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Agro-technical studies for seed yield enhancement in Ashwagandha (*Withania somnifera* Dunal.)

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ABSTRACT

An experiment has been carried out in the Department of Horticulture, Janta College, Bakewar, Etawah (UP) India, during two cropping seasons in split plot design, using cultivars viz., cv. Poshita and cv. JA - 20 as main plot. Two planting distance 30 x 30 cm and 30 x 20 cm were used as sub plot. These plants were raised in nursery bed and transplanted after 30 days of sowing. After 30, 60 and 90 days of transplanting the plants were sprayed with IAA 100 ppm, IAA 200 ppm, GA 50 ppm, GA 100 ppm, CCC 2000 ppm and CCC 3000 ppm solutions. In control they were sprayed with distilled water (sub sub-plot). Results abstracted that cv Poshita took more number of days for 50 % flowering and maturity as compared to cv. JA – 20. However, cultivar JA – 20 produced significantly higher number of berries per plant with higher seed yield as compared to cv. Poshita. Stand geometry did not have any significant effect on days to 50 % flowering and maturity. Planting distance 30x30 cm produced higher number of berries and seed yield per plant, although 30 x 20 cm planting distance produced significantly higher seed yield per plot and per hectare. All concentrations of plant growth regulators increased seed yield. GA 100 ppm took minimum days for 50 % flowering and maturity. The maximum number of berries and seed yield ware recorded from IAA 200 ppm treated plants.

INTRODUCTION

Ashwagandha (*Withania somnifera* Dunal.), a member of family Solanaceae, is an important drug ancient pharmacopoeias. The plant is erect, herbaceous, evergreen, tomentose and branched under – shrub reaching upto 13-150 cm in height with ovate, hairy, thin leaves. The commercial drug consists of the dried root, which occur in small pieces 10.0 to 17.5 cm long and 6- 12 mm in diameter. The roots are dark-brown with a creamy interior. Ashwagandha is commonly known as winter cherry in English. In India it is known as Punir or Asgandh in Hindi. The species is native of India, Pakistan and Sri Lanka. It is strength and vigour promotion drug. The leaf and root extract of the plant contains withanolides, which exhibit marked activity against various diseases especially bacterial infections. Among several alkaloids present in ashwagandha, withanine and somniferine are used in the treatment of carbuncles, ulcer and painful

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swellings. The crop is grown on marginal land and also suitable for dry land farming.

Looking at its high demand and sustainable use *withania* crop has much scope for its wide cultivation in India. The information on seed production and agro– techniques of ashwagandha cultivation is scanty. Therefore, present investigation was undertaken to evaluate the effect of different plant growth regulators and planting distances. On productivity profiles of *W. somnifera*.

MATERIALS AND METHODS

The present investigation was carried out in the horticulture garden of Janta College (P.G.), Bakewar, Etawah (U.P.). Geographically, the district falls between the parallels of 26.21^0 and 27.1^0 North latitude and 78.45^0 and 79.45^0 East longitude. It is situated 150.06 meters above mean sea level. The average rainfall of the Etawah district is about 805 mm per annum and more than 80 per cent rainfall is received in July and September. During winters the days are bright and sunny while nights are cool, with occasional frost. The soil of experimental plot was well – drained sandy loam with medium fertility. The experiment was laid out in split plot design, using cultivars viz., cv. Poshita and cv. JA - 20 as main plot. Two planting distance 30 x 30 cm and 30 x 20 cm were used as sub plot. These plants were raised in nursery bed and transplanted after 30 days of sowing. After 30, 60 and 90 days of transplanting the plants were sprayed with IAA 100 ppm, IAA 200 ppm, GA 50 ppm, GA 100 ppm, CCC 2000 ppm and CCC 3000 ppm solutions, where as in control they were sprayed with distilled water (sub sub-plot). The size of each plot was 180 x 120 sq.cm. Data were recorded during the period of experiment in both the seasons on days to 50% flowering, number of berries per plant, days to maturity, seed yield per plant, seed yield per plot and the seed yield per hectare.

