International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(1): 641-645
www.biochemjournal.com
Received: 12-11-2025
Accepted: 15-12-2025

T Swati
Department of Plantation Spices Medicinal and Aromatic Plants, College of Horticulture, Rajendranagar, Hyderabad, Telangana, India

M Padma
Department of Plantation Spices Medicinal and Aromatic Plants, College of Horticulture, Rajendranagar, Hyderabad, Telangana, India

M Rajkumar
Department of Plantation Spices Medicinal and Aromatic Plants, College of Horticulture, Rajendranagar, Hyderabad, Telangana, India

A Sivasankar
Department of Plantation Spices Medicinal and Aromatic Plants, College of Horticulture, Rajendranagar, Hyderabad, Telangana, India

Corresponding Author:
M Padma
Department of Plantation Spices Medicinal and Aromatic Plants, College of Horticulture, Rajendranagar, Hyderabad, Telangana, India

Effect of sowing time, seed rate and harvesting duration on yield of Ashwagandha (*Withania somnifera*)

T Swati, M Padma, M Rajkumar and A Sivasankar

DOI: https://www.doi.org/10.33545/26174693.2026.v10.i1Sh.7050

Abstract
The experiment was carried out at Herbal garden, Rajendranagar, Hyderabad during the 2009-10. The experiment was laid out in Completely Randomized Block Design with factorial concept comprising a total of 18 treatments replicated thrice with two sowing dates (August 15th and August 30th), three seed rates (10 kg/ha, 12 kg/ha and 14 kg/ha) and three harvesting durations (150 DAS, 180 DAS and 210 DAS). Length of the root (29.43 cm) was longer with the crop sown on August 15th when compared to August 30th crop. Among the seed rates, S_1 (10 kg/ha) recorded maximum length of the root (28.49 cm). Among the harvesting durations, H_1 (150 DAS) recorded maximum length of the root (28.46 cm). The highest length of the root (31.63 cm) was recorded with August15th sown crop with a seed rate of 12 kg/ha and harvesting duration of 210 DAS ($D_1S_2H_3$). Maximum thickness of the root (1.23 cm) was recorded with August 15th sown crop when compared to August 30th crop. Among the harvesting durations, H_3 (210 DAS) recorded maximum thickness of the root (1.18 cm). Among the three way interactions, maximum thickness of the root (1.32 cm) was recorded with August15th sown with a seed rate of 12 kg/ha and harvesting duration of 210 DAS ($D_1S_2H_3$). Maximum fresh root yield (13.91 q/ha) and dry root yield (3.38 q/ha) was recorded in August 15th sown crop when compared to August 30th crop. Among the harvesting durations, H_3 (210 DAS) recorded maximum fresh root yield (13.48 q/ha) and dry root yield (3.12 q/ha). Among the three way interactions, maximum fresh root yield (15.63 q/ha) and dry root yield (4.40 q/ha) were recorded with August15th sown crop with a seed rate of 12 kg/ha and harvesting duration of 210 DAS ($D_1S_2H_3$). Days taken for harvesting of seed (152.96 days) was early in August 15th sown crop when compared to August 30th crop. Among the interactions, early days taken for harvesting of seed (150.00 days) was recorded with August15th sown crop with a seed rate of 12 kg/ha and harvesting duration of 180 DAS ($D_1S_2H_2$). Maximum total biomass production (1109.25 g/m^2) was recorded in August 15th sown crop when compared to August 30th crop. Among the harvesting durations, H_3 (210 DAS) recorded maximum total biomass production (1079.39 g/m^2). The highest total biomass production (1304.18 g/m^2) was recorded with August15th sown crop with a seed rate of 12 kg/ha and harvesting duration of 180 DAS ($D_1S_2H_2$).

