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Effect of transplanting age on seed yield and quality in Davana (*Artemisia pallens*)

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Davana (*Artemisia pallens* Wall ex. D.C.) is an important high valued annual medicinal and aromatic herb of India belonging to the family Asteraceae. An experiment was conducted at Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during 2011 to optimize the age of seedling for transplanting Davana to maximize the growth, herbage yield seed yield and seed quality attributes of Davana. The experiment was laid out with five different transplanting age of seedlings *viz*., 25-, 30-, 35-, 40- and 45-day-old seedlings in pot culture. The results revealed that 35-day-old seedlings exhibited better growth in terms of survival percentage (90%), plant height (45.1 cm), number of branches plant^{-1} (18.5), number of flower heads plant^{-1} (87.9), seed yield plant^{-1} (531.8 mg), 1000 seed weight (110 mg), resultant seed germination (64%) and vigour index (168).

Key words: Age of seedling for transplanting, Davana, dry matter, germination, herbage yield, seed yield, vigour.

INTRODUCTION

Aromatic plants are the natural source of perfumes and fragrance widely exploited by essential oil industries across 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 and India stands 3rd in essential oil production in the world. 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). *A. pallens* possesses anti-inflammatory, antipyretic and analgesic properties and it is used in Indian folk medicine for the treatment of Diabetes mellitus (Al-Harbi et al., 1994). The productivity of any crop is the ultimate results of its growth and development and which is mainly depended on the transplanting age of seedlings. Exact age of transplant would therefore be helpful in understanding the relationship between the physiological state of the transplant, its survival in the field and its growth responses under various cultural systems and environments. Since Davana is sexually propagated and then transplanted, an attempt was made to optimize the age of seedling for transplanting Davana to maximize the

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Table 1. Effect of age of transplanting on seedling characters.

Treatment	Field emergence (%)	Seedling length (cm)	Dry matter production (g seedlings^{-10})	Vigour index	Survival percentage (%)	Plant height (cm)
25 days seedlings	65 (53.73)	9.4	0.19	611	81 (64.15)	41.0
30 days seedlings	65 (53.73)	11.2	0.38	728	86 (68.02)	43.4
35 days seedlings	65 (53.73)	12.7	0.43	826	90 (71.56)	45.1
40 days seedlings	62 (51.84)	13.4	0.5	831	85 (67.21)	43.5
45 days seedlings	62 (51.84)	13.3	0.54	825	83 (65.65)	43.1
Mean	64	12	0.408	764	85 (67.21)	43.2
SEd	2.50	0.30	0.01	19.34	2.42	0.65
CD (P=0.05)	NS	0.64	0.03	41.23	5.16	1.40

Figures in parentheses indicate arc sine transformed values.

growth, herbage yield seed yield and quality.

MATERIALS AND METHODS

Pure seeds of Davana were obtained from the Horticultural College and Research Institute, Periyakulam. An experiment was conducted at Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during 2011. The experiment was laid out in a randomized complete block design with four replications. Five different transplanting age of seedlings viz., 25-, 30-, 35-, 40- and 45-day-old seedlings, with the spacing of 7.5 cm to accommodate 10 plants/plot. Based on recommendation 125:125:75 kg/ha. For single pot 6:6:3 mg/pot was calculated based on soil weight of the pot filled.

At the time of transplanting the seedling, seedling length (cm), dry matter production (g/10 seedlings) and vigour index observed. After transplanting, growth attributes such as plant height (cm), days to first flower, days to 50% flowering, number of branches/plant and yield attributes viz., number of flower heads/plant, seed yield/plant, seed yield/plot, 1000 seed mass and herbage yield/plot were recorded. 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) (Table 2). Dry matter production (g seedlings^{-10}) was achieved in an oven maintained at 85°C for 48 h and cooled in a dessicator for 30 min and then weighed in an electronic digital balance. The data obtained from experiments were analyzed by the 'F' test for significance following the method. Wherever necessary, the percent values were transformed to angular (Arcsine) values before analysis. The critical differences (CD) were calculated at 5% probability level.

RESULTS

No significant difference was observed for the field emergence (Table 1). Among the treatments evaluated, 25-day-old seedlings recorded the lowest seedling length, while the highest seedling length was recorded in 40-day-old seedlings, which was on par with that in the 45-day-old seedlings. Significant differences were recorded for dry matter production due to transplanting age of the seedlings. The higher dry matter production was record by 45-day-seedling followed by 40-day- seedling, and the lower dry matter production was recorded by 25-day-seedling. The maximum vigour index recorded by 40-day-seedling which was on par with 45-day-seedling and 35-day-seedling. For survival percentage, the maximum value was recorded by 35-day-seedling and the minimum value recorded by 25-day-seedling. The plant height significantly differed due to age of seedling. The plant height was highest for 35-day-seedling and the lowest plant height recorded by 25-day-seedling.