RESULTS AND DISCUSSION

Days to 50% flowering: During present investigation the cultivar Poshita took more number of days (127.20) for 50% flowering as compared to cv. JA – 20 (119.36 days). On contrary to it Nigam *et al.,* [8] reported only 74 days to 50 % flowering in cv. JA-20 (Synonym: WS 20) under Mandsaur (MP) conditions. It was also noted that stand geometry did not have any significant effect on days to 50% flowering. Application of plant growth regulators also influenced the days to 50 % flowering. GA 100 ppm took minimum days (119.91) for 50% flowering. Although both concentrations of GA reduced vegetative phase and apparently induced flowering earlier yet it was statistically at par with control (121.42). These results corroborate with earlier finding of Joshi and Singh [4], who reported in carrot 14 – 20 days advanced flowering with GA application. Additionally many other workers also reported early flowering in various crops with the use of GA [2,6]. IAA 100 and 200 ppm appeared to cause delayed flowering but this difference was statistically insignificant. The results of IAA are in contrast with those of Bhattacharjee [2] who reported that soil drench of IAA 10 ppm showed a trend of early flowering. Both the concentration of CCC delayed the flowering and maximum number of days (127.25) was taken for 50 % flowering by CCC 3000 ppm treated plants. These results are in agreement with Girisha *et al.* [3], who reported early flowering i.e., days to first flowering and days to 50% flowering in daisy with the foliar application of GA 150 ppm and delayed flowering with CCC 400 ppm.

Number of berries per plant: The cultivars under study differed significantly for production of berries. Cultivar JA – 20 produced significantly higher number of berries (32.37) per plant as compared to cv. Poshita (30.68). On the other hand Nigam *et al.,* [8] reported 25 berries per plant in cv. WS – 20 (JA – 20). The stand geometry has also significant effect on number of berries per plant. It was increased with the increase in planting distance. Wider spacing (30x30cm) produced higher number of berries (32.42) whereas it was 30.63 per plant in closer spacing (30 x 20 cm). Similar observations have also been noted in ashwagandha by Pakkiyanathan *et al.* [10], who reported that number of berries gradually increased with increase in planting distance. It may be due to increase in uptake of nutrients from the soil and better use of light with increase in planting distance.

Table 1: Effect of cultivar, stand geometry and plant growth regulators on flowering & fruiting attributing characters of Ashwagandha.

Treatments	Days to 50% flowering			Number of berries per plant			Days to maturity		
	I st Season	2nd Season	Pooled	I st Season	2nd Season	Pooled	I st Season	2nd Season	Pooled
JA-20	120.05	118.67	119.36	32.50	32.25	32.37	206.12	204.12	205.12
Poshita	127.64	126.76	127.20	30.93	30.43	30.68	213.71	212.24	212.97
CD at 5 %	**2.90**	**3.77**	**1.53**	**1.68**	**1.43**	**0.71**	**2.73**	**3.08**	**1.33**
30 x 30 cm	123.45	122.33	122.89	32.54	32.30	32.42	209.69	207.95	208.82
30 x 20 cm	124.24	123.09	123.67	30.88	30.37	30.63	210.14	208.41	209.28
CD at 5 %	**NS**	**NS**	**NS**	**1.23**	**1.11**	**0.69**	**NS**	**NS**	**NS**
IAA 100 ppm	124.00	123.08	123.54	33.92	33.93	33.92	211.67	209.92	210.79
IAA 200 ppm	124.50	123.42	123.96	33.99	34.00	33.99	211.59	210.00	210.79
GA 50 ppm	120.84	119.42	120.13	33.03	32.87	32.95	204.67	202.58	203.62
GA 100 ppm	120.58	119.25	119.91	33.47	33.40	33.43	204.75	202.50	203.62
CCC 2000 ppm	127.17	126.33	126.75	29.30	28.52	28.91	214.42	213.08	213.75
CCC 3000 ppm	127.75	126.75	127.25	29.62	28.88	29.25	214.75	213.50	214.13
Control	122.09	120.75	121.42	28.67	27.78	28.22	207.58	205.67	206.62
CD at 5 %	**4.34**	**5.23**	**3.34**	**2.06**	**1.94**	**1.39**	**3.73**	**4.68**	**2.95**

