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Influence of Ratoon Crop on Growth and Yield Attributes and Resultant Seed Quality of Davana

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Abstract- Davana (Artemisia pallens wall.ex.D.C.) is an important high valued annual aromatic herb of India belonging to the family Asteraceae. A field experiment was conducted at TamilNadu agricultural university, Coimbatore during rabi 2011 to study the influence of ratoon crop on growth, yield attributes and resultant seed quality of davana. The experiment was laid out with four different treatments *viz.*, Stubbles cut at 5 cm height, Stubbles cut at 10 cm height, Stubbles cut at 15 cm height, Control (Normal crop) defoliation with the spacing of 15x7.5 cm and 125:125:75 NPK kg/ha were adopted in a randomized block design with five replications. Studies on ratoon crop revealed that defoliated seedlings improved the seed yield plot^{-1} (30.39 g), herbage yield plot^{-1} (980 g), germination (62%) and vigour index (148.8).

Index Terms- Ratoon crop, davana, crop growth, seed yield and seed quality.

I. INTRODUCTION

Aromatic plants are the natural source of perfumes and fragrance widely exploited by essential oil industries across the world. India stands 3rd in essential oil production in the world. Davana (Artemisia pallens wall.ex.D.C.) is an important high valued annual aromatic herb of India belonging to the family Asteraceae and commercially cultivated in south India as a short duration crop from November to march. India has a monopoly in production and export trade of davana oil. Davana is traditionally used in religious ceremonies and in making garlands, bouquets, floral decorations and floral chaplets, lends an element of freshness and a rich sumptuousness of fragrance to religious occasions (Narayana *et al*., 1998). Davana is being propagated through seeds. The productivity of any crop is the ultimate results of its growth and development. *Artemisia pallens* possesses anti-inflammatory, antipyretic and analgesic properties. It is used in Indian folk medicine for the treatment of Diabetes mellitus. (Al-Harbi *et al*., 1994). Ratooning is a method of harvesting a crop which leaves the roots and the lower parts of the plant uncut to give the ratoon or the stubble crop. The main benefit of ratooning is that the crop matures earlier in the season. Ratooning can also decrease the cost of preparing the field and planting. Hence, an attempt was made to study the effect of ratoon crop on the growth and yield attributes and resultant seed quality.

II. MATERIALS AND METHODS

Field experiments was conducted during rabi 2011 at TamilNadu Agricultural University Coimbatore to study the effect of different dates of transplanting on the growth and yield attributes and resultant seed quality of davana. The seeds of davana (*Artemisia pallens*) obtained from Horticultural college and Research Institute, Periyakulam was chosen for the study. The experiment was laid out in Randomized block design with five replications. Treatment details are Stubbles cut at 5 cm height, Stubbles cut at 10 cm height, Stubbles cut at 15 cm height and Control (Normal crop) defoliation with the spacing of 15x7.5 cm and 125:125:75 NPK kg/ha accommodating 90 plants/plot. Growth attributes such as plant height(cm), fresh weight of the seedling (g/plant), dry matter production, chlorophyll content of the seedling, days to first flower, days to 50% flowering, number of branches/plant. Yield attributes viz., number of flower heads/plant, seed yield/plant, seed yield/plot, 1000 seed weight, herbage yield/plot. Resultant seed quality such as germination (%)(ISTA,1999), seedling length (cm) the distance between the tip of the primary leaf to the tip of the primary root, vigour index (Abdul Baki and Anderson,1873) and Dry matter production (g seedlings^{-10}) dried in a hot air oven maintained at 85°C for 48h and cooled in a dessicator for 30 min and weighed in an electronic digital balance. The data obtained from experiments were analyzed by the 'F' test for significance following the method. Factorial Randomized Block Design as described by Panse and Sukhatme. 1985. Wherever necessary, the percent values were transformed to angular (Arc-sine) values before analysis. The critical differences (CD) were calculated at 5 per cent probability level. The data were tested for statistical significance.