Keywords: Ashwagandha, seed rate, harvesting duration, sowing time, yield

Introduction
Ashwagandha is an important cash crop for greening the arid and dry zone having medicinal properties belonging to solanaceace. Ashwagandha is late sown kharif crop and harvested between 150-170days after sowing. It is mainly cultivated in the drier parts of Madhya Pradesh, Punjab, Rajasthan and South India. In Madhya Pradesh, it is cultivated in about 4000 hectares area[1]. Ashwagandha is an important drug used in ayurvedic medicines. The pharmacological activity of the roots is attributed to the presence of alkaloids withanine and somniferine. The roots also contain stach, reducing sugars and glycosides.

The plant is a rich source of crude protein, calcium and phosphorous [1]. The leaf paste and decoction are used both externally and internally for many ailments like sore eyes, boils hand and foot swellings, wounds etc. An infusion of bark is used for control of asthma. The fruits and seeds are used in chest complaints.

Ashwagandha is commercially grown for its roots. Now-a-days, use of ayurvedic medicines is increasing due to fewer side effects. The drug is mainly used in ayurvedic and unani preparations. The alkaloid withaferine-A which is present in roots having antibiotic and anti-tumour prorerties [2].

Plant extract of ashwagandha on stored pulses and products showed 100 per cent mortality of callosobruchus pest [3]. Crude leaf extract of ashwagandha gave 90-100 per cent inhibition of Tobacco Mosaic Virus in chillies [4].

Materials and Methods

The experiment was carried out during August 2009-March 2010 in Herbal garden, Rajendranagar, Hyderabad. The experiment was laid out with two sowing dates (August 15th and August 30th), three seed rates (10 kg/ha, 12 kg/ha and 14 kg/ha) and three harvesting durations (150 DAS, 180 DAS and 210 DAS) in Completely Randomized Block Design with factorial concept comprising a total of 18 treatments replicated thrice. The land was brought to fine tilth by ploughing and harrowing. The experimental area was divided into plots of 2m x 3m size. Irrigation channels of 0.5m size were provided. The cleaned seeds mixed with sand at the ratio of 1:1 and sown directly in the field by broadcasting method. Uniformly growing five plants were randomly selected and tagged from the net plot area in each treatment and replication for the purpose of recording the observations at harvest. The data recorded on yield were subjected to statistical analysis. The data were analyzed using computer software programmed by the method of variance [5].

Results and Discussion.

Effect of sowing time on yield:

The August 15th crop performed better in yield characters compared to sowing on August 30th. Yield characters like maximum length of the root (29.43 cm), thickness of the root (1.23 cm), fresh root yield (13.91 q/ha), dry root yield (3.38 q/ha) and total biomass production (1109.25 g/m^2) were recorded in August 15th sowing. Minimum days taken for harvesting of seed (152.96 days) in August 15th sown crop.

The root yield of Ashwagandha was significantly influenced by dates of sowing. The results indicated that the crop sown on August 15th recorded significantly higher root yield (3.38 q/ha) over the August 30th sowing (2.26 q/ha). This clearly indicated that the optimum date of sowing for Ashwagandha crop would be August 15th .Similar results at Rahuri (Maharashtra) were reported having significant effect of dates of sowing on root yield of Ashwagandha [6].

The higher root yield due to sowing on August 15th could be attributed to better performance of crop with respect to yield contributing characters at harvest. The root length (29.43 cm), thickness of the root (1.23 cm), fresh root yield (13.91 q/ha) and dry root yield (3.38 q/ha) were significantly higher with the crop sown on August 15th compared to August 30th sowing. Similar studies of significant effect of date of sowing were reported on root length of Ashwagandha [7].

In the present study the crop sown on August 15th recorded higher leaf area compared to August 30th sowing. Higher total biomass production per plant with August 15th sowing can be related to higher values of growth indices like leaf area. It is well established that infrastructure of the plant is decided by the growth indices. This concept not only involves the final crop yield and its components also probes into the physiological events that have occurred in early growth stages causing variation in the yield. The significant effect of dates of sowing on root yield were reported in Ashwagandha at Jobner (Rajasthan) [7].

