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Effect of organic nutrient on yield and yield attributes of Ashwagandha (*Withania somnifera* (L.) Dunal)

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Abstract

The present investigation entitled “Effect of organic nutrient on yield and yield attributes of Ashwagandha. (*Withania somnifera* (L.) Dunal).” was carried out at Research Cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, during *rabi* season of 2017-2018. The experiment was laid out in split plot design with three replications. The whole treatments were divided into main plot i.e. flat bed, ridge and furrow method and sub plot i.e. control, FYM @10 t ha⁻¹, FYM @15 t ha⁻¹, Vermicompost @5 t ha⁻¹, Vermicompost @7.5 t ha⁻¹, Castor cake @1.5 t ha⁻¹, Castor cake @2.5 t ha⁻¹, RDF (NPK @40:60:20 kg ha⁻¹). Ashwagandha variety GAA-1 was sown on 30th October 2017 and harvested on 05th June 2018. Observation regarding different sowing methods, maximum dry matter accumulation, number of berries, fresh root yield, dry root yield and seed yield were recorded maximum with ridge and furrow sowing method as compared to flatbed sowing method while based on application of organic source of nutrients, maximum dry matter accumulation, number of berries, fresh root yield, dry root yield and seed yield were recorded maximum with application of FYM @15 t ha⁻¹ as compared to other organic source of nutrient and their levels for Ashwagandha crop. Ridge and furrow sowing method with FYM @15 t ha⁻¹ gave best results in terms of yield and its attributes of Ashwagandha.

Keywords: FYM, main plot, nutrient, ridge and furrow, yield

Introduction

Ashwagandha (*Withania somnifera* (L.) Dunal). is a small woody shrub or herb that grows or reaches about 30-150 cm in height belongs to the family Solanaceae. (Shravankumar and Datta (2014) [4]. The fruits or berries are smooth, spherical, red coloured with 6 mm diameter enclosed in an inflated and membranous calyx. (Nigam and kandalkar 1995) [1]. Organic manures are considered for producing good yield and quality produce by improving water penetration, capacity of water holding, soil structure improvement, microbial biomass, nutrient availability and resistance to drought and heat stress. The beneficial effect of organic manures on growth and yield of crops could be attributed to the fact that after proper decomposition and mineralization, the manures supply nutrients directly to the plants and also have solubilizing effect on fixed forms of nutrients in soil (Sinha *et al.* 1981) [3]. It also helps in improving the soil pH which has an impact on plant growth. The nutrient management in Ashwagandha may be one of the major strategies for increasing the yield of Ashwagandha. In addition, organic manures enhance a good root quality. So, it is necessary to find out a suitable recommendation for manuring in Ashwagandha cultivation, planting methods play an important role in contributing to the high yield. Therefore proper planting method is necessary for harvesting dry root yield, protect the plant under water logging situation during heavy rainfall.

Material and Methods

Description of materials used and methods adopted during the course of investigation in order to conduct the experiment and record scheduled observations, the present investigation entitled “Effect of organic nutrient on yield and yield attributes of Ashwagandha. (*Withania somnifera* (L.) Dunal)”. was carried out at Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) during Rabi 2017-18. The experiment was conducted at Herbal Garden Research cum Instructional farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) in mid-eastern part of

Chhattisgarh in the latitude at 21.16° North and 81.36° East of 289 meters above mean sea level having sub-tropical humid climate season. The whole treatments were divided into main plot i.e. flat bed, ridge and furrow method and sub plot i.e. control, FYM @10 t ha⁻¹, FYM @15 t ha⁻¹, Vermicompost @5 t ha⁻¹, Vermicompost @7.5 t ha⁻¹, Castor cake @1.5 t ha⁻¹, Castor cake @2.5 t ha⁻¹, RDF (NPK @40:60:20 kg ha⁻¹). The experiment was laid out in split plot design with three replications. The maximum temperature recorded was 42.9 °C during the period from 07th May to 13th May 2018 and minimum 9.5 °C during 24th December to 31st December 2017. The maximum relative humidity occurs 90% during 05th November to 11th November 2017 and minimum 15% during 26th March to 01st April 2018.

