researcharticle | International Journal of Plant Sciences, (July to December, 2009) Vol. 4 Issue 2 : 396-398

Effect of plant density and fertilizer levels on seed yield and seed quality in Ashwagandha

S.R. KARAD, P.D. KHADE, A.U. KUBDE AND S.R. JADHAV

Accepted : March, 2009

SUMMARY

An experiment was undertaken with a view to study the effect of plant density and fertilizer levels on the growth, seed yield, quality and yield-contributing characters in Ashwagandha with three replications by using three different spacing S_1 (30 x 10 cm), S_2 (30 x 20 cm) and S_3 (30 x 30 cm) and four different fertilizers levels. The wider spacing of 30 x 30 cm recorded early flowering, higher number of branches and berries per plant. While plant count at harvest, seed and root yield per hectare were maximum with the closer spacing of 30 x 10 cm. Fertilizer application of 10 t FYM with 80:40:20 kg NPK/ha recorded significant effect on early flowering, number of branches^{-1}, number of berries $^{-1}$, plant height, seed yield^{-1} and per hectare,1000 grain weight and germination percentage. While root yield^{-1}and per hectare were maximum with the fertilizer level of 10 t FYM with 60:30:15 kg NPK/ha. The number branches^{-1}, number of berries^{-1} and seed yield^{-1} was highest due to S_3F_3, S_3F_3 and S_3F_3, interaction, respectively.

Key words : Ashwagandha, Plant density, Fertilizer level, Interaction

Ashwagandha is one of the important medicinal plant. There exist considerable gap between demand and supply of medicinal land aromatic plants, which provide raw material to pharmaceutical industries. The importance and demand of Ashwagandha is increasing in all system of medicines. The cultivation of Ashwagandha crop is mostly restricted to Mandsapur district of Madhya Pradesh and adjoining villages of Kota district of Rajasthan. In recent years its cultivation has been started in Maharashtra State particularly in Jalgaon, Buldhana, Akola, Ahmednagar, Pune and Nashik district. However, the crop has not been extensively studied for many aspects including Maharashtra conditions. Keeping these points in view, efforts have been made in the present investigation to assess the effect of different spacing and fertilizer levels and their interaction effect of plant density and fertilizer levels on seed yield and seed quality characters of Ashwagandha for Kolhapur region.

MATERIALS AND METHODS

The present study was undertaken with a view to find out the effect of different spacing, fertilizer levels and their interaction on the growth, yield and the yield contributing characters, seed yield and the quality of seed in Ashwagandha. The experiment with 12 treatments was laid out in FRBD with 3 replications on well prepared piece of land at Agril. Botany section farm, College of Agriculture, Kolhapur during *kharif* 2007-2008. The local collected genotypes were used as planting material. The 12 treatments combinations were formulated from three spacing *i.e.* S_1 (30x 10 cm), S_2 (30x 20 cm), S_3 (30x 30 cm) and four fertilizers levels *i.e.* F_1 (Control), F_2 (40:20:10), F_3 (60:30:15) and F_4 (80:40:20). The combinations were as S_1F_1, S_1F_2, S_1F_3, S_1F_4; S_2F_1, S_2F_2, S_2F_3, S_2F_4; S_3F_1, S_3F_2, S_3F_3, S_3F_4; S_4F_1, S_4F_2, S_4F_3 and S_4F_4. Half dose of N and full dose of P_2O_5, K_2O and FYM was applied uniformly at sowing as a basal dose remaining half dose of N was given as top dressing in two equal splits. The allocation of these treatments was done randomly. All other cultural practices were followed as per recommended. The data were recorded on 14 different character like days to 50% flowering, number of branches^{-1}, number of berries^{-1}, plant height, number of plant/plot, seed yield^{-1}, seed yield/ha, root yield^{-1}, root yield/ha, 1000 seed weight, recovery percentage, germination, vigour index, dry matter content/10 seedlings. The data were analysised as per Panse and Sukhatme (1967). The germination percentage of seed was tested according to the ISTA rule (Annoymous, 1985) and vigour index was calculated by equation suggested by Abdual-Baki and Anderson (1973).

