



Seed Germination Improvement in Variety of *Withania* *Somnifera* (L.) Dunal

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ABSTRACT

Withania somnifera (L.) Dunal is an important medicinal crops in Ayurvedic and an indigenous medicine for over 3000 years in India. The field experiment was conducted at the research centre, area of college campus, Department of Botany, Dr. Ambedkar College, Chandrapur during kharif season of 2014-2015 and 2015-2016. The results revealed that maximum germination percentage (100%, 100%), Vigour index (1018.3, 1027.9 cm) and Germination value (154.48, 154.48 cm) were observed when seeds were sown in field soil with 100% vermiwash, 40% vermiwash was also beneficial for root and shoot length. Thus, the result of the present study clearly suggest that 100% vermiwash and 40% vermiwash could be used directly in soil in the near future for improvement in seed germination percentage, vigour index (VI), Germination value (GV) and seedling length.

Keywords: *Withania somnifera*, seed germination, vigour index, seedling growth.

I. INTRODUCTION

In Ayurveda, *Withania somnifera* (L.) Dunal a member of Family Solanaceae is a valued herb and as such was used and cultivated for centuries in India. It is also known as Ashwagandha ('smells like a horse'), is an important medicinal plant cultivated and primarily occupies north-western region of Madhya Pradesh about an area of 4000 ha in India (Nigam and Kandalkar 1995). It is a subtropical plant of great value, which plays an important role in health improvement around the world. It has been used for thousands of years and is still regarded as one of the most valuables ayurvedic medicinal plants. Studies indicate that *Withania somnifera* possesses anti-inflammatory, anti-tumor, anti-stress, anti-oxidant, immunomodulatory and rejuvenation properties (Archana and Namasivayam, 1999).

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 (Glottter et. al., 1973). Traditionally it 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). In order to improve the rates of germination and to facilitate farmers in adopting proper techniques, trials have been made to find out the best treatment on seed germination in this study by using vermiwash. 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). 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* variety (JA-134.) Due to over exploitation, the species is now widespread to high market demand. There is a need to increase the propagation by seeds. Hence, taking into consideration all this it is intended to undertake the present investigation with an objective increase seed germination, vigour index (VI) and germination value (GV) by use of various concentrations of vermiwash.

II. METHODS AND MATERIAL

The seeds of *Withania somnifera* (L.) Dunal variety Jawahar Asgand-134 (JA-134) were collected from AICRP, MAP unit, College of Horticulture, RVSKVV, Mandasur (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 seeds were sown and 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, root and shoot length 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 :
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 for each parameter were executed using CRD design and statistically analyzed by One Way ANOVA as suggested by Gomez and Gomez (1984).

III. RESULT AND DISCUSSION

Data presented in Table-1 shows that the 1st and 2nd season seeds of *Withania somnifera* variety Jawahar Asgand-134 (JA-134) exhibited 100% seed germination in soil + 100% vermiwash (T5). 72.00% and 74.44% germination were also noticed in seeds sown with soil + 80% vermiwash (T4). The minimum germination percentages 43.33% and 48.88% were recorded in control (T0) 41.10%, 45.53%. in seeds sown with soil + 60% vermiwash (T3), respectively in the 1st and 2nd season. Similarly, 42.22% were recorded in soil + 40% vermiwash in the 2nd season. Joshi and vig (2010) reported the positive effects of 15% vermiwash on germination percentage was found to be the best and significantly enhanced the yield and quality of *Lycopersicum esculentum* (L.) In addition, Fathima and Malathy (2014) observed that vermiwash along with gibberellic acid resulted in higher seed germination and seedling growth in *Hibiscus sabdariffa* and *Phaseolus vulgaris*. Very low germination percentage (25.55%, 28.88%) were recorded in soil + 20% vermiwash in the 1st and 2nd season. The results revealed that the maximum root length 10.009 and 10.034cm. were obtained in seeds sown with soil + 40% vermiwash (T2). While, the minimum root length (5.45, 5.766cm) and (5.8cm, 5.856cm) were recorded in control (T0) and seeds sown with soil + 100% vermiwash (T5), respectively in the 1st and 2nd season. Similarly Kaur et. al., (2015) recorded the maximum root length and plant biomass in *Abelmoschus esculentus* after using 15% vermiwash. These result clearly indicate that vermiwash can be exploited as a potent bio- fertilizer and foliar spray. 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. The result showed maximum shoot length (7.426 cm, 7.45cm) and (6.756cm, 6.776 cm) were observed in seeds sown with soil + 40% vermiwash (T2) and soil + 60% vermiwash (T3) while minimum shoot length (3.703, 4.036cm) and (4.383, 4.423cm) were observed in control (T0) and

seeds with soil + 100% vermiwash (T5), respectively in 1st and 2nd season. It was also found that Sundararasu et. al., (2014) conducted a study to evaluated the effect of vermiwash on growth and productivity of brinjal plants. The maximum R/S ratio 1.471 cm was observed in control (T0) during 1st season and 1.454 cm during 2nd season with soil + 80% vermiwash (T4) as compared to other treatments while the minimum R/S ratio (1.135) and (1.138cm) was recorded in soil + 60% vermiwash (T3). However, the maximum VI (1018.3, 1027.9cm) and minimum VI (363.474, 420.666cm) was recorded in seeds with soil + 100% vermiwash and soil + 20% Vermiwash in the 1st and 2nd season. Furthermore, the maximum GV (154.48 and 154.48cm) were observed in soil + 100% vermiwash while minimum GV (15.02 and