III. RESULTS AND DISCUSSION

The results of Table 1 were followed. Significant difference was observed in the plant height at vegetative, flowering and maturity stages, plant height was highest with defoliated seedlings (51.84 cm) and the lowest with stubbles cut at 5 cm height (18.54 cm). At flowering stage, the maximum plant height was recorded by defoliated seedlings (53 cm) and the minimum height was recorded in stubbles cut at 5 cm height (39.31 cm). At maturity stage, defoliated seedlings recorded the higher plant height (52.30 cm) and the lowest height was recorded in stubbles cut at 5 cm height (47.63 cm). Fresh weight was highest in defoliated seedlings (8.82 g) followed by the Stubbles cut at 15 cm (7.53 g) and the lowest was recorded with stubbles cut at 5 cm height (5.56 g). At flowering stage, the

higher fresh weight of the seedlings (16.18 g) was recorded by defoliated seedlings, and the lowest was recorded in stubbles cut at 5 cm height (10.41 g). At maturity stage the maximum fresh weight of the seedlings was recorded by defoliated seedlings (13.94 g) followed by Stubbles cut at 15 cm (12.34 g) and the lowest value was recorded with stubbles cut at 5 cm height (9.31 g).

The results of Table 2 were followed. The higher dry matter production at maturity was observed in defoliated seedlings (5.56 g) and the lowest value was recorded with stubbles cut at 5 cm height (3.21 g). At flowering stage, the higher dry matter production of the seedlings (10.42 g) was recorded by defoliated seedlings, followed by stubbles cut at 15 cm (8.37 g) and the lowest value was recorded with stubbles cut at 5 cm height (6.56 g). At maturity stage, the maximum dry matter production of the seedlings recorded by defoliated seedlings (9.83 g) and the lowest value was recorded with stubbles cut at 5 cm height (6.04 g).At vegetative stage, the chlorophyll content was highest with stubbles cut at 15 cm (13) followed by stubbles cut at 10 cm (12) and the lowest value was recorded in defoliated seedlings (11). At flowering stage, the maximum chlorophyll content recorded by stubbles cut at 15 cm (13) and the lowest value was recorded in defoliated seedlings (10). At maturity stage, stubbles cut at 15 cm recorded the higher chlorophyll content (12) and the lowest value was recorded with defoliated seedlings (10).

The results of Table 3 were followed. Significant difference was noticed in days to first flowering, defoliated seedlings (41 days) attained early flowering, followed by stubbles cut at 15 cm (41 days) and the late flowering was noticed in stubbles cut at 5 cm height (46 days). For days to fifty per cent flowering, defoliated seedlings (45 days) attained early fifty per cent flowering, followed by stubbles cut at 15 cm (49 days) and the late fifty percent flowering was noticed in stubbles cut at 5 cm height (53 days).Significant difference was noticed in number of branches. The more number of branches was observed in defoliated seedlings (18.52) and the lowest value was recorded in stubbles cut at 15 cm (13.87).The maximum number of flower heads plant^{-1} recorded by defoliated seedlings (69) followed by stubbles cut at 15 cm (62) and the flower heads plant^{-1} was lowest in stubbles cut at 5 cm height (52.02).The maximum seed yield^{-1} plant was recorded by defoliated seedlings (4.32 g) followed by stubbles cut at 15 cm (4.22 g) and the seed yield was minimum in stubbles cut at 5 cm height (3.72 g).The maximum seed yield plot^{-1} was recorded by defoliated seedlings (30.39 g) which is on par with stubbles cut at 15 cm (29.72 g) and the seed yield plot^{-1} was minimum in stubbles cut at 5 cm height (25.67 g).1000 seed weight was highest in defoliated seedlings (135 mg) which is on par with stubbles cut at 15 cm (132 mg) and the 1000 seed weight was the lowest in stubbles cut at 5 cm height (114 mg). The maximum herbage yield plot^{-1} was recorded by defoliated seedlings (980.68 g) followed by stubbles cut at 15 cm (868.12 g) and the herbage yield was minimum in stubbles cut at 5 cm height (642.30 g).

The results of Table 4 were followed .Significant difference was observed in germination percentage due to ratoon treatments. The germination percentage was highest with defoliated seedlings (62%), which is on par with stubbles cut at 15 cm (59 %) and the germination was lowest in stubbles cut at 5 cm height (56%).The maximum seedling length was recorded by defoliated seedlings and stubbles cut at 15 cm (2.41 cm) and the seedling length was lowest in stubbles cut at 10 cm and stubbles cut at 5 cm height (2.31 cm).No significant difference was observed for dry matter production. The maximum vigour index was recorded by defoliated seedlings (148.80) followed by stubbles cut at 15 cm (141.60) and the vigour index was minimum in stubbles cut at 5 cm height (129.03).

