International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(2): 155-157

Received: 14-01-2017
Accepted: 15-02-2017

SR Chaudhary
Department of Soil Science and Agricultural Chemistry, Anand Agricultural University, Anand, Gujarat, India

Jitendra Kumar
Director, ICAR - Directorate of Medicinal and Aromatic Plants Research, Boriavi, Anand, Gujarat, India

DG Chaudhary
Ph.D Scholar at Department of Soil Science and Agricultural Chemistry, Anand Agricultural University, Anand, India

RB Patel
Department of Soil Science and Agricultural Chemistry, Anand Agricultural University, Anand, Gujarat, India

Correspondence
SR Chaudhary
Department of Soil Science and Agricultural Chemistry, Anand Agricultural University, Anand, Gujarat, India

Study the effect of organic management on growth and yield parameter of ashwagandha {*Withania somnifera* (Linn.) Dunal}

SR Chaudhary, Jitendra Kumar, DG Chaudhary and RB Patel

Abstract
Indiscriminate use of inorganic fertilizers is deleterious to soil health. Application of organic manures helps to maintain soil microbial population, soil fertility as well as enhance the oil quality of Ashwagandha. Keeping in view, an experiment was conducted at the farm of ICAR - Directorate of Medicinal and Aromatic Plants Research, Lambhvel, Anand district (Gujarat), India during the period of August 2015 to May, 2016 to study the effect of organic management on growth and yield parameter of ashwagandha {*Withania somnifera* (Linn.) Dunal}. The experiment was laid out in split plot design in three replications. The experimental treatment comprised of different organic treatments as a main plot (M_1: FYM @ 15 t ha^{-1}, M_2: vermicompost @ 7.5 t ha^{-1} and M_3 : castor cake @ 2.5 t ha^{-1}) and four different bio-fertilizers treatments as a sub plot (S_1) control, (S_2) bio-fertilizers (*Azotobacter* + PSB; Seed treatment), (S_3) Jivamrut (3 Spray at 25, 50 and 75 DAS), (S_4) bio-fertilizers (*Azotobacter* + PSB, Seed treatment) + Jivamrut (3 Spray at 25, 50 and 75 DAS). In light of the results obtained from this investigation, it is indicated that among organics the application of castor cake @ 2.5 t ha^{-1} and in case of bio-fertilizer, treatment bio-fertilizer (*Azotobacter* + PSB) as a seed treatment + Jivamrut (3 Spray at 25, 50 and 75 DAS) to *kharif* Ashwagandha (cv. Jawahar ashgandh-20), produced higher growth and yield by maintaining soil health over rest of treatments.

Keywords: Ashwagandha, Bio-fertilizers, Castor cake, FYM, Vermicompost

1. Introduction
Ashwagandha (*Withania somnifera* L. Dunal) is one of the important medicinal plants and used in the traditional Indian medicine since ancient times. It belongs to the solanaceae family and is native to Indian subcontinent. The plant grows erect to a height of 35-75 cm having small green-coloured flowers and orange-red ripe fruit. Ashwagandha commonly called 'winter cherry' is a dry land medicinal crop, the roots of ashwagandha are the economic part of the plant and are used in the preparation of Ayurveda and Unani medicines. It is used for curing carbuncles in the indigenous system of medicine. The paste prepared out of its root is used for curing skin diseases, bronchitis and ulcers. The rasayanas apart from their use for promoting physical and mental health also provide defense against diseases and arest ageing process (Singh *et al*., 2001; Bhattacharya *et al*., 2002) [8, 1]. *W. somnifera* is used as dietary supplement and the decoction of its root is used as nutrient and health restorative to pregnant and old people. The roots are prescribed in medicines for hiccup, several female disorders, bronchitis, rheumatism, dropsy, and stomach and 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) [7]. The root bark is administered to patients of asthma and other chest complaints. The paste prepared out of its leaves is used for curing inflammation of tubercular glands, cure eye boils, and swellings of hands and feet, in treatment of syphilis, to kill the lice infecting the body. The green berries are used for treating ringworm.
The international market of medicinal plants is over US $ 60 billion per year, which is growing at the rate of 7 per cent per annum. The present export of herbal raw materials and medicines from India is about US $ 100-114 million per year mainly to USA, Germany, France, Switzerland, U.K. and Japan.
In worldwide market, ashwagandha has recently acquired considerable significance and having tremendous marketing potential owing to demand of its roots to the tune of 7000 tons and estimated production of 1500 tonnes (Umadevi *et al*., 2012) [10]. Ashwagandha found throughout the drier parts of India, Pakistan, Afghanistan, Sri Lanka, Congo,

South Africa and Egypt. Ashwaghandha is cultivated over an area of 15000 ha with a production of 60,000 tones and productivity of 4.00 q ha^{-1} in India.