16.2cm) was recorded in soil + 20 % vermiwash respectively, 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 percentage, R/S ratio, VI and GV varied in different soil types. The data were significant at 95% probability level, except R/S ratio in 1st season and VI in 1st and 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 Asgand-134

Sr. No.	Treatment	Vermiwash Concentration (%)	Germination (%)		Root Length (cm)		Shoot Length (cm)		R/S Ratio		VI		GV	
			1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd
1	T0	Control	43.33	48.88	5.45	5.766	3.703	4.036	1.471	1.428	396.599	479.721	21.94	30.44
2	T1	S+20%vw	25.55	28.88	8.073	8.136	6.153	6.43	1.312	1.265	363.474	420.666	15.02	16.2
3	T2	S+40%vw	38.88	42.22	10.009	10.034	7.426	7.45	1.347	1.346	677.872	738.174	28.06	29.44
4	T3	S+60%vw	41.10	45.53	7.67	7.713	6.756	6.776	1.135	1.138	592.908	659.684	30.8	35.35
5	T4	S+80%vw	72.22	74.44	6.373	6.72	4.436	4.62	1.436	1.454	780.625	844.149	75.04	73.27
6	T5	S+100%vw	100.00	100.00	5.8	5.856	4.383	4.423	1.323	1.323	1018.3	1027.9	154.48	154.48
		CD	0.0018*	0.0005*	0.00001*	0.00001*	0.00001*	0.00001*	0.172 ^{ns}	0.00002*	0.0714 ^{ns}	0.0518 ^{ns}	0.0382*	0.0026*

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 (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

IV. CONCLUSION

From the above finding it may be summarized that soil + 100% vermiwash gave better results for seed germination, VI and GV over control. Amongst all concentrations, soil + 40% vermiwash gave best response for root length and shoot length during 1st and 2nd season. Hence, 100% vermiwash and 40% vermiwash proves to be an effective fertilizer when added directly with soil increased germination percentage (%), VI, GV, root length and shoot length.

V. REFERENCES

- [1]. Nigam K.B. and Kandalkar V.S., "Medicinal and Aromatic Plants." Adv. Hort, 1995.
- [2]. Joshi R. and Vig R., "Effect of vermicompost on Growth, Yield and Quality of Tomato (*Lycopersicum esculentum* L.)." African Journal of Basic and Applied Sciences, 2010.
- [3]. Kattimani K.N., Reddy Y.N. and Roa R.B, "Effect of pre-sowing seed treatment on germination, seedling emergence, seedling vigour and root yield of Ashwagandha (*Withania Somnifera* Dunal)," Seed Science and Technology, 1999.

- [4]. Prajapati N.D., Purohit S.S., Sharma A.K. and Kumar T.A., A Handbook of Medicinal Plants. - a complete source book, Aqarobios, 2003. Jodhpur, India.
- [5]. Glotter E, Kirson I, Abraham A and Lavie D, "Constituents of *Withania somnifera* Dun. XIII. The withanolides of chemotype. III. Tetrahedron", 1973.
- [6]. Archana A. and Namasivayam, "Antistressor effect of *Withania somnifera*." Journal of Ethnopharmacol, 1999.
- [7]. CIMAP. "Technical Manual for Entrepreneurship in Cultivation and Processing of Medicinal and Aromatic plants", Published Central Institute of Medicinal and Aromatic Plants, 2004. Lucknow, India.
- [8]. Annual Report, "Twenty Five Years of Research Medicinal and Aromatic Plants. 1975-2000. AICRP on Medicinal and Aromatic Plants JNKVV" College of Agriculture, Indore (M.P.), 2000.
- [9]. Annual Report, "Twenty Five Years of Research Medicinal and Aromatic Plants. 1975-2000. AICRP on Medicinal and Aromatic Plants JNKVV" College of Horticulture, Mandasaur (M.P.), 2000.
- [10]. Gomez K.A. and Gomez A.A., "Statistical Procedures for Agricultural Research, (2nd ed.) John Wiley & sons, 1984. New York. USA.
- [11]. Annual Report, "Cultivation of Some Commercially Important Medicinal Plants. National Medicinal Plant Board Ministry of Health and Family Welfare," Government of India. New Delhi.
- [12]. Abdul-Baki A.A. and Anderson J.D., "Vigour determination in soyabean seed by multiple criteria", Crop Science, 1973.
- [13]. ISTA, "International Rules for Seed Testing", Seed Science and Technology, 1999.
- [14]. Vakeswaran V., Krishnaswamy V., "Improvement in storability of Ashwagandha (*Withania somnifera*, Dunal) seeds through prestorage treatments by triggering their Physiological and Biological properties", Seed Technology, 2003.
- [15]. Fathima M. and Malathy S., "Studies on growth Promoting effects of Vermiwash on the germination of Vegetable Crops", International Journal of Current Microbiol. and Applied Sciences, 2014.
- [16]. Varghese S.M. and Prabha M.L., "Biochemical characterization of vermiwash and its Effects on growth of *Capsicum frutescens*", Malaya J. Biosciences, 2014.
- [17]. Sundararasu K. and Jeyasankar A., "Effect of vermiwash on growth and yield of brinjal, *Solanum melongena* (eggplant or aubergine)", Asian Journal of Science and Technology, 2014
- [18]. Kaur P., Bhardwaj M. and Babbar I., "Effect of vermicompost and vermiwash on growth of Vegetables", Research Journal of Animal, Veterinary and Fishery Sciences, 2015. Amritsar, Punjab, India.
- [19]. Ansari A. .A., "Effect of vermicompost and vermiwash on the productivity of spinach *Spinacia oleracea*, onion *Allium cepa* and potato *Solanum tuberosum*", World journal of Agricultural Sciences, 2008.