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Effect of spacing on growth and yield of V*iola pilosa*

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A field experiment was conducted to determine effect of spacing on growth and yield of *Viola pilosa* at UHF, Nauni-Solan during 2002-2003. Study revealed that maximum plant height (19.72 cm) was found in 20x20 cm spacing, which was significantly superior all other spacings. Similarly, number of leaves (19.74), number of flowers (2.32) and fresh and dry flower weight (0.20 and 0.07g,). The values for yield parameters viz., fresh and dry flower yield (150.0 and 40.0 kg/ha) and fresh and dry herb yield (397.90 and 99.47 q/ha) were maximum in 10x10 cm spacing. The values decreased with the further increase in spacing and minimum yield was obtained at the wider spacing of 30x30 cm

Key words : *Viola pilosa*, Biofertilizers, Growth, Yield, Spacing.

INTRODUCTION

Viola pilosa Blume syn. *Viola serpens* Wall ex Ging is a member of family Violaceae. It is mainly distributed in the temperate Himalayas upto an altitude of about 2000 m, extending eastwards to the hills of Meghalaya, Nagaland, Manipur, towards south in Ganjam hills in Orissa, Nilgiri and Palini hills in Tamil Nadu at an altitude of 1500-2000 m. The herb constitutes a part of the commercial banafsha and is similar to those of *Viola odorata*. The plant is in high demand both in Ayurveda and other systems of medicines for its diverse medicinal uses viz. A medicinal oil (Roghani-banafsha) is prepared, treatment of lung trouble and in blood disorders (Raizada and Saxena, 1978; Bhattacharjee, 2001), as an expectorant, diaphoretic, antipyretic, diuretic, laxative in billionus affections, as a household remedy for infantile disorders, cough, cold, sore throat and hoarseness (Kheterpal *et al*., 1987). It is also useful in asthma, bleeding piles, cancer of throat, constipation, fever, headache and skin diseases (Anonymous, 1986).

The unsystematic exploitation of important drug yielding plants to support pharmaceutical industry has been identified as one of the biggest cause for loss of many species (Lewin, 1986; Wilson, 1988). Their regeneration and protection in nature is today a challenge to restore our biological heritage. The rich repositories of the past have been ruthlessly exploited and several species of drug plants are facing threat to their survival. The cultivation, protection and conservation of these plants are thus necessary to provide sustainable supply of crude drugs and also to ease pressure on natural resources. Keeping in view, the above factors the present work was undertaken on development of agro-technique of *Viola pilosa* Blume, under two experiments viz. effect of spacing and response of organic manure and biofertilizers on growth and yield

MATERIALS AND METHODS

The field study was conducted at the experimental area of the Department of Forest products, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni-Solan. The area is mid hill zone of Himachal Pradesh (35° 52' N Lat., 70° 11' E Long., 1235 m asl alt.), India.. There were nine spacings (Treatments) laid out in Randomized Block Design with three replications. Treatments were T_1- 10×10 cm , T_2- 10 × 15 cm, T_3- 15× 15 cm, T_4- 15 ×20 cm , T_5 - 20×20, T_6- 20×25 cm T_7- 25×25 cm T_8- 25×30 and T_9- 30×30 cm. Plots size was 1×1 m and farm yard manure was applied to enriched the field before planting the plants. The field was irrigated immediately after transplanting and subsequently once in three days in earlier stage and once in week at later on. The crop was harvested after one growing season. The observations were recorded on growth parameters (plant height, number of leaves and number of flowers) and yield parameters (fresh flower weight, dry flower weight, fresh yield and dry yield, fresh herb yield and dry herb yield) by selecting five plants in each plot. The data collected on various parameters was subjected to statistical analysis for drawing

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RESULTS AND DISCUSSION

Growth and biomass :