Organic Farming is a production system that sustains the health of soils, ecosystems and people. The new approaches to the use of organic amendments in farming have proven to be effective means of improving soil structure, enhancing soil fertility and increasing crop yields and quality. Organic manures are plant and animal wastes that are used as sources of plant nutrients. They release nutrients after their decomposition.

2. Materials and Methods

2.1 Experimental site

A field experiment was carried out during the period of August 2015 to May, 2016 at the farm of ICAR - Directorate of Medicinal and Aromatic Plants Research, Lambhvel, Anand, Gujarat, India during the *Kharif* season of the year 2015. The climate of Anand region is semi - arid and subtropical with hot summer and cool winter and located at 22^0- 35' North altitude and 22^0-55' East longitude with an elevation of 45.1 meters above mean sea level. Monsoon generally commences in the third week of June and retreats by 15th September. Most of the rainfall is received from the south-west monsoon currents. July and August are the months of heavy rainfall. The average rainfall of this region is about 866 mm. Temperature during the rainy season ranges from 20^0 to 35 ^{0}C. Winter sets in the month of November and continues till the middle of February. December and January are the coldest month of the year. The temperature during the winter varies from 11^0 to 28^0C. The summer season usually commences during the second fortnight of February and ends by the month of June. April and May are the hottest months with the temperature rising as high as 43 ^{0}C and occasionally touching 45 ^{0}C.

2.2 Treatment and experimental detail

The treatment comprised of different organic treatments as a main plot (M_1: FYM @ 15 t ha^{-1}, M_2: vermin compost @ 7.5 t ha^{-1} and M_3 : castor cake @ 2.5 t ha^{-1}) and four different bio-fertilizers treatments as a sub plot (S_1) control, (S_2) bio-fertilizers (*Azotobacter* + PSB; Seed treatment), (S_3) Jivamrut (3 Spray at 25, 50 and 75 DAS), (S_4) biofertilizers (*Azotobacter* + PSB, Seed treatment) + Jivamrut (3 Spray at 25, 50 and 75 DAS). The experiment was laid out in split plot design in three replications.

The FYM was given before *kharif* season @ 15 t ha^{-1}, vermin compost @ 7.5 t ha^{-1} and castor cake @ 2.5 t ha^{-1} to main plot in the plough furrow. Bio-fertilizers *Azotobacter* and *phosphate solubilizing bacteria* were used for seed treatment and Jivamrut sprayed 3 times at 25, 50 and 75 DAS in sub plot. Field was regularly watered and weed free condition was maintained till 150 DAS. The observations like plant height, number of branches were taken at the time of 60 and 100 DAS and harvesting in accordance with the crop growth in plots.

2.3 Plant parameters

The observations like plant height, number of branches were taken at the time of 60 and 100 DAS and harvesting in accordance with the crop growth in plots. The fresh and a shed dry weight of roots, root girth and root length were recorded from each plot. When ashwagandha was at maturity stage (150 DAS), the plants were uprooted carefully. In all, there were three replications and total numbers of plots were thirty six (36).

2.5 Statistical analysis

All the data recorded during the study period were statistically analyzed as methods suggested by Steel and Torrie (1982) using Tukey's Studentized Range (HSD) test in SAS programme.

3. Results and Discussion

3.1 Growth and yield parameter

Plant height, number of branches (30, 60, 100 DAS and at harvest), root girth, root length, fresh root weight, dry root weight and root yield (fresh and dry) of ashwagandha were significantly affected by the treatment of different organic manures and these were rewarded significantly higher under application of castor cake @ 2.5 t ha^{-1} and was at par with treatment of vermicompost @ 7.5 t ha^{-1}. The application of castor cake reported higher growth and yield might be due to might be due to quick supply of nutrient to plant at initially so better root development as compare to FYM and vermicompost, moreover P is important for root development which made available through castor cake which reported by Maji *et al*., (2010) [4], Patel *et al*., (2003) [6] and Vajantha *et al*., (2012) [11].

