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RESEARCH ARTICLE

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Effect of spacing on yield attributes and yield of ashwagandha

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ABSTRACT

A field study was conducted on loamy sand soils of Regional Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. The yield attributes *viz.*, number of branches, number of berry per plant, number of seeds per berry, test weight, root girth, dry root yield and seed yield were recorded higher when crop was sown at 22.5 cm x 10 cm spacing. Where as, plant height, root length and root : shoot ratio was significantly higher with broadcasting method, but it was statistically at par with 22.5 cm x 10 cm spacing. Broadcasting method of sowing produced significantly higher dry root yield as compared to 15 cm x 10 cm and 30 cm x 10 cm spacing. 22.5 cm x 10 cm spacing produced significantly higher seed yield as compared to 15 cm x 10 cm spacing.

KEY WORDS : Ashwagandha, Yield attributes, Yield, Berry, Withanolids

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INTRODUCTION

Among the various medicinal plants *Withania somnifera* Dunal, commonly known as Ashwagandha in Ayurvedic literature is found as a weed and is known by the local name Asundha in this area. It is an important medicinal plant. It belongs to the family *Solanaceae*. It is a shrub found throughout drier parts of India, Pakistan, Baluchistan and Sri Lanka.

Ashwagandha is widely used in various preparations of Indian traditional system of medicine and Homeopathy and also find its use in allopathic medicine to cure several diseases. It contains many alkaloids of which, withanine and somniferine are important from commercial point of view (Dastur, 1970). Withanolids are the most important bioactive constituents of roots of ashwagandha. In India annual requirement of ashwagandha roots is around 7,000 tonnes, while production is hardly 1350 tonnes (Misra *et al.,* 1998). Due to the demand of ashwagandha roots in recent times and considering the future demand, there exists much scope for extensive cultivation of this crop. The demand is said to be on account of its reported male sex stimulating properties (Joshi *et al.,* 1981).

Roots of ashwagandha show considerable variation in regard to its growth habit, yield potential and respond differentially to plant population. So, spacing play an important role in increasing root yield.

In view of the above facts, an experiment was conducted to study the effect of spacing on yield attributes and yield of ashwagandha.

MATERIALS AND METHODS

The field experiment was conducted at Regional Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, during ensuring *Kharif* season of 2006-2007.Ashwagandha variety WS-100 was used in this study. The experiment was conducted with randomized block design with four replications. Experiment included four treatments *i.e.* Broad casting-S_1, 15 cm x 10 cm-S_2 22.5 cm x 10 cm-S_3 and 30 cm x 10 cm-S_4. Gross plot size was 3.6 m x 2.7 m and net plot size of S_1 :3.0 m x 2.1 m, S_2 :3.0 m x 2.1 m, S_3:3.0 m x 1.8 m and S_4 :3.0 m x 2.1 m. The soil of experimental plot was loamy sand in texture having pH 7.8 and 7.7 from 0-15 and 15-30 cm depth, respectively. It was low in available nitrogen (218 and 204 kg ha^{-1} from 0-15 and 15-30 cm depth, respectively); medium in available phosphorus (26.31 and 22.33 kg ha^{-1} from 0-15 and 15-30 cm depth, respectively) and potash (248 and 232 kg ha^{-1} from 0-15 and 15-30 cm depth, respectively). Half dose of the

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nitrogen @15 kg ha^{-1} in the form of urea was applied in furrow as basal dose and remaining half dose @15 kg ha^{-1} of nitrogen was applied in the form of urea at 45 DAS. The seeds treated with Dithane M-45 @ 3 g kg^{-1} of seeds were mixed with fine sand for uniform sowing. In broadcasting method, seeds @ 6 kg/ha were broadcasted uniformly and light brooming was carried out for uniform distribution of the seeds. In case of line sowing, seeds @ 6 kg/ha in the respective plots of treatment was manually drilled in furrows as per the treatments. The furrows were slightly covered with soil. The first irrigation was given immediately after sowing followed by subsequent irrigation as per requirement. Thinning was done at 10 cm apart at 35 DAS. Interculturing and weeding were carried out as and when required. For recording yield attributes five plants were randomly selected from each net plot area and tagged to record the observations. The vernier caliper was used for measuring the berry diameter. When the crop was physiologically matured, light irrigation was given a day prior to harvesting. Five previously tagged plants were harvested separately to record post-harvesting observations. First of all, the ring area were harvested and shifted out from plot. Thereafter, plants from each net plot were uprooted manually and cut from collar and aerial parts and root portion was separated and allowed them to sun dry for two weeks. The remaining parts *i.e.,* aerial parts of the plants were also separately kept in the field for sun drying. After complete drying, the seeds were separated from the berries by beating with wooden sticks, cleaned and weighed separately. The weight of cleaned ashwagandha seeds and roots were recorded in gram per plot and converted into kilogram per hectare.