Effect of seed rate on yield

The seed rate of 10 kg/ha (S_1) recorded maximum length of the root (28.49cm), maximum dry root yield (2.88 q/ha), total biomass production (997.54 g/m^2) when compared to S_2 (12 kg/ha) and S_3 (14 kg/ha).

Highest dry root yield with thick roots and good quality roots were reported with seed rate of 10 kg/ha on yield of Ashwagandha [8]. Similar results of good quality root yield were reported in Ashwagandha [9, 10].

Effect of harvesting duration on yield

The harvesting duration of 150 DAS (H_1) recorded maximum length of the root (28.46 cm) when compared to H_2 (180 DAS) and H_3 (210 DAS).

Yield characters like fresh root yield (13.48 q/ha), dry root yield (3.12 q/ha), total biomass production (1079.39 g/m^2) recorded maximum in 210 days of harvesting duration compared to 150 days and 180 days. The root yield of Ashwagandha increased with increased period of harvesting. This indicated that the optimum stage of harvesting would be 180 DAS.

Plant height and stem branches showed strong positive association with root yield and also showed positive direct effect. The positive contribution through indirect effect of other yield contributing components like root length, root thickness and seed yield showed positive association with root yield [11]. The results are in conformity who reported by a significant increase in yield of both thin and thick roots (92.0 to 171.0kg/ha and 25.9 to 43.6 kg/ha respectively) with the increase in days of harvesting of Ashwagandha from 90 to 210 [8].

The higher root yield of Ashwagandha crop harvested at 210 DAS can be attributed to higher values of yield parameters at harvest. The root length, root diameter, fresh root weight and dry root weight were significantly higher with the crop harvested at 210 DAS compared to other harvesting stages.

The yield parameters of Ashwagandha increased with increased period of harvesting. The higher values of yield were mainly attributed to better growth of the plant, which can be related to higher values of growth parameters like plant height, primary branches etc.

Interactions

August 15th sowing and 12 kg/ha seed rate (D_1S_2) recorded significantly maximum thickness of the root (0.94cm) at 120 DAS. A combination of August 15th sowing, 12 kg/ha seed rate and harvesting duration of 210DAS ($D_1S_2H_3$) recorded significantly maximum thickness of the root (1.32 cm) at 210 DAS.

Though interaction treatments were not significant, a combination of August15th sown crop with a seed rate of 12 kg/ha and harvesting duration of 210 DAS ($D_1S_2H_3$) recorded maximum length of the root (31.63 cm). Maximum fresh root yield (15.63 q/ha) and dry root yield (4.40 q/ha) were recorded with August15th sown crop with a seed rate of 12 kg/ha and harvesting duration of 210 DAS ($D_1S_2H_3$).

Though interaction treatments were not significant, a combination of August15th sown crop with a seed rate of 12 kg/ha and harvesting duration of 180 DAS ($D_1S_2H_2$) recorded early harvesting of seed (150.00 days) and highest total biomass production (1304.18 g/plant).

Table 1: Effect of sowing time, seed rate and harvesting duration on length of the root (cm) at 210 DAS in Ashwagandha.

	Seed rate(S)			
Sowing date(D)	**S_1(10kg/ha)**	**S_2 (12 kg/ha)**	**S_3 (14 kg/ha)**	**Mean**
D_1 (August 15th)	29.37	29.52	29.40	29.43
D_2 (August 30th)	27.62	27.01	26.73	27.12
Mean	28.49	28.27	28.07	
Harvesting duration(H)				
H_1 (150 DAS)	29.05	27.65	28.68	28.46
H_2 (180DAS)	28.45	27.93	28.62	28.33
H_3 (210DAS)	27.98	29.22	26.90	28.03
Mean	28.49	28.27	28.07	