Growth and yield parameters viz., plant height, number of branches (30, 60, 100 DAS and at harvest), root girth, root length, fresh root weight, dry root weight and root yield fresh and dry) of ashwagandha were significantly affected due to different bio-fertilizers treatment and these were significantly higher under application of biofertilizer (*Azotobacter* + PSB) as a seed treatment + jivamrut (3 Spray at 25, 50 and 75 DAS) compared to rest of treatments because jivamrut stimulate native beneficial activity which improve the nutrient transformation. PSB improve availability of phosphorus which play a unique role in energy conservation and transfer the balanced supply of nitrogen throughout the life cycle of crop reduced leaf senescence and whose able to furnish the increased the assimilate demand of plant sink which resulted in higher growth and yield. These results were in close conformity with finding of Gajbhiye *et al*., (2010) [3], Mohapatra & Das (2009) [5] and Darzi *et al*., (2012) [2].

Table 1: Effect of different organic manures and bio-fertilizers on plant height, number of branches per plant and root growth of ashwagandha at different growth stages.

Treatments	Plant Height (cm)			Number of branches per plant			Growth Parameter	
[A] Main Plot	60 DAS	100 DAS	At harvest	60 DAS	100 DAS	At harvest	Root girth (mm)	Root length (cm)
M_1	^{b}9.94	^{b}27.84	^{b}41.95	^{b}2.75	^{b}5.63	^{b}11.22	^{b}8.52	^{b}18.29
M_2	^{ab}10.44	^{ab}29.53	^{ab}49.25	^{a}3.50	^{b}5.70	^{ab}13.69	^{b}8.28	^{ab}20.84
M_3	^{a}12.01	^{a}33.52	^{a}52.47	^{a}3.82	^{a}7.09	^{a}14.57	^{a}10.05	^{a}21.59
Tukey's HSD	2.04	5.51	8.41	0.72	1.25	2.54	1.42	3.04
CV %	13.03	12.50	12.08	14.83	14.08	13.29	10.96	10.34
[B] Sub Plot								
S_1	^{b}9.73	^{b}27.98	^{b}45.19	^{ab}3.54	^{b}5.59	^{b}9.90	^{b}8.14	^{b}18.12

S_2	[b] 10.13	[ab] 30.84	[ab] 48.78	[ab] 3.17	[ab] 6.32	[a] 13.49	[a] 9.53	[a] 21.12
S_3	[b] 10.77	[ab] 29.99	[ab] 45.56	[b] 3.11	[ab] 6.21	[a] 14.35	[b] 8.50	[ab] 19.98
S_4	[a] 12.57	[a] 32.37	[a] 52.01	[a] 3.60	[a] 6.46	[a] 14.89	[a] 9.63	[a] 21.75
Tukey's HSD	1.43	3.95	6.64	0.46	0.84	2.06	0.84	2.10
M × S	NS	NS	NS	NS	NS	NS	NS	NS
CV %	9.93	7.79	10.41	10.31	10.33	11.77	7.08	7.81

(M_1: FYM @ 15 t ha^{-1}, M_2: vermicompost @ 7.5 t ha^{-1} and M_3: castor cake @ 2.5 t ha^{-1}) (S_1) control, (S_2) bio-fertilizers (*Azotobacter* + PSB; Seed treatment), (S_3) Jivamrut (3 Spray at 25, 50 and 75 DAS), (S_4) bio-fertilizers (*Azotobacter* + PSB, Seed treatment) + Jivamrut (3 Spray at 25, 50 and 75 DAS).

Table 2: Effect of different organic manures and bio-fertilizers on root yield of ashwagandha

Treatments	**Yield character**			
[A] Main Plot	**Fresh root yield (kg ha^{-1})**	**Dry root yield (kg ha^{-1})**	**Fresh root yield plant^{-1} (g)**	**Dry root yield plant^{-1} (g)**
M_1	[b] 796.03	[b] 179.82	[b] 7.76	[a] 4.13
M_2	[ab] 912.93	[ab] 204.15	[ab] 8.93	[a] 4.32
M_3	[a] 941.44	[a] 214.65	[a] 9.87	[a] 5.04
Tukey's HSD	139.54	32.99	1.37	0.92
CV %	10.86	11.36	10.66	14.01
[B] Sub Plot				
S_1	[b] 805.46	[b] 181.34	[b] 7.95	[b] 4.15
S_2	[a] 908.02	[ab] 205.05	[a] 9.17	[ab] 4.75
S_3	[ab] 892.26	[ab] 199.36	[ab] 8.77	[ab] 4.27
S_4	[a] 928.12	[a] 212.42	[a] 9.52	[a] 4.83
Tukey's HSD	101.14	26.86	1.06	0.62
M × S	NS	NS	NS	NS
CV %	8.59	10.10	9.06	10.40

