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Research Article

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Standardization of Organic Amendments on Yield of Ashwagandha (*Withania somnifera* L.)

Suresh, V.[1*], C. Ciba[1], P. Irene Vethamoni[2], R. Kousalya, R. Karthikkannan, R. Keerthana, R. Logesh, M. Lokesh Kumar and P. Poomari

[1]Assistant Professor (Hort.), [3]Students (Hort.)

RVS Padmavathy College of Horticulture, Sempatti, Dindigul, Tamil Nadu, India

[2]Professor (Hort.), Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

*Corresponding Author E-mail: sureshboss122@gmail.com

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ABSTRACT

The present investigations were carried out at RVS Padmavathy College of Horticulture, Sempatti during 2018-2019. The experiment was laid out in Factorial Randomized Block Design (FRBD) with a total of eight treatment combinations with three replications. The organic sources as soil application viz., FYM @ 25 t ha^{-1}, Vermicompost @ 2.5 t ha^{-1}, VAM @ 25 kg ha^{-1} and Phophobacteria @ 2 kg ha^{-1} and foliar application viz., Humic acid @ 0.3 per cent and Panchakavuya @ 3 per cent. The two way interactions between soil application and foliar nutrients had highly significant influence on fresh root yield, dry root yield, root length and root width. The treatment S_2F_1 (vermicompost @ 2.5 t ha^{-1} + humic acid @ 0.3 per cent) registered the highest fresh root yield (104.98 g plant^{-1}), fresh root yield (3.89 t $^{-1}$), dry root yield (72.40 g plant^{-1}), dry root yield (2.68 t ha^{-1}) root length (13.58 cm) and root width (1.12 cm).

Keywords: *Vermicompost, Humic acid yield and Ashwagandha.*

INTRODUCTION

Ashwagandha is generally known as 'Indian Ginseng' belongs to the family Solanaceae. It is found in wild state in the Mediterranean region of North Africa. In India it is mainly cultivated in Mandsaur district of Madhya Pradesh, adjoining villages of Kota district of Rajasthan and Karnataka. Ashwagandha roots and occasionally its leaf and seeds are used in ayurvedic and unani medicines preparations (Majumdar, 1955). The total alkaloid content present in roots is reported to vary between 0.13 to 0.31 per cent. Apart from roots, alkaloids have also been reported in leaves and berries (Sreerekha et al., 2004). The roots are prescribed in medicines for hiccup, several female disorders, bronchitis, rheumatism, dropsy and stomach, lung inflammation and skin diseases. They are mostly used for curing general and sexual disabilities. Roots are having anti-aging property (Savitha et al., 2009).

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In *Gloriosa superba*, Gupta et al. (2013) reported that the treatment vermicompost @ 4 t ha^{-1} +1/3 NPK at 120:50:75 kg ha^{-1} which has higher recorded value of plant height (144.96 cm), number of leaves plant (172.03), number of branches plant (4.35), number of flower plants (30.50), number of fruit plant (10.10) and seed yield (4.47 g). Denre Monas et al. (2014) reported that higher plant height, number of leaves per plant, leaf area, number of branches per plant, number of fruits per plant, fruit length, total chlorophyll content, reducing sugars and starch content were recorded by application of humic acid @ 0.05 per cent + zinc @ 0.05 per cent + boron @ 0.02 per cent in pepper. The integration of organic manures will lead to the buildup of soil fertility, increased in crop productivity with concomitant nutrient balances besides minimizing the pollution hazards.

MATERIALS AND METHODS

The field experiments were carried out at RVS Padmavathy College of Horticulture, Sempatti, Dindigul during 2018-2019. The experiment was laid out in Factorial Randomized Block Design (FRBD) with a total of eight treatment combinations with three replications. The data were subjected to statistics analysis as the method suggested by Panse and Sukhatme, 1985.