Among the treatments evaluated, the first flowering came by 35-day-seedling and the late first flowering was recorded by 25-day-seedling. For 50% flowering 25-day-seedling has taken the maximum days and 35-day-seedling has taken the minimum days. For number of branches, the minimum number was recorded by 25-day-seedling and the maximum number recorded by 35-day-seedling. The maximum number of flower heads per plant was recorded by 35-day-seedling and the minimum number of flower heads per plant was recorded by 25-day-seedling. A significant variation in single plant yield was observed due to transplanting age of seedling. The maximum seed yield was recorded by 35-day-seedling and the minimum seed yield was recorded by 25-day-seedling. The higher 1000 seed weight recorded by 35-day-seedling and 25-day-seedling recorded lower 1000 seed weight.

Significant difference was observed in resultant seed quality characters due to transplanting age of seedling. The higher values recorded by the 35-day-seedling and the lower values recorded by the 25-day-seedlings for germination (%), seedling length, dry matter production and vigour Index (Table 3).

DISCUSSION

The age of seedlings at the time of transplanting is also an important contributor for better performance of seedlings. The effect of transplant age on yield is an issue often investigated by growers to maximize production potential. Amongst various factors affecting the yield, lack of high yielding cultivars, supply of inadequate amount of farm yard manure, the age of seedlings at the time of transplanting is an important

Table 2. Effect of age of transplanting on yield attributes.

Treatment	Days to first flowering	Days to 50% flowering	Number of branches plant^{-1}	Number of flower heads plant^{-1}	Seed yield plant^{-1} (g)	1000 seed weight (mg)
25 days seedlings	50	57	16.2	76.2	4.19	100
30 days seedlings	46	56	17.1	80.6	4.61	101
35 days seedlings	45	53	18.5	87.9	5.31	110
40 days seedlings	48	55	18.0	82.4	4.44	106
45 days seedlings	49	56	17.6	77.8	4.27	104
Mean	48	55	17.48	80.98	4.56	104
SEd	1.35	1.39	0.49	1.23	11.53	2.97
CD (P=0.05)	2.89	2.97	1.06	2.64	24.59	6.33

Table 3. Effect of age of transplanting on resultant seed quality.

Treatment	Germination (%)	Seedling length (cm)	Dry matter production (mg seedlings^{-10})	Vigour index
25 days seedlings	58(49.60)	2.23	1.20	129
30 days seedlings	60(50.76)	2.31	1.22	139
35 days seedlings	64(53.13)	2.62	1.23	168
40 days seedlings	62(51.94)	2.45	1.21	152
45 days seedlings	61(51.35)	2.38	1.20	145
Mean	61(51.35)	2.40	1.21	146
SEd	0.66	0.01	0.00	2.25
CD (P=0.05)	1.45	0.04	0.01	4.90

factor (Safina et al., 2006). Hence, the experiment was conducted to optimize the age of transplanting for davana seedlings to maximize the seed yield.

Among the age of seedlings, seedlings transplanted at 35 days recorded the higher vigour index survival percentage. The survival percentage is decreased with increase in the age of seedlings. Plant height of the seedling significantly affected by various ages of transplants. At 35 days old seedlings recorded maximum height followed by 30 and 40 days seedlings. Hence, it could be hypothesized the temperature is quite suitable for younger seedling for better growth. Maximum number of branches (18.5) found in 35 days old seedlings where as the aged seedlings (45 days) transplants produced less number of branches. Overall younger seedlings produced higher numbers of branches than older seedlings, which might be due to less root damage and minimum transplanting shock, as younger seedlings can more easily establish themselves after transplanting in the main field (Naeem et al., 2011). These results agree with the findings of (Shin et al., 1999) in chilly plants and also (Safina et al., 2006). The reason might be the plants are enforced to stop their growth at particular level of temperature. Similar trend was also observed in seed yield and 1000 seed weight. 1000 seed weight is an important yield contributor that depends on genetic makeup and is the least affected by growing conditions (Ashraf et al., 1999). The seedlings transplanted at the age of 35 days recorded highest seed yield and 1000 seed weight. This might be due to the transplanting of vigorous seedlings. The seed quality characters were significantly influence by transplanting age of seedling. The physiological potential of the seed in terms of germination (64%) and vigour index (168) were higher with the seedling transpalanted at the age of 35 days.

From this study, it can be concluded from all the parameters that 35 days old transplant exhibited best growth in terms of vigour index, survival percentage, plant height, number of branches plant^{-1}, number of flower heads plant^{-1}, seed yield plant^{-1}, 1000 seed weight, resultant and seed germination.

Conflict of Interests

The authors have not declared any conflict of interests.

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