With the increase in spacing, it was found that plant height, number of leaves per plant, number of flowers per plant, resulting into more plant height, more number of leaves and more number of flowers as compared to closer spacing. Similar results have been reported by Sood *et al*. (1996) in *Melissa officinalis*. At wider spacings above 20x20 cm i.e. 20x25 cm, 25x25 cm, 25x30 cm and 30x30 cm, there was no further increase in plant height, number of leaves, number of flowers and flower weight and the values obtained for these parameters were statistically at par with each other and with the values obtained at 20x20 cm spacing (Table 1). This may be because of the fact that in wider row spacings, the plant population was less and due to inherent plant architecture, it could not put up much growth so as to utilize available nutrients and cover given space. These results are in line with those of Sood *et al.* (1997) in *Matricaria chamomilla*.

Table 1 : Effect of plant density on growth of *Viola pilosa*

Spacings (cm)	Plant height (cm)	No. of leaves/ plant	No. of flowers/ plant
T_1 (10x10)	9.48	10.07	1.57
T_2 (10x15)	12.86	12.26	1.68
T_3 (15x15)	14.08	14.63	1.82
T_4 (15x20)	15.99	16.43	1.86
T_5 (20x20)	19.72	19.74	2.32
T_6 (20x25)	19.11	19.48	2.01
T_7 (25x25)	18.48	19.17	1.87
T_8 (25x30)	18.75	18.86	1.72
T_9 (30x30)	18.27	18.62	1.63
C.D. at 5%	1.73	1.18	0.45

fresh flower and dry flower weight per plant showed significant increase upto 20x20 cm spacing (Table 1). Maximum plant height (19.72 cm) was found in 20x20 cm spacing, which was significantly superior to 10x10 cm (9.48 cm), 10x15 cm (12.86 cm), 15x15 cm (14.08 cm) and 15x20 cm (15.99 cm) spacings. Similar trend was obtained in number of leaves per plant, number of flowers per plant and fresh and dry flower weight per plant. It may be due to the fact that at medium spacing with optimum plant density, the competition between the plants for nutrients, light, water etc. was relatively low,

Table 2 : Effect of spacings on production potential of *Viola pilosa*

Spacings (cm)	Fresh flower weight/ plant (g)	Fresh flower yield (kg/ha)	Dry flower weight/ plant (g)	Dry flower yield (kg/ha)	Fresh herb yield (q/ha)	Dry herb yield (q/ha)
T_1 (10x10)	0.15	150.00	0.04	40.00	397.90	99.47
T_2 (10x15)	0.16	96.00	0.05	30.00	298.32	74.57
T_3 (15x15)	0.17	61.00	0.05	18.00	211.49	52.85
T_4 (15x20)	0.18	54.00	0.06	18.00	198.35	49.57
T_5 (20x20)	0.20	50.00	0.07	17.50	184.71	46.17
T_6 (20x25)	0.19	38.00	0.06	12.00	161.33	40.32
T_7 (25x25)	0.19	30.40	0.06	9.60	121.96	30.47
T_8 (25x30)	0.18	21.60	0.05	6.00	85.29	21.32
T_9 (30x30)	0.18	16.20	0.05	4.50	81.03	20.25
C.D. at 5%	0.02	12.61	0.01	2.63	84.87	2.34

Flower yield :

The values for yield parameters viz., fresh and dry flower yield (150.0 and 40.0 kg/ha) and fresh and dry herb yield (397.90 and 99.47 q/ha) were maximum in 10x10 cm spacing. The values decreased with the further increase in spacing and minimum yield was obtained at the wider spacing of 30x30 cm (Table 2). This may be due to the fact that more number of plants is accommodated per unit area at closer spacing of 10x10 cm resulting into higher yields. The present investigations are in line with the findings of Zelecki (1972) in *Matricaria chamomilla*; Vadiel *et al.* (1980) in *Mentha citrata*; Randhawa *et al.* (1984b) in *Mentha spicata*; Ramchandra *et al.* (2002) in *Pogostemon cablin*.

The present study showed that 20X20 cm density of plants is batter for growth and biomass where as, 10X10cm spacing can be considered for herb yield in field.

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