Dry matter accumulation (g plant⁻¹)

After recording the plant height and root length the sample plants were cut from collar region and separated into shoots and roots. Separated shoots and roots were sun dried, followed by drying in hot air oven at 60 °C for 48 hours to obtain constant dry weight. The samples were weighed on an electronic balance and then average biomass was calculated with respect to root biomass, shoot biomass, and dry matter accumulation in g plant⁻¹.

Number of berries plant⁻¹

Number of berries was counted at the time of harvest from five randomly selected plants in each plot and the average was worked out to get number of berries plant⁻¹.

Fresh root yield (kg ha⁻¹)

The fresh root was recorded at harvest by electronic balance

of 10 kg capacity and fresh root was converted in kg ha⁻¹

Dry root yield (kg ha⁻¹)

The dry root was recorded at harvest by electronic balance of 10 kg capacity and dry root was converted in kg ha⁻¹.

Seed yield (kg ha⁻¹)

After threshing and cleaning the weight of clean seeds from each plot was recorded in g at 14% moisture levels by using top pan balance. The readings were applied to the whole of the yield and converted into kg ha⁻¹.

Results and Discussion

Dry matter accumulation (g plant⁻¹)

The results revealed that the dry matter accumulation of Ashwagandha g plant⁻¹ was computed at 60, 90, 120 DAS and at harvest stage of plant growth and the data are presented in (Table 1). The dry matter accumulation was affected significantly due to different sowing methods. Among the observations it highest dry matter accumulation (42.79 g plant⁻¹) was recorded under ridge and furrow sowing method at 120 DAS whereas, lowest dry matter accumulation (39.50 g plant⁻¹) with flatbed sowing method at the same DAS of plant growth stage.

Dry matter accumulation of Ashwagandha was significantly influenced by organic sources of nutrients. Maximum dry matter accumulation (48.92 g plant⁻¹) was recorded under FYM @15 t ha⁻¹ at 120 DAS followed by application of FYM @10 t ha⁻¹ (43.67 g plant⁻¹) at the same DAS. The interaction effect between sowing methods and organic sources of nutrient for dry matter accumulation were found significant.

Table 1: Dry matter accumulation (g plant⁻¹) of Ashwagandha as influenced by sowing methods and organic sources of nutrients

Treatment	Dry matter accumulation (g plant ⁻¹)				
		60 DAS	90 DAS	120 DAS	At harvest
Main plot: Sowing methods (MS)					
M1: Flat bed method		10.38	17.75	27.97	39.50
M2: Ridge and furrow method		13.04	23.16	32.74	42.79
SEM±		0.04	0.44	0.23	0.45
CD (P= 0.05%)		0.22	2.67	1.37	2.71
Sub plot: Organic sources of nutrient (S)					
S1: Control		8.29	12.45	22.33	35.43
S2: FYM @10 t ha ⁻¹		13.89	22.90	34.90	43.67
S3: FYM @15 t ha ⁻¹		15.76	25.92	38.42	48.92
S4: Vermicompost @5 t ha ⁻¹		10.72	20.73	30.73	40.12
S5: Vermicompost @7.5 t ha ⁻¹		12.54	22.25	33.75	43.17
S6: Castor cake 1.5 t ha ⁻¹		9.07	17.84	25.67	37.91
S7: Castor cake 2.5 t ha ⁻¹		10.62	20.52	28.69	39.73
S8: RDF		11.82	21.04	31.37	40.21
SEM±		0.21	0.88	0.99	1.00
CD (P= 0.05%)		0.62	2.56	2.87	2.91
Interaction (MS× S)		S	S	S	S

Number of berries plant⁻¹

Number of berries plant⁻¹ of Ashwagandha was significantly influenced by different sowing methods. The maximum number of berries (374.55) was recorded in ridge and furrow sowing method and lowest (338.06) in flat bed sowing method this might be due to maximum photosynthates are translocated to sink.

The number of berries plant⁻¹ was significantly influenced by organic sources of nutrient. Number of berries plant⁻¹ was superior with the application of FYM @15 t ha⁻¹ (437.11) followed by application of FYM @10 t ha⁻¹ (395.01). The interaction effect between sowing methods and organic sources of nutrient for number of berries were found significant.