Treatment details

Factor I	Factor II
S_1 – FYM (25 t ha^{-1}) S_2 – Vermicompost (2.5 t ha^{-1}) S_3 – VAM (25 kg ha^{-1}) S_4 – Phosphobacteria (2 kg ha^{-1})	F_1 – Humic acid (0.3 per cent) F_2 – Panchakavuya (3 per cent)

Treatment combinations

S_1F_1	FYM (25 t ha^{-1}) + Humic acid (0.3 per cent)
S_1F_2	FYM (25 t ha^{-1}) + Panchakavuya (3 per cent)
S_2F_1	Vermicompost (2.5 t ha^{-1}) + Humic acid (0.3 per cent)
S_2F_2	Vermicompost (2.5 t ha^{-1}) + Panchakavuya (3 per cent)
S_3F_1	VAM (25 kg ha^{-1}) + Humic acid (0.3 per cent)
S_3F_2	VAM (25 kg ha^{-1}) + Panchakavuya (3 per cent)
S_4F_1	Phosphobacteria (2 kg ha^{-1}) + Humic acid (0.3 per cent)
S_4F_2	Phosphobacteria (2 kg ha^{-1}) + Panchakavuya (3 per cent)

RESULTS AND DISCUSSIONS

In the present study the organic amendments had a highly significant effect on fresh root yield (g plant^{-1}), fresh root yield (t ha^{-1}), dry root yield (g ha^{-1}), dry root yield (t ha^{-1}) root length (cm) and root width (cm) of ashwagandha (Table 1, 2 and 3).

Among the four different soil application the treatment S_2 (Vermicompost @ 2.5 t ha^{-1}) recorded highest fresh root yield (104.40 g plant^{-1}), fresh root yield (3.82 t ha^{-1}), dry root yield (71.17 g ha^{-1}), dry root yield (2.64 t ha^{-1}) root length (13.41 cm) and root width (1.10 cm) and it was followed by the treatment S_3 (VAM @ 25 kg ha^{-1}) respectively. The least fresh root yield (74.13 g plant^{-1}), fresh root yield (2.75 t ha^{-1}), dry root yield (51.13 g plant^{-1}), dry root yield (1.89 t ha^{-1}) root length (10.02 cm) and root width (0.77 cm) was registered in S_1 (FYM @ 25t ha^{-1}).

The two different foliar application revealed that the treatment F_1 (humic acid @ 0.3 per cent) registered the higher fresh root yield (86.87 g plant^{-1}), fresh root yield (3.22 t ha^{-1}), dry root yield (59.91 g ha^{-1}), dry root yield (2.22 t ha^{-1}) root length (11.54 cm) and root width (0.92 cm) while the treatment F_2 (panchagavya @ 3 per cent) recorded the least fresh root yield (84.56 g plant^{-1}), fresh root yield (3.13 t ha^{-1}), dry root yield (58.32 g ha^{-1}), dry root yield (2.16 t ha^{-1}) root length (11.33 cm) and root width (0.90 cm).

The two way interactions between soil application and foliar nutrients had highly significant influence on fresh root yield (g plant^{-1}), fresh root yield (t ha^{-1}), dry root yield (g plant^{-1}), dry root yield (t ha^{-1}), root length (cm) and dry root length (cm) of ashwagandha. The treatment S_2F_1 (vermicompost @ 2.5 t ha^{-1} + humic acid @ 0.3 per cent) registered the highest fresh root yield (104.98 g plant^{-1}), fresh root yield (3.89 t ha^{-1}), dry root yield (72.40 g ha^{-1}), dry root yield (2.68 t ha^{-1}) root length (13.58 cm) and root width (1.12 cm) respectively and it was followed by the treatment S_2F_2 (vermicompost @ 25 t ha^{-1} + Humic acid @ 0.3 per cent) with the fresh root yield (101.40 g plant^{-1}), fresh root yield (3.76 t ha^{-1}), dry root yield (69.93 g ha^{-1}), dry root yield (2.59 t ha^{-1}) root length (13.24 cm) and root width (1.08 cm) respectively. The lowest fresh root yield (73.04 g plant^{-1}), fresh root yield (2.71 t ha^{-1}), dry root yield (50.37 g ha^{-1}), dry root yield (1.87 t ha^{-1}) root length (9.97 cm) and root width (0.75 cm) was recorded in the treatment S_1F_2 (FYM @ 25 t ha^{-1}+ panchakavuya @ 3 per cent).