RESULTS AND DISCUSSION

The character 50 % flowering was significantly early in the case of wider plant spacing of S_3 (30x 30 cm) (84.00

Correspondence to:
S.R. KARAD, Department of Agricultural Botany, College of Agriculture, KOLHAPUR (M.S.) INDIA
Authors' affiliations:
P.D. KHADE AND A.U. KUBDE, Department of Agricultural Botany, College of Agriculture, KOLHAPUR (M.S.) INDIA
S.R. JADHAV, Department of Agronomy, College of Agriculture, KOLHAPUR (M.S.) INDIA

Table 1 : Analysis of variance of means for 14 characters in Ashwagandha

Spacing / treatments	Days to 50% flowering	No. of branches per plant	No. of berries per plant	Plant height at mat. (cm)	Number of plants / plot at harvest	Seed yield per plant (g)	Seed yield/ hectare (kg)	Root yield per plant (g)	Root yield/ hectare (kg)	1000 seed weight (g)	Recovery %	Germination	Vigour Index	Dry matter content per 10 seedlings (g)
Spacing (cm)														
S_1 30 x 10 cm	85.83	8.98	210.25	52.30	95.58	0.75	198.78	5.60	1483.28	1.43	97.79	83.00	554.72	0.020
S_2 30 x 20 cm	85.00	9.30	225.93	50.48	55.17	0.97	148.51	8.16	1247.77	1.45	97.83	84.17	566.61	0.020
S_3 30 x 30 cm	84.00	9.60	234.75	50.91	37.67	1.30	135.39	10.17	1061.20	1.46	97.85	84.67	572.09	0.020
S.E. ±	0.26	0.10	3.52	0.81	0.53	0.02	2.70	0.12	23.30	0.003	0.05	0.35	8.56	0.000
C.D. (P=0.05)	0.75	0.29	10.33	N.S.	1.56	0.04	7.93	0.35	68.33	0.01	N.S.	1.01	N.S.	N.S.
Fertilizer levels (Kg/ha)														
F_1(Control)	83.33	8.27	160.67	47.36	62.11	0.72	115.01	7.49	1163..82	1.42	97.74	82.22	548.89	0.020
F_2 (40:20:10)	84.56	8.87	213.24	49.98	62.67	0.92	147.40	7.91	1249.40	1.43	97.81	83.56	557.18	0.020
F_3 (60:30:15)	85.67	9.90	254.00	51.62	63.11	1.15	184.18	8.27	1335.42	1.47	97.86	84.56	572.52	0.020
F_4 (80:40:20)	86.22	10.13	266.67	55.97	63.33	1.23	197.00	8.23	1307.70	1.48	97.89	85.33	579.30	0.020
S.E. ±	0.29	0.11	4.07	0.93	0.62	0.02	3.12	0.14	26.90	0.003	0.06	0.40	9.89	0.000
C.D. (P=0.05)	0.87	0.33	11.93	2.73	N.S.	0.05	9.16	0.40	78.90	0.01	N.S.	1.17	N.S.	N.S.
Interaction (S x F)														
S.E. ±	0.51	0.20	7.05	1.61	1.07	0.03	5.41	0.24	46.60	0.006	0.10	0.69	17.13	0.00
C.D. (P=0.05)	N.S.	0.58	20.67	N.S.	N.S.	0.08	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
General mean	84.94	9.29	223.64	51.23	62.81	1.01	160.90	7.98	1264.09	1.45	97.83	83.94	564.48	0.020

NS-Non significant

days) than closer spacing *i.e.* S_2 (30x 20 cm) (85.00 days) and S_1 (30x 10 cm) (85.33 days) (Table 1). Number of branches per plant were significantly affected by spacings. The plants at the wider spacings of S_3 (30x 30 cm) (9.60) had more number of branches as compared to other spacing. Number of berries per plantat wider spacing S_3 (30x 30 cm) were higher than other spacings. Similar findings were reported by Reddy and Krishnan (1996) in *Solanum viarum.* The plant height at maturity was not significantly influenced due to spacing. The more number of plants at the time of harvest was noticed at closer spacing S_1(30x 10cm). While it was decreased with wider spacing S_2 (30x 20 cm) and S_3 (30x 30 cm).

The seed yield^{-1} was higher (1.30 g) due to wider spacing of S_3 (30x 30 cm) which might be due to cumulative effect of increased number of branches, berries and better development of plants at low plant population per unit area. It is interesting to record that the seed yield per hectare was significantly increased with decreased in spacing though the seed yield^{-1} was higher at wider spacing. These results are in confirmation with those of Desai *et al*. (1973), Kalyansundaram *et al*. (1981b), and Mahajan (1998) reported in Isabgol. The root yield^{-1} was higher (10.17 g) due to wider spacing S_3 (30 x 30 cm) which was might be due to more area available for growth of plant roots at low plant population. The root yield per hectare was significantly increased with decrease in spacing S_1 (30 x 10 cm) though the root yield^{-1} was higher at wider spacing. These results are in confirmation with those of Nigam (1984) and Kahar *et al*. (1994).

Fertilizer level of 10 t FYM with 80:40:20 kg NPK/ha (F_4) delayed the flowering, while it has recorded highest number of branches (10.13), number of berries per plant (266.67), plant height (55.97), seed yield per plant (1.23g) and per hectare (197.00g), 1000 seed weight (1.48g) and germination percentage (85.33). While root yield per plant (8.27g) and per hectare (1335.42kg) were maximum with the fertilizer level of 10 t FYM with 60:30:15 kg NPK/ha (F_3). However, remaining attributes were not much affected due to fertilizer levels.