Plant growth regulators also promoted number of berries per plant in ashwagandha. The maximum number of berries (33.99) was recorded in IAA 200 ppm treated plants followed by plants treated with IAA 100 ppm (33.92), GA 100 ppm (33.43) and GA 50 ppm (32.95). Although both concentrations of CCC also produced higher number of berries per plant yet the number was at par with control (28.22). These findings are in agreement with results of Joshi and Singh [5] in chilli. Pol *et al*., [11] also reported increased the number of fruits with the use of GA and CCC in ashwagandha. It may be due to the plant growth regulators increase the uptake of nutrients from the soil, which has beneficial effect on synthesis of carbohydrates and high concentration of assimilates in the plants ultimately causes increase in number of fruits.

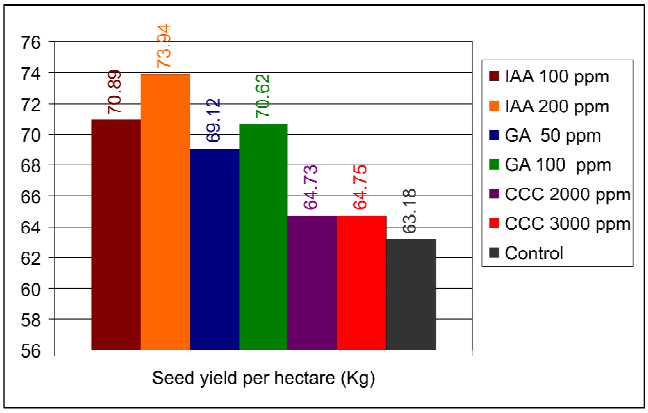

Fig.1: Effect of plant growth regulators on seed yield of Ashwagandha

Days to maturity: In the present experiment, Poshita took higher number of days (212.97) for maturity as compared to cv. JA – 20 (205.12 days). On the contrary Nigam *et al.,* [8,9] reported that only 135 days were required by plant to reach maturity in cv. WS – 20 under climatic conditions of Mandsaur, MP. Arun *et al.,* [1] observed seed maturation stage in ashwagandha after 211 days of transplanting. Mishra *et al.,* [10] reported maturity within 180-210 days in cv. Poshita. It was also noted that stand geometry did not significantly affect the days to maturity. Both concentrations of GA 50 and 100 ppm took minimum days (203.62) for maturity. IAA 100 and 200 ppm showed delayed maturity (210.79). Both concentrations of CCC also delayed the maturity in ashwagandha and maximum number of days (214.13) was taken for maturity by CCC 3000 ppm treated plants.

Seed yield: In the present investigation higher seed yields were recorded in cv. JA – 20 (0.58 g/plant, 15.58 g/plot and 72.12 Kg/ha) as compared to cv. Poshita (0.49 g/per plant, 13.88 g/plot and 64.23 Kg/ha) on per plant, per plot and per hectare basis, respectively (Table 2). It may be due to higher number of berries per plant in cv. JA – 20 as compared to cv. Poshita. Nigam and Kandalkar [9] also reported 50 – 75 Kg seed yield per hectare in ashwagandha. Stand geometry affected the seed yield per plant. Planting distance at 30 x 30 cm produced significantly higher seed yield per plant

Table 2: Effect of cultivar, stand geometry and plant growth regulators on seed yield of Ashwagandha.