RESULTS AND DISCUSSION

The yield attributes *viz.*, no. of branches, no. of berry per plant, no. of seeds per berry, test weight, root girth and seed yield were recorded higher when crop was sown at 22.5 cm x 10 cm spacing. This was only due to plant received, more nutrient, sunlight, moisture, due to less number of plants, could increase the number of branches. The findings are in close proximity with those obtained by Patel, (2001) and Agarwal (2003). The plant height was tallest under broadcasting as compared to line sowing due to severe competition between the plants for nutrients, moisture, light and space. Agarwal (2003) also reported that taller plant height was recorded under closer spacing. The results showed that maximum length of roots was observed with closer spacing (broadcasting) while maximum root girth was recorded with wider spacing (22.5 cm x 10 cm). This might have been due to more

Table 1: Effect of sowing seasons on yield attributes of aswagandha

Treatments	Plant height at harvest (cm)	No. of branches per plant at harvest	No. of berries per plant	No. of seeds per berry	Berry diameter (cm)	Test weight (g)	Root length (cm)	Root girth (cm)	Root dry wt. per plant (g)	Dry root yield (kg/ha)	Seed yield (kg/ha)
S_1: Broadcasting	71.85	7.12	32.52	29.57	0.51	1.59	18.32	3.55	0.28	730	535
S_2: 15 cm x 10 cm	69.94	3.9	29.82	27.81	0.5	1.51	16.65	3.33	0.25	629	452
S_3: 22.5 cm x 10 cm	72.06	5.05	38.54	31.15	0.6	1.78	17.63	3.95	0.25	659	576
S_4: 30 cm x 10 cm	71.18	4.81	31.52	29.93	0.58	1.71	15.79	3.83	0.23	455	527
S.E.	1.53	0.12	0.96	0.6	0.01	0.01	0.55	0.09	0.01	24.6	21
CD (P=0.05)	4.5	0.33	2.71	1.73	0.03	0.02	1.6	0.25	0.02	71.3	60.9
C.V.%	3.9	8.85	9.51	6.91	6.55	2.9	11.1	8.1	9.21	13.8	7.1

Table 2 : Cost benefit ratio as influenced by sowing spacing in ashwagandha

Treatments	Gross realization (Rs ha^{-1})	Cost of cultivation (Rs ha^{-1})	Net realization (Rs ha^{-1})	CBR
S_1: Broadcasting	48650	13463	35187	3.61
S_2: 15 cm x 10 cm	41470	13463	28007	3.08
S_3: 22.5 cm x 10 cm	48570	13463	35107	3.61
S_4: 30 cm x 10 cm	39700	13463	26237	2.95

number of plants in a given area causing severe competition for moisture and nutrient resulting in more length of roots in search of water and nutrients as compared to the wider spaced plants whereas due to less number of plants in a given area a less competition for nutrient and moisture, resulted in more accumulation of dry matter in roots zone leads increased in root girth. The findings are closely conformity with Patel (2001), Agarwal *et al*. (2003) and Agarwal *et al*. (2004). The data presented in Table 1 indicated that broadcasting method produced significantly higher dry root yield (730 kg ha^{-1}) as compared to 15 cm x 10 cm and 30 cm x 10 cm spacing. However, 22.5 cm x 10 cm spacing produced significantly higher seed yield (576 kg ha^{-1}) as compared to 15 cm x 10 cm spacing. This might have been due to more availability of nutrients, moisture and other favourable environmental condition as well as soil factors for growth. The results for number of berries per plant, dry root yield and seed yield are in close proximity with those obtained by Agarwal (2003). However, Patel (2001) reported root : shoot ratio was higher under closer pacing due to higher plant population under closer spacing. The respective increased in root yield with broadcasting treatment was of the order of 16.1, 10.8 and 60.4 per cent over 15 cm x 10 cm, 22.5 cm x 10 cm and 30 cm x 10 cm spacing, respectively. Though, the yield attributes such as root girth and dry roots yield per plant were improved and recorded higher values with wider spacing (22.5 cm x 10 cm). The overall per hectare yield was found to decrease in wider spacing only due to less plant population in wider spacing as compared to broadcasting treatment. These findings are in agreement with those conducted by Nigam *et al*. (1984), Patel, (2001), Annoymous (2002) and Patel *et al*. (2004). The seed yield per hectare increased by increasing the spacing and found maximum with 22.5 cm x 10 cm spacing. This might have been due to more no. of branches, no. of berries, no. of seeds per berry, berry diameter and test weight in wider spacing as compared to narrow spacing. However, Patel (2001) found higher seed yield under broadcasting method.

Economics:

The data presented in Table 2 indicated that the broadcasting method gave maximum net realization of Rs.35187 ha^{-1} which was 25.64, 0.23 and 34.11 per cent higher than 15 cm x 10 cm (Rs.28007 ha^{-1}), 22.5 cm x 10 cm (Rs.35187 ha^{-1}) and 30 cm x 10 cm (Rs.26237 ha^{-1}), respectively. In respect of CBR, crop sown at broadcasting (S_1) recorded higher CBR of 3.61 followed by 22.5 cm x 10 cm spacing (3.61). Based on the findings and economics, it is concluded that the economically potential production of ashwagandha crop can be secured by sowing the crop with a broadcasting method under North Gujarat condition.

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