Seed rates (S)						
Harvesting duration (H)	**S_1 (10 kg/ha)**		**S_2 (12 kg/ha)**		**S_3 (14 kg/ha)**	
Sowing dates (D)	**D_1 (Aug 15th)**	**D_2 (Aug30th)**	**D_1 (Aug 15th)**	**D_2 (Aug 30th)**	**D_1 (Aug15th)**	**D_2 (Aug30th)**
H_1 (150DAS)	30.33	27.77	29.00	26.30	30.93	26.43
H_2 (180DAS)	30.87	26.03	27.93	27.93	30.03	27.20
H_3 (210DAS)	26.90	29.07	31.63	26.80	27.23	26.57

Factors	**S.E m ±**	**CD (5%)**	**Interactions**	**S.E m ±**	**CD (5%)**
Sowing date (D)	0.46	1.32	DXS	0.79	NS
Seed rate (S)	0.56	NS	DXH	0.79	NS
Harvesting duration (H)	0.56	NS	SXH	0.97	NS
			DXSXH	1.37	NS

Table 2: Effect of sowing time, seed rate and harvesting duration on thickness of the root (cm) at 210 DAS in Ashwagandha.

	Seed rate(S)			
Sowing date(D)	**S_1(10kg/ha)**	**S_2 (12 kg/ha)**	**S_3 (14 kg/ha)**	**Mean**
D_1 (August 15th)	1.21	1.25	1.23	1.23
D_2 (August 30th)	1.05	0.99	1.07	1.04
Mean	1.13	1.12	1.15	
Harvesting duration(H)				
H_1 (150 DAS)	1.05	1.08	1.10	1.08
H_2 (180DAS)	1.11	1.11	1.18	1.13
H_3 (210DAS)	1.23	1.16	1.16	1.18
Mean	1.13	1.12	1.15	

Seed rates (S)						
Harvesting duration (H)	**S_1 (10 kg/ha)**		**S_2 (12 kg/ha)**		**S_3 (14 kg/ha)**	
Sowing dates (D)	**D_1 (Aug 15th)**	**D_2 (Aug 30th)**	**D_1 (Aug15th)**	**D_2 (Aug 30th)**	**D_1 (Aug15th)**	**D_2 (Aug30th)**
H_1 (150DAS)	1.15	0.95	1.22	0.94	1.20	1.00
H_2 (180DAS)	1.18	1.05	1.19	1.03	1.13	1.06
H_3 (210DAS)	1.30	1.16	1.32	1.01	1.18	1.15

Factors	**S.E m ±**	**CD (5%)**	**Interactions**	**S.E m ±**	**CD (5%)**
Sowing date (D)	0.01	0.03	DXS	0.02	0.06
Seed rate (S)	0.01	NS	DXH	0.02	NS
Harvesting duration (H)	0.01	0.04	SXH	0.03	NS
			DXSXH	0.04	0.05

Table 3: Effect of sowing time, seed rate and harvesting duration on fresh root yield (q/ha) at 210 DAS in Ashwagandha.

	Seed rate(S)			
Sowing date(D)	**S_1(10kg/ha)**	**S_2 (12 kg/ha)**	**S_3 (14 kg/ha)**	**Mean**
D_1 (August 15th)	14.02	13.64	14.06	13.91
D_2 (August 30th)	12.20	11.99	11.96	12.05
Mean	13.00	12.82	13.00	
Harvesting duration(H)				
H_1 (150 DAS)	13.58	12.15	12.63	12.79
H_2 (180DAS)	12.73	12.17	13.08	12.66
H_3 (210DAS)	13.02	14.13	13.30	13.48
Mean	13.00	12.82	13.00	

Harvesting duration (H)	Seed rates (S)					
	S_1 (10 kg/ha)			S_2 (12 kg/ha)		S_3 (14 kg/ha)	
	Sowing dates (D)	D_1 (Aug 15th)	D_2 (Aug 30th)	D_1 (Aug15th)	D_2 (Aug 30th)	D_1 (Aug 15th)	D_2 (Aug 30th)
H_1 (150DAS)	15.23		11.93	12.77	11.53	14.20	11.07
H_2 (180DAS)	13.57		11.90	12.53	11.80	14.53	11.63
H_3 (210DAS)	13.27		12.77	15.63	12.63	13.43	13.17

Factors	S.E m ±	CD (5%)	Interactions	S.E m ±	CD (5%)
Sowing date (D)	0.31	0.89	DXS	0.54	NS
Seed rate (S)	0.38	NS	DXH	0.54	NS
Harvesting duration (H)	0.38	NS	SXH	0.66	NS
			DXSXH	0.93	NS

Table 4: Effect of sowing time, seed rate and harvesting duration on dry root yield (q/ha) at 210 DAS in Ashwagandha.