(M_1: FYM @ 15 t ha^{-1}, M_2: vermicompost @ 7.5 t ha^{-1} and M_3: castor cake @ 2.5 t ha^{-1}) (S_1) control, (S_2) bio-fertilizers (*Azotobacter* + PSB; Seed treatment), (S_3) Jivamrut (3 Spray at 25, 50 and 75 DAS), (S_4) bio-fertilizers (*Azotobacter* + PSB, Seed treatment) + Jivamrut (3 Spray at 25, 50 and 75 DAS).

4. Conclusion

In light of the results obtained from this investigation, it is indicated that among organics the application of castor cake @ 2.5 t ha^{-1} and in case of biofertilizer, treatment bio-fertilizer (*Azotobacter* + PSB) as a seed treatment + jivamrut (3 Spray at 25, 50 and 75 DAS) to *kharif* ashwagandha (cv. Jawahar ashgandh-20), produced higher growth and yield by maintaining soil health over rest of treatments.

5. Acknowledgements

I am sincerely thankful to Dr. Jitendra Kumar, Director, ICAR - Directorate of Medicinal and Aromatic Plants Research, Boriavi, Anand, for their valuable & sagacious guidance, and prudent admonitor rendered throughout the study. I am also thankful to Dr. K. B. Kathiria, Director of research & Dean PG Studies, Dr. K. P. Patel, Principal & Dean AAU, Anand for providing necessary facilities for undertaking the research work throughout the period of studies. I register my sincere thanks to my advisory committee members Dr. S. N. Shah, Dr. R. B. Patel, Dr. B. B. Basak and Dr. V. B. Darji.

6. References

1. Bhattacharya SK, Bhattacharya D, Sairam K, Ghosal S. Effect of *Withania somnifera* glycowithanolides on a rat model of tardive dyskinesia. *Phytomedecine*, 2002; 9:167-170.
2. Darzi Mohammad T, Farnaz S, Mohammadreza HSH. Influence of compost and biofertilizer on yield and essential oil of dil (*Anethum graveolens* L). International journal of Advanced Biological and Biochemical Research. 2012; 2(2):446-455.
3. Gajbhaiye RP, Deshmukh SB. Root production and seed yield of ashwagandha as influenced by organic manures and boifertilizers. Journal of Medicinal and Aromatic Plant Sciences. 2010; 32(4):358-361.
4. Maji Germinara D, Chiesa A. Effect of organic manures on senna. Spanish Journal of agricultural Research 2010; 1(2):103-107.
5. Mohapatra SC, Das TK. Integrated effect of bio-fertilizers and organic manures on turmeric (*Curcuma longa*). Environment and Ecology. 2009; 27(3)A:1444-1445.
6. Patel BS, Amin AU, Patel KP, Patel MM. Effect of organic manure alone or in combination with inorganic fertilizer on productivity of winter drilled fennel. Indian journal of Agronomy. 2003; 48(3):232-234.
7. Savitha Murthy M, Mamatha B, Shivananda TN. Phytochemistry and Medicinal uses of *Withania somnifera* (L.) *Biomed*. 2009; 4(2):123-129.
8. Singh B, Saxena AK, Chandan BK, Gupta DK, Bhutani KK, Anand KK. Adaptogenic activity of a novel withanolide-free aqueous fraction from the roots of Withania somnifera Dun. Phytother. Res. 2001; 15:311-318.
9. Steel GD, Torrie JH. Principles and procedures of statistics. Mc Graw Hill Book Co. Inc. New York, 1982.
10. Umadevi M, Rajeswari R, Sharmila RC, Selvavenkadesh S, Pushpa R, Sampath Kumar KP *et al*. Traditional and medicinal uses of Withania somnifera. Pharma Innov. 2012; 1(9):102-110.
11. Vajantha Harikrishna BL, Dasog GS, Patil PL. Effect of study the organic manures on ashwagandha. Karnataka J. Agric. Sci. 2012; 18(2):364-369.