The principle involved in ratoon cropping are that the ratoon crop has well developed root system, earlier maturity and the perennial nature. Ratooning can also decrease the cost of preparing the field and planting. Commercially davana is cultivated for herbage yield, hence to study the effect of ratoon crop this experiment was conducted with four treatments *viz.*, leaving the stubble height at 5 cm, 10 cm, 15 cm and defoliation of the leaves. Among these treatments, defoliated seedling recorded higher growth, and yield attributes. Plant height, number of branches, number of flower heads, seed yield plant^{-1}, seed yield plot^{-1} and herbage yield plot^{-1} were also higher for the stubbles cut at the height of 15 cm which was on par with the defoliated seedlings, and stubbles cut at the height of 5 cm recorded the lowest values. The reason might be the time taken and nutrients translocation will be lower in case of the stubbles cut at the height of 5 cm. (Fig.1 and 2).

Dry matter production is directly proportional to the ratio of seasonal transpiration (De Wit 1958; Hanks *et al*., 1969). In most situations, grain production is directly dependent upon total dry matter production (Hanks and Rasmussen 1982). In the present study stubbles cut at the height of 15 cm recorded higher dry matter production, seed yield, herbage yield, 1000 seed weight. This is probably because plants cut at a higher level utilized less energy in recovery compared to the lower stubble height. This observation is in conformity with the findings of Stockdale (2005) reported that aboveground total seed numbers and seed weights were generally greater for the higher defoliation height (7.0 vs. 2.8 cm) of subterranean clover (*Trifolium subterraneum* L.).

IV. Conclusion

The experiment was laid out with four different treatments *viz.*, Stubbles cut at 5 cm height, Stubbles cut at 10 cm height, Stubbles cut at 15 cm height, Control (Normal crop) defoliation adopted with the spacing of 15x7.5 cm and 125:125:75 NPK kg/ha. From the present investigation, Studies on ratoon crop revealed that defoliated seedlings improved the seed yield plot^{-1} (30.39 g), herbage yield plot^{-1} (980 g), germination (62%) and vigour index (148.8).

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Table 1. Influence of ratoon crop on growth attributes at different growth periods

	Plant height (cm)				Fresh weight of the seedling (g plant^{-1})			
Treatments	**Vegetative stage**	**Flowering stage**	**Maturity stage**	**Mean**	**Vegetative stage**	**Flowering stage**	**Maturity stage**	**Mean**
Stubbles cut at 5 cm height	18.54	39.31	47.63	35.26	5.56	10.41	9.31	9.24
Stubbles cut at 10 cm height	21.09	40.20	47.94	36.31	6.29	12.36	10.72	10.80
Stubbles cut at 15 cm height	22.63	42.59	49.35	38.19	7.53	14.62	12.34	12.41
Defoliated seedlings	51.84	53.00	52.30	52.38	8.82	16.18	13.94	14.09
Mean	**28.53**	**43.78**	**49.31**		**7.05**	**13.39**	**11.58**	
SEd	1.62	1.30	0.77		0.27	0.49	0.08	
CD (P=0.05)	3.54	2.83	1.68		0.60	1.08	0.18	

Table 2. Influence of ratoon crop on growth attributes at different growth periods

	Dry matter production of the seedling (g plant^{-1})				Chlorophyll content			
Treatments	**Vegetative stage**	**Flowering stage**	**Maturity stage**	**Mean**	**Vegetative stage**	**Flowering stage**	**Maturity stage**	**Mean**
Stubbles cut at 5 cm height	3.21	6.56	6.04	**5.27**	11	12	11	**11**
Stubbles cut at 10 cm height	4.31	7.59	7.13	**6.34**	12	12	11	**12**
Stubbles cut at 15 cm height	4.72	8.37	7.56	**6.88**	13	13	12	**13**
Defoliated seedlings	5.56	10.42	9.83	**8.60**	11	10	10	**10**
Mean	**4.45**	**8.23**	**7.64**		**12**	**12**	**11**	
SEd	0.187	0.32	0.31		0.2	0.1	0.0	
CD (P=0.05)	0.40	0.69	0.67		0.5	0.3	0.1	

