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Influence of Nitrogen and Spacing on the Performance of *Allium odorosum* under Mid-altitude Foothill condition of Manipur

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ABSTRACT

Allium odorosum, locally known as Maroi Nakupi in Manipuri, is one of the important underutilized herbal spices of mid-altitude sub-Himalayan region. The present study was undertaken to find out the effect of nitrogen and spacing on *Allium odorosum* with three levels of nitrogen (45, 60 and 75 kg/ha) and six levels of spacing (15x7.50 cm^2, 15x10 cm^2, 15x12.50 cm^2, 20x7.50 cm^2, 20x10 cm^2 and 20x12.50 cm^2) under foothill condition of Manipur. Nitrogen dose has significantly increased all the growth and yield characters. Irrespective of spacing, maximum leaf yield (8 t/ha) was recorded with nitrogen dose of 75 kg/ha. Spacing also influenced significantly all the characters under study except width of leaf. Irrespective of nitrogen dose, the closest spacing (15x7.50 cm^2) recorded the highest leaf yield (10.28 t/ha) followed by 15 X 10 cm^2 (7.80 t/ha) due to higher plant population. Although higher number of leaves per plant (28.21) was recorded at wider spacing (20x12.50 cm^2), it could not compensate the gain in yield due to more plant population under close spacing. Interaction between nitrogen and spacing was also found to be significant for most of the characters. Maximum leaf yield (11.20 t/ha) was recorded in plants grown with higher nitrogen dose (75 kg/ha) and closest spacing (15x7.50 cm^2), followed by medium nitrogen dose (60 t/ha) and closest spacing of 15x7.50 cm^2 (10.58 t/ha).

Key words: *Allium odorasum*, Manipur, Maroi Nakupi, nitrogen, spacing

INTRODUCTION

Manipur, one of the North Eastern states of India, known for its diverse flora is the treasure trove of many indigenous wild food plants. The ethnic communities inhabiting the Manipur state use about 400 species of wide varieties of wild plants, ranging from algae to angiosperms as food (Anonymous 1994). *Allium odorosum* belongs to the family Liliaceae, locally known as "*Maroi Nakupi*" is one of the perennial spices grown in almost home gardens in the Manipur valley (Premila and Chetry 2013). It is a perennial herbaceous plant forming dense clump, 20-40 cm tall with prominently spreading rhizome and has 4-9 leaves. The leaves are harvested 45-60 days after planting and the same plant may continue to produce many years if optimum requirement of soil moisture and proper fertilization is done during the growing period. The cold tolerant cultivar (locally known as Ningtham Sidabi) which can thrive in frosty winter is also found in Manipur. Hence, the crop can be grown throughout the year. The young leaves and inflorescences flavour like garlic and are used for culinary purposes daily in majority of