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Effect of Sowing Depths on Seed Germination of *Salvia sclarea* L. and *Rosmarinus officinalis* L.

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Abstract

A field experiment was conducted to assess the effect of sowing depths on seed germination of *Salvia sclarea* L. and *Rosmarinus officinalis* L. Results indicated that sowing depths markedly influenced the germination in both the crops. The maximum seed germination of 60.50 and 48.43% was recorded in *S. sclarea, R. officinalis*, respectively at 0.5 cm sowing depth. The other germination parameters viz., mean daily germination, peak value, germination value and germination energy index also gave the maximum value at this sowing depth. Thereafter, the germination per cent declined with increase in sowing depth and no germination was recorded beyond 2.0 cm.

Key words : *Salvia sclarea* L., *Rosmarinus officinalis* L., Sowing depth, Germination

Aromatic plants have been used in India since the last thousands of years as perfumery material. Frequent mention about the use of essences, perfumes, scented water, sandal, camphor and saffron for religious functions and marriage ceremonies are found in 'Vedas'. Aromatic plants were featured in personal adornment and beautification of home. At one time perfumes were considered as sign of luxury and were used by urban rich. It is not true now a days because of our day to day requirements like soaps, cosmetics, toothpastes, mouth washes, shampoos, detergents, household sprays, confectioneries, pharmaceuticals, agarbatties, include the use of suitable essential oils due to fragrance. Despite the low level of per capita income in India as compared to developed countries, there exists a large class of consumers for essential oils based products. The wide range of edaphic and climatic conditions of Himachal Pradesh offers an ample scope for introduction and cultivation of large number of aromatic plants of interest to the perfumery and flavouring industry. Clary sage (Salvia sclarea L.) and rosemary (Rosmarinus officinalis L.) were introduced at Solan, Himachal Pradesh from Bulgaria and Hungary, respectively through NBPGR, New Delhi. Clary sage is a medium sized (60—90 cm), perennial, cold and drought resistant aromatic plant. Essential oil of clary sage is valuable perfumery raw material. It is used in flavoring of alcoholic and non--alcoholic beverages, ice creams, candy and baked goods (1). The oil also exhibited analgesic action, anti-inflamatory activity (2) and cytotoxic activity (3). Rosemary is a dense evergreen shrub, up to one meter in height with a characteristics aromatic smell. Its essential oil is used in perfumery for scenting of toilet water, soaps and flavoring of food products. Rosemary oil is also known to have anti-oxidative (4), anti-fungal (5), anti-malarial (6) property and vascular smooth muscle relaxant effect (7).

One of the important agronomic practices that costs nothing but gives greater benefits is the depth of sowing. Optimum depth of sowing is needed for better availability of moisture, avoidance of bird damage and attack and uniform germination of seeds. Depth of sowing varies from shallow to deep depending on soil type, moisture condition and size of seed. Larger sized seeds contain considerable energy stored and can grow for longer time without becoming photosynthetically dependent. Hence larger seeds are sown deeper than the smaller sized seeds with a limited energy store. Keeping in view the multifarious uses and lack of sufficient agro-techniques of clary sage and rosemary, a study was carried out to

evaluate the sowing depth for getting maximum germination.

Methods

The field experiment was conducted at experimental farm of Dr YS Parmar University of Horticulture and Forestry, Nauni-Solan, Himachal Pradesh to find out the best sowing depth of *Salvia sclarea* L. and *Rosmarinus officinalis* L. The experimental site falls under mid-hill zone of Himachal Pradesh. Soil was sandy loam in texture with pH 7.75. The experiment was laid out in randomized block design with seven treatments and four replications. Treatments included were different sowing depths viz., 0.5 cm (T_1), 1.0 cm (T_2), 1.5 cm (T_3), 2.0 cm (T_4), 2.5 cm (T_5), 3.0 cm (T_6) and surface sowing (T_0). Mature and cleaned seeds were sown in October and nursery beds were irrigated immediately after sowing. Thereafter, regular irrigation was done and weeding was done as and when required. Daily germination was recorded and germination per cent, mean daily germination, peak value, germination value, germination energy index were worked out. The results obtained were statistically analyzed under randomized block design (8).