Among the different organic manures, vermicompost @ 2.5 t ha^{-1} + humic acid @ 0.3 per cent (S_2F_1) showed significantly higher fresh root yield, dry root yield, root length and root width. Vermicompost improve the soil physical condition and promotes organic matter, which in turn, produce organic acids, which inhibits particularly IAA oxidase enzyme, resulting in enhancing the promotive effect of auxin-IAA, which has direct effect on plant growth, herbage yield. In cucumber, Rauthan and Schnttzer (1981) proved that application of humic acid had improved the growth of foliage and roots by increased cell elongation and increased water uptake by increased plant roots as well as root systems and increased nutrients uptake, increased leaf surface area.

In the present study among the organic manures recorded significantly higher root length and root width. Among the different organic manures, vermicompost @ 2.5 t ha^{-1} + humic acid @ 0.3 % (S_2F_1) showed significantly higher root length and root width. vermicompost improve the soil physical condition and promotes organic matter, which in turn, produce organic acids, which inhibits particularly IAA oxidase enzyme, resulting in enhancing the promotive effect of auxin-IAA, which has direct effect on plant growth, herbage yield. In cucumber, Rauthan and Schnttzer (1981) proved that application of humic acid had improved the growth of foliage and roots by increased cell elongation and increased water uptake by increased plant roots as well as root systems and increased nutrients uptake.

Table 1: Effect of organic amendments on fresh root yield (g plant^{-1}) and fresh root yield (t ha^{-1}) of ashwagantha

Treatment	Fresh root yield (g plant^{-1})			Fresh root yield (t ha^{-1})		
	F_1	F_2	Mean (S)	F_1	F_2	Mean (S)
S_1	75.22	73.04	**74.13**	2.79	2.71	**2.75**
S_2	104.98	101.40	**103.19**	3.89	3.76	**3.82**
S_3	87.58	84.49	**86.03**	3.24	3.13	**3.19**
S_4	79.71	79.30	**79.51**	2.95	2.94	**2.94**
Mean (F)	**86.87**	**84.56**		**3.22**	**3.13**	
	SEd	**CD (0.05)**		**SEd**	**CD (0.05)**	
S	0.049	0.121		0.06	0.137	
F	0.026	0.061		0.005	0.01	
SF	0.062	0.149		0.05	0.11	

Table 2: Effect of organic amendments on dry root yield (g plant^{-1}) and dry root yield (t ha^{-1}) of ashwagantha

Treatments	Dry root yield (g plant^{-1})			Dry root yield (t ha^{-1})			
	F_1	F_2	Mean (S)	Treatments	F_1	F_2	Mean (S)
S_1	51.88	50.37	**51.13**	S_1	1.92	1.87	**1.89**
S_2	72.40	69.93	**71.17**	S_2	2.68	2.59	**2.64**
S_3	60.40	58.27	**59.33**	S_3	2.24	2.16	**2.20**
S_4	54.97	54.69	**54.83**	S_4	2.04	2.03	**2.03**
Mean (F)	**59.91**	**58.32**		**Mean (F)**	**2.22**	**2.16**	
	SEd	**CD (0.05)**			**SEd**	**CD (0.05)**	
S	1.37	2.75		**S**	0.0001	0.005	
F	0.09	0.19		**F**	0.0007	0.003	
SF	1.10	2.21		**SF**	0.0101	0.050	

Table 3: Effect of organic amendments on root length (cm) and root width (cm) of ashwagantha

Treatments	Root length (cm)			Root width (cm)			
	F_1	F_2	Mean (S)	Treatments	F_1	F_2	Mean (S)
S_1	10.06	9.97	**10.02**	S_1	0.79	0.75	**0.77**
S_2	13.58	13.24	**13.41**	S_2	1.12	1.08	**1.10**
S_3	11.94	11.63	**11.79**	S_3	0.94	0.95	**0.95**
S_4	10.57	10.48	**10.53**	S_4	0.82	0.81	**0.82**
Mean (F)	**11.54**	**11.33**		**Mean (F)**	**0.92**	**0.90**	
	SEd	**CD (0.05)**			**SEd**	**CD (0.05)**	
S	0.44	0.22		**S**	0.04	0.02	
F	0.40	0.20		**F**	0.04	0.02	
SF	0.45	0.22		**SF**	0.04	0.02	

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