	Seed rate(S)			
Sowing date(D)	S_1(10kg/ha)	S_2 (12 kg/ha)	S_3 (14 kg/ha)	Mean
D_1 (August 15th)	3.42	3.31	3.40	3.38
D_2 (August 30th)	2.33	2.13	2.32	2.26
Mean	2.88	2.72	2.86	
Harvesting duration(H)				
H_1 (150 DAS)	3.13	2.25	2.50	2.63
H_2 (180DAS)	2.72	2.50	2.93	2.72
H_3 (210DAS)	2.78	3.42	3.15	3.12
Mean	2.88	2.72	2.86	

Harvesting duration (H)	Seed rates (S)					
	S_1 (10 kg/ha)			S_2 (12 kg/ha)		S_3 (14 kg/ha)	
	Sowing dates (D)	D_1 (Aug 15th)	D_2 (Aug30th)	D_1 (Aug15th)	D_2 (Aug 30th)	D_1 (Aug15th)	D_2 (Aug30th)
H_1 (150DAS)	3.83		2.43	2.63	1.87	3.20	1.80
H_2 (180DAS)	3.47		1.97	2.90	2.10	3.83	2.03
H_3 (210DAS)	2.97		2.60	4.40	2.43	3.17	3.13

Factors	S.E m ±	CD (5%)	Interactions	S.E m ±	CD (5%)
Sowing date (D)	0.17	0.50	DXS	0.30	NS
Seed rate (S)	0.21	NS	DXH	0.30	NS
Harvesting duration (H)	0.21	NS	SXH	0.37	NS
			DXSXH	0.52	NS

Table 5: Effect of sowing time, seed rate and harvesting duration on days taken for harvesting of seed in Ashwagandha.

	Seed rate(S)			
Sowing date(D)	S_1(10kg/ha)	S_2 (12 kg/ha)	S_3 (14 kg/ha)	Mean
D_1 (August 15th)	154.00	152.00	152.89	152.96
D_2 (August 30th)	167.00	168.44	166.89	167.44
Mean	160.50	160.22	159.89	
Harvesting duration(H)				
H_1 (150 DAS)	162.33	160.67	160.00	161.00
H_2 (180DAS)	160.67	158.33	161.00	160.00
H_3 (210DAS)	158.50	161.67	158.67	159.61
Mean	160.50	160.22	159.89	

Harvesting duration (H)	Seed rates (S)					
	S_1 (10 kg/ha)			S_2 (12 kg/ha)		S_3 (14 kg/ha)	
	Sowing dates (D)	D_1 (Aug 15th)	D_2 (Aug 30th)	D_1 (Aug15th)	D_2 (Aug 30th)	D_1 (Aug15th)	D_2 (Aug30th)
H_1 (150DAS)	154.00		170.67	152.00	169.33	150.67	169.33
H_2 (180DAS)	154.00		167.33	150.00	166.67	156.00	166.00
H_3 (210DAS)	154.00		163.00	154.00	169.33	152.00	165.33

Factors	S.E m ±	CD (5%)	Interactions	S.E m ±	CD (5%)
Sowing date (D)	0.62	1.78	DXS	1.07	NS
Seed rate (S)	0.76	NS	DXH	1.07	NS
Harvesting duration (H)	0.76	NS	SXH	1.31	NS
			DXSXH	1.85	NS