Results and Discussion

The different sowing depths exhibited significant effect on germination percent of both the crops. The results obtained are discussed below.

Salvia sclarea L.

The results of effect of sowing depths on seed germination reveal that the germination of *Salvia sclarea* seeds varied significantly among different treatments (Table 1). The highest germination (60.50%) was observed when seeds were sown at 0.5 cm depth. All the germination parameters viz., mean daily germination (1.95%), peak value (2.58%), germination value (5.03%) and germination energy index (194.88%) registered maximum value at 0.5 cm sowing depth. With further increase in sowing depth the germination per cent declined and the lowest germination (10.50%) was recorded at 2.0 cm depth. Thereafter, seed did not germinate at 2.5 and 3.0 cm sowing depths.

Table 1. Effect of depth of sowing on seed germination of *Salvia sclarea* L. Figures in parentheses are arcsine transformed values.

Treatment	Germination (%)	Mean daily germination (%)	Peak value (%)	Germination value (%)	Germination energy index (%)
T_0	13.50 (21.52)	0.44	0.75	0.33	64.19
T_1	60.50 (51.09)	1.95	2.58	5.03	194.88
T_2	51.50 (45.86)	1.66	2.04	3.39	174.38
T_3	36.00 (36.87)	1.16	1.27	1.47	112.18
T_4	10.50 (18.85)	0.34	0.35	0.12	49.64
T_5	0.00 (0.00)	0.00	0.00	0.00	0.00
T_6	0.00 (0.00)	0.00	0.00	0.00	0.00
$CD_{0.05}$	(2.46)	0.08	0.23	0.49	13.97

Rosmarinus officinalis L.

Table 2 shows that Rosmarinus officinalis seeds responded in the same way to different sowing depths as in S. sclarea by giving the maximum germination (48.43%) at 0.5 cm sowing depth. Mean daily germination (1.56%), peak value (2.97%), germination value (4.63%) and germination energy index (57.18%) also registered the maximum value at 0.5 cm sowing depth. The minimum germination (5.09%) was recorded at surface sowing. No germination was recorded when seeds were sown at 2.5 cm and 3.0 cm depths.

The results revealed that surface sowing and deep sowing depth greatly reduced the germination in both the crops (Tables 1 and 2). It may be due to the reason that in deep sowing, the radical of seed-

Table 2. Effect of depth of sowing on seed germination of *Rosmarinus officinalis* L. Figures in parentheses are arcsine transformed values.

Treatment	Germination (%)	Mean daily germination (%)	Peak value (%)	Germination value (%)	Germination energy index (%)
T_0	5.09 (2.14)	0.16	0.68	0.11	20.76
T_1	48.43 (40.36)	1.56	2.97	4.63	57.18
T_2	40.16 (34.89)	1.30	1.92	2.50	50.86
T_3	31.19 (27.59)	1.01	1.70	1.72	43.19
T_4	15.08 (10.21)	0.49	0.72	0.35	35.18
T_5	0.00 (0.00)	0.00	0.00	0.00	0.00
T_6	0.00 (0.00)	0.00	0.00	0.00	0.00
$CD_{0.05}$	(2.10)	0.28	0.32	0.49	2.46

lings remain embedded too deep and are not able to emerge out ; hence no germination occurred below 2.0 cm sowing depth. These results are in conformity with the findings of Hartmann and Kester (9). The present findings are also similar to those reported by Hildebrandt and Schulz (10) that on an average, more seeds emerged from soil covered seed than from surface sown seeds. The seed of both the crops is smaller in size and smaller sized seeds are not sown deeper as they contain limited energy stored as compared to large sized seeds which can be sown at deeper depth. Similarly, Letchamo and Gosselin (11) also suggested that seeds of dandelion *(Taraxacum officinale)* should not be sown at deeper depth, if faster and uniform germination is desired.

From this study it is concluded that *S. sclarea* and *R. officinalis* seeds may be sown at 0.5 cm sowing depth to get maximum germination.

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