The application of F_4 fertilizer level increased seed yield^{-1} by 70.83 per cent over

F_1 level. The F_4 level produced significantly 71.29, 33.65 and 6.96 per cent more seed yield per hectare than F_1, F_2 and F_3, respectively. It was attributed to the favorable and cumulative influence of F_4 level on yield contributing characters such as number of berries^{-1} (266.67), seed yield^{-1} (1.23g) etc. The quality parameters such as recovery percentage, vigour index and dry matter per 10 seedling were not significantly affected by different levels of fertilizer. However, 1000 seed weight and germination percentage were significantly higher with increased fertilizer level *i.e.* F_4 which might be due to better seed development.

After critical examination of data it is observed that the interaction effects of spacing and fertilizers levels on the characters *viz.* 50 per cent flowering, plant height and number of plants at harvest were found to be non-significant for many characters. The findings are in accordance with those reported by Ramesh *et al*. (1989).

Number of branches^{-1} were significantly more at 30 x 30 cm spacing with the application of 10 t FYM with 60:30:15 kg NPK/ha (11.10) *i.e.* S_3F_3 interaction than other interaction effects. This may be due to the resultant effect of more nutrients available at wider spacing and higher dose of fertilizer. Number of berries^{-1} were significantly more at 30 x 30 cm spacing with the application of 10 t FYM with 80:40:20 kg NPK/ha (271.33) *i.e.* S_3F_4 interaction than other interaction effects.

It is interesting to note that though the interaction effects were not significant for some characters, but the interaction between spacing and fertilizer was found to be significant for seed yield^{-1}. The combine effect of spacing 30 x 30 cm and fertilizer 10 t FYM with 80:40:20 kg NPK /ha *i.e.* S_3F_4 interaction produced more seed yield^{-1}. It might be due to better development of plant and aggregate effects of individual characters at lower plant population with wider spacing and higher dose of fertilizer application. The differences in seed yield per hectare due to interactions between spacing and fertilizer were found to be non-significant. These results are in agreement with those of Kalyansundaram *et al.* (1981 b) in Isabgol. While Mahajan (1998) reported significant effect of interaction between (S x N) on seed yield. Seed yield^{-1} was maximum in the treatment combination of S_3F_4.

The differences in root yield^{-1} and per hectare due to interaction between spacing and fertilizers were found to be non-significant. As regards seed quality, the entire interaction effects among spacing and fertilizers levels were not significant for all the seed quality attributes *i.e.* 1000 seed weight, recovery percentage, germination percentage, vigour index, dry matter per 10 seedlings.

Acknowledgment:

The authors are thankful to the Associate Dean, College of Agriculture, Kolhapur for providing the facilities and grateful to C.E.O., NMPB, New Delhi for providing financial assistance for conducting the research trials under adhoc project.

REFERENCES

Abdual Baki, A. and Anderson, J.D. (1973). Vigour determination of soybean seed by multiple criteria. *Crop Sci.,* **13** (6) : 630-633.

Anonymous (1985). International Rules for Seed Testing (Rules and Annexes). *Seed Sci. Technol*., **13** : 299- 513.

Desai, N.D., Mehtra, K.G., Godhani, P.R. and Modi. J.M. (1973). Proc. of 1st All India Workshop (AICIP) on Medicinal and Aromatic plant. 17-19 November.

Kahar, L.S., Tomar, S.S. and Pathan, M.A. (1994). All India 10th Co-ordinated Research Project on Medicinal and Aromatic plant. 17-29 Jan.

Kalyansundaram, N.K., Patel, B.R., Patel P.B. and Dalal, K.C. (1981 b). Proc. Of 4th All India Workshop (AICIP) on Medicinal and Aromatic plant. August.

Mahajan, R.S. (1998). Seed yield, seed quality of Isabgol (*Plantago ovata* Forsk) as influenced by sowing methods, seed rates and nitrogen levels. M.Sc. (Agri.) Thesis, M.P.K.V., Rahuri.

Nigam, K.B. (1984). Ashwagandha cultivation. *Indian Hortic.*, **28** (4) : 39-41.

Panse, V.G. and Sukhatme, P.V. (1967). *Statistical Methods for Agricultural Workers*. Indian Council of Agricultural Research (2nd Ed.).

Ramesh, M.N., Faroogi, A.A. and Tilak Subbaiah (1989). The effect of sowing date and nutrients on growth and yield of Isabgol (*Plantago ovata* F.). *Crop Res.*, **2**(2) : 169-174.

Reddy and Krshnan, M.L.N. (1996). Response to planting arrangement and density indiploid and induced autotetraplod varieties of *Solanum viarum* Dunal. for berry yields. *Crop Res.*, **12**(2) : 173-181.

****
*****