Table 6: Effect of sowing time, seed rate and harvesting duration on total biomass production (g/m^2) at 210 DAS in Ashwagandha

	Seed rate(S)			
Sowing date(D)	**S_1(10kg/ha)**	**S_2 (12 kg/ha)**	**S_3 (14 kg/ha)**	**Mean**
D_1 (August 15th)	1125.92	1161.72	1040.13	1109.25
D_2 (August 30th)	869.16	804.48	810.61	828.08
Mean	997.54	983.09	925.37	
Harvesting duration(H)				
H_1 (150 DAS)	882.31	787.54	863.97	844.61
H_2 (180DAS)	1021.52	1048.93	875.56	982.00
H_3 (210DAS)	1088.78	1112.82	1036.58	1079.39
Mean	997.54	983.09	925.37	

Seed rates (S)						
Harvesting duration (H)	**S_1 (10 kg/ha)**		**S_2 (12 kg/ha)**		**S_3 (14 kg/ha)**	
Sowing dates (D)	**D_1 (Aug 15th)**	**D_2 (Aug 30th)**	**D_1 (Aug15th)**	**D_2 (Aug 30th)**	**D_1 (Aug15th)**	**D_2 (Aug30th)**
H_1 (150DAS)	992.93	771.69	897.74	677.34	1041.57	686.38
H_2 (180DAS)	1250.10	792.95	1304.18	793.68	1012.40	738.72
H_3 (210DAS)	1134.72	1042.84	1283.23	942.41	1066.43	1006.73

Factors	**S.E m ±**	**CD (5%)**	**Interactions**	**S.E m ±**	**CD (5%)**
Sowing date (D)	38.35	110.23	DXS	66.43	NS
Seed rate (S)	46.97	NS	DXH	66.43	NS
Harvesting duration (H)	46.97	135.00	SXH	81.36	NS
			DXSXH	115.06	NS

References

1. Nigam KB, Rawat GS, Prasad B. Effects of methods of sowing, plant density and fertility levels on ashwagandha. South Indian Hortic. 1984;32:356-359.
2. Farooqui AA, Khan MM, Vasundhara M. Production technology of medicinal and aromatic crops. Bangalore (India): Natural Remedies; 2001. p. 90-91.
3. Anuradha V, Neelima G, Daniel T. Effect of certain plant extracts on *Callosobruchus maculatus* as pest on stored pulses. J Ecobiol. 2002;14(1):67-71.
4. Peshney NL, Moghe PG. Inhibition of tobacco mosaic virus from chilli by different plant extracts. PKV Res J. 1989;13:119-123.
5. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi (India): ICAR; 1985. p. 1-539.
6. Desai P, Dumbre AD, Mahatale PV, Shirole M, Mahatale YV. Effect of planting dates on growth attributes, seed yield and seed quality of ashwagandha. Ann Plant Physiol. 2004;18(2):160-162.
7. Agarwal M, Singh P, Agarwal MK. Effect of sowing date and spacing on yield attributes and root yield of ashwagandha. J Med Aromat Plant Sci. 2004;26(3):473-474.
8. Patel KV, Patel DH, Patel SA, Sriram S. Effect of seed rate and crop duration on root yield and quality of ashwagandha. J Med Aromat Plant Sci. 2003;25(1):54-57.
9. Gholap SV, Mahorkar VK, Wankhade SG, Wanjari SS, Jahagirdar SW. Effect of organic manures and plant spacing on growth, yield and quality of safed musli (*Chlorophytum borivilianum*). PKV Res J. 2005;29:13-16.
10. Satyanarayana Reddy G, Susila T, Raj Kumar M. Effect of seed rate and spacing on yield of ashwagandha (*Withania somnifera* Dunal.). Hyderabad (India): Herbal Garden Scheme, Rajendranagar; 2009.
11. Kandalkar VS, Patidar H, Nigam KB. Genotypic association and path coefficient analysis in ashwagandha (*Withania somnifera*). Indian J Genet. 1993;53(3):257-260.