Table 2: Number of berries plant⁻¹ of Ashwagandha as influenced by sowing methods and organic sources of nutrients

Treatment	No. of berries plant ⁻¹				
Main plot: Sowing methods (MS)					
M1: Flat bed method			338.06		
M2: Ridge and furrow method			374.55		
SEm±			0.68		
CD (P= 0.05%)			4.12		
Sub plot: Organic sources of nutrient (S)					
S1: Control			247.53		
S2: FYM @10 t ha ⁻¹			395.01		
S3: FYM @15 t ha ⁻¹			437.11		
S4: Vermicompost @5 t ha ⁻¹			349.54		
S5: Vermicompost @7.5 t ha ⁻¹			386.99		
S6: Castor cake 1.5 t ha ⁻¹			326.49		
S7: Castor cake 2.5 t ha ⁻¹			340.97		
S8: RDF			366.80		
SEm±			1.80		
CD (P= 0.05%)			5.22		
Interaction (MS× S)			S		

Fresh root yield (kg ha⁻¹)

The data recorded of fresh root yield of Ashwagandha, the different sowing methods produced significantly higher fresh root yield of Ashwagandha. The fresh root yield of Ashwagandha was recorded at harvest stage. Among the sowing methods, ridge and furrow sowing method produced highest (1885.56 kg ha⁻¹) fresh root yield. The difference between flat bed and ridge and furrow method was found significant. Among different organic sources of nutrient,

higher fresh root yield (2360.11 kg ha⁻¹) was obtained with application of FYM @15 t ha⁻¹. The interaction effect between sowing methods and organic sources of nutrient were found significant. This might be due to higher number of root length, root diameter and other growth and yield attributing character. Paturde *et al.* (2002) [2] stated that the number of tubers, fresh and dry tuber yield of safed musli were significant increased with the application of organic manures such as farm yard manure and vermicompost.

Table 3: Root and seed yield of Ashwagandha as influenced by sowing methods and organic sources of nutrients

Treatment	Fresh root yield	Dry root yield	Seed yield
	Kg ha ⁻¹	Kg ha ⁻¹	Kg ha ⁻¹
Main plot: Sowing methods (MS)			
M1: Flat bed method	1690.41	485.94	151.96
M2: Ridge and furrow method	1885.56	559.85	174.82
SEm±	13.66	1.60	1.09
CD (P= 0.05%)	83.10	9.72	6.62
Sub plot: Organic sources of nutrient (S)			
S1: Control	901.18	262.62	124.81
S2: FYM @10 t ha ⁻¹	2100.47	678.50	181.41
S3: FYM @15 t ha ⁻¹	2360.11	702.68	201.28
S4: Vermicompost @5 t ha ⁻¹	1804.16	556.06	163.72
S5: Vermicompost @7.5 t ha ⁻¹	2010.35	610.50	171.20
S6: Castor cake 1.5 t ha ⁻¹	1505.96	408.70	147.39
S7: Castor cake 2.5 t ha ⁻¹	1753.08	502.21	152.72
S8: RDF	1888.57	560.87	164.58
SEm±	21.64	4.34	2.90
CD (P= 0.05%)	62.68	12.57	8.40
Interaction (MS× S)	S	S	S

Dry root yield (kg ha⁻¹)

Data related to dry root yield as influenced significantly by sowing methods. The dry root yield of Ashwagandha was recorded at harvest. Among the sowing methods, ridge and furrow sowing method produced highest (559.85kg ha⁻¹) dry root yield, which was significantly superior over other methods of sowing. As regard to organic sources of nutrients FYM gave significantly superior results over others. Higher (702.68kg ha⁻¹) dry root yield of Ashwagandha was recorded with the application of FYM 15 t ha⁻¹. The interaction effect between sowing methods and organic sources of nutrient for dry root yield were found significant. Paturde *et al.* (2002) [2] stated that the number of tubers, fresh and dry tuber yield of safed musli were significant increased with the application of

organic manures such as farm yard manure and vermicompost.

Seed yield (kg ha⁻¹)

The data pertaining in (Table 3) to seed yield was significantly influenced by different sowing methods. The maximum seed yield (174.82 kg ha⁻¹) was recorded in ridge and furrow sowing method due to better transfer of photosynthates to sink. Highest (201.28 kg ha⁻¹) seed yield was recorded with the application of FYM @15 t ha⁻¹. The interaction effect between sowing methods and organic sources of nutrient for seed yield was found significant.

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