Treatments	Seed yield per plant (g)			Seed yield per plot (g)			Seed yield per hectare (Kg)		
	1st Season	2nd Season	Pooled	1st Season	2nd Season	Pooled	1st Season	2nd Season	Pooled
JA-20	0.58	0.59	0.58	15.44	15.72	15.58	71.47	72.77	72.12
Poshita	0.49	0.49	0.49	13.82	13.93	13.88	64.03	64.44	64.23
CD at 5 %	**0.01**	**0.02**	**0.01**	**0.84**	**0.75**	**0.36**	**1.98**	**2.04**	**0.92**
30 x 30 cm	0.56	0.56	0.56	12.22	12.34	12.28	56.56	57.05	56.81
30 x 20 cm	0.51	0.52	0.52	17.04	17.32	17.18	78.93	80.15	79.54
CD at 5 %	**0.01**	**0.01**	**0.01**	**0.71**	**0.70**	**0.41**	**1.75**	**1.66**	**1.00**
IAA 100 ppm	0.56	0.57	0.57	15.20	15.43	15.31	70.35	71.42	70.89
IAA 200 ppm	0.58	0.58	0.58	15.84	16.11	15.97	73.31	74.57	73.94
GA 50 ppm	0.55	0.55	0.55	14.82	15.04	14.93	68.59	69.64	69.12
GA 100 ppm	0.56	0.56	0.56	15.13	15.37	15.25	70.06	71.18	70.62
CCC 2000 ppm	0.51	0.51	0.51	13.93	14.09	14.01	64.48	64.99	64.73
CCC 3000 ppm	0.51	0.52	0.51	13.91	14.06	13.98	64.41	65.08	64.75
Control	0.49	0.50	0.50	13.58	13.68	13.63	63.02	63.33	63.18
CD at 5 %	**0.01**	**0.01**	**0.01**	**1.14**	**1.13**	**0.79**	**3.05**	**2.88**	**2.06**

(0.56g) as compared to 30 x 20 cm plant spacing (0.52 g). It may be due to higher number of berries per plant in higher planting distance. However, closer planting distance at 30 x 20 cm produced significantly higher seed yield per plot and per hectare (17.18g and 79.54 Kg) as compared to 30 x 30 cm plant spacing (12.28 g/plot and 56.81 Kg/ ha). It may be due to higher number of plants per unit area with 30 x 20 cm planting distance as compared to wider spacing.

All concentrations of plant growth regulators also increased seed yield. Maximum seed yield was obtained by IAA 200 ppm treatment (0.58 g/plant, 15.97 g/plot and 73.94 Kg/ha). Both concentrations of GA (50 and 100 ppm) and CCC (2000 and 3000 ppm) also produced significantly higher seed yield per plant as compared to control. GA proved its superiority over CCC. Similarly Joshi and Singh (1982) also observed that although both GA and CCC increased seed yield significantly in carrot yet GA proved superior to CCC. Pol *et al*. [11] also reported increased the seed yield with the use of GA and CCC in ashwagandha.

CONCLUSION

During the present investigation seed yield per plant was significantly affected by cultivar. The higher seed yield was recorded in plants of cv. JA – 20 (0.58g) and lower yield was noted in plants of cv. Poshita (0.49g). Stand geometry also affected the seed yield per plant. Planting distance 30 x 30 cm produced higher seed yield per plant (0.56g) and 30 x 20 cm plant spacing produced lower seed yield per plant (0.51 g). During the experiment the effect of plant growth regulators produced significant effect on seed yield per plant. The maximum seed yield per plant (0.58g) was obtained in IAA 200 ppm treated plants and minimum (0.49 g) in the intreated control. On the basis of present study, it could be concluded that the plants of cv. JA – 20 treated with IAA 200 ppm and planted at 30x30 cm distance produced maximum seed yield per plant and plants of cv. Poshita treated with distilled water (control) and planted at 30 x 20 cm produced minimum seed yield per plant.

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