Table 3. Influence of ratoon crop on yield attributes

Treatments	Days to first flowering	Days to 50% flowering	Number of branches	Number of flower heads plant^{-1}	Seed yield plant^{-1} (g)	Seed yield plot^{-1} (g)	1000 seed weight (mg)	Herbage yield plot^{-1} (g)
Stubbles cut at 5 cm height	46.21	53.45	16.55	52.02	3.72	25.67	114.00	642.30
Stubbles cut at 10 cm height	44.40	50.30	15.64	58.00	4.08	28.70	127.50	754.15
Stubbles cut at 15 cm height	42.60	48.70	13.87	62.00	4.22	29.72	132.00	868.12
Defoliated seedlings	40.80	44.50	18.52	69.00	4.32	30.39	135.00	980.68
Mean	**43.50**	**49.24**	**16.14**	**60.26**	**4.08**	**28.62**	**127.50**	**811.31**
SEd	0.77	1.01	0.42	1.51	0.02	0.08	2.47	5.99
CD (P=0.05)	1.67	2.21	0.93	3.30	0.06	0.18	5.38	13.06

Table 4. Influence of ratoon crop on resultant seed and seedling quality characters

Treatments	Germination (%)	Seedling length(cm)	Dry matter production (g seedlings^{-10})	Vigour index
Stubbles cut at 5 cm height	56 (48.44)	2.31	1.2	129
Stubbles cut at 10 cm height	55 (47.87)	2.31	1.2	127
Stubbles cut at 15 cm height	59 (50.18)	2.41	1.2	142
Defoliated seedlings	62 (51.94)	2.41	1.0	149
Mean	**58 (49.60)**	**2.36**	**1.2**	**136**
SEd	0.97	0.03	0.16	2.65
CD (P=0.05)	2.11	0.07	NS	5.79

Fig.1. Influence of ratoon crop on seed yield plant^{-1}(g) and herbage yield plant^{-1} (g)

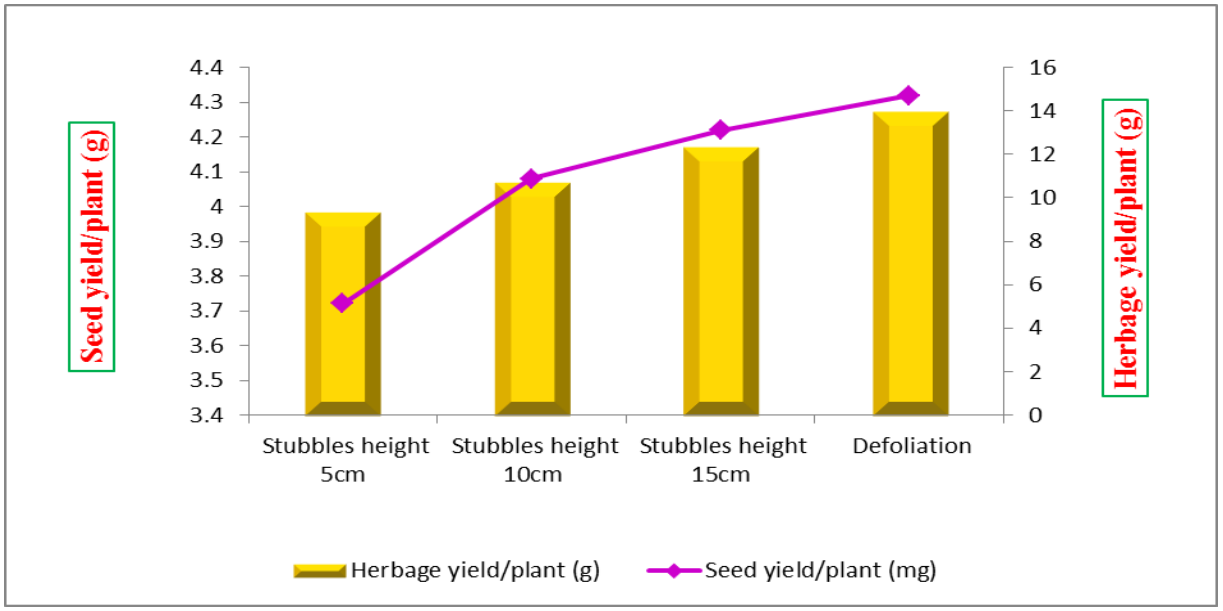

Fig.2. Influence of ratoon crop on 1000 seed weight (mg), germination (%) and vigour index