *Vigna Munga*, *Vigna radiate*, *Sesamum indicum*

resulted in increase of growth parameters like the root length, shoot length, no. of twigs and leaves and total biomass of the plant after spraying the vermiwash of *Perionyx excavate*. Sundararasu *et.al.*, (2014) conducted a study to evaluated the effect of vermiwash on growth and productivity of brinjal plants. The highest R/S ratio (1.369 cm) was observed in control (T0) during 1st season and (1.819 cm) during 2nd season with field soil + 20 % vermiwash (T1) as compared to other treatments, respectively. However, (1125.6 and 1076.9 cm) in seeds treated with field soil + 80% vermiwash (T4) while, the lowest seedling VI (419.53 and 369.5 cm) with control (T0) was recorded in the 1st and 2nd season.

The result of soil testing in Table-2 indicate the variation in soil parameter viz. pH, EC(dsm⁻¹), organic carbon, Nitrogen, Phosphate and Potassium with various concentrations of vermiwash, Germination, R/S ratio and VI varied in different soil types. The data were significant at 95% probability level, except shoot length in both seasons (1st and 2nd) and germination percentage in 2nd season seeds, which were non-significant.

Table 1. Effects of different concentrations of vermiwash on seed germination and seedling growth in *Withania somnifera* variety Jawahar Aagand-20

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	42.00	40.00	5.773	5.225	4.216	4.012	1.369	0.767	419.53	369.5
2	T1	S+20%vw	49.00	46.60	10.598	10.498	5.87	5.77	0.018	1.819	806.93	758.0
3	T2	S+40%vw	67.00	66.00	7.393	7.326	6.38	6.31	1.158	1.161	922.79	899.9
4	T3	S+60%vw	72.00	70.00	7.002	6.942	6.32	6.24	1.108	1.112	959.18	922.7
5	T4	S+80%vw	78.50	76.60	7.8	7.6	6.54	6.46	1.193	1.176	1125.69	1076.9
6	T5	S+100%vw	75.40	73.30	6.74	6.538	6.26	6.196	1.077	1.055	980.2	933.4
		CD	0.00001*	1.790 ^{ns}	0.0001*	0.0001*	0.2399 ^{ns}	0.3046 ^{ns}	0.00001*	0.0001*	0.0015*	0.0001*

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

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

Sr. No.	Treatments	Soil	pH	EC (ds m ⁻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

III. CONCLUSION

From the above data it may be concluded that the 80% vermiwash gave better response over control, and proves to be an effective fertilizer when added directly. Amongst all concentrations, field soil + 80 % vermiwash gave best response for seed germination and shoot length where field soil + 20 % vermiwash gave better response to root length. Vermiwash increases germination percentage from 20 % to 80% but over 80 % concentration, germination decreases during 1st and 2nd season. Hence 80% vermiwash increased germination percentage, shoot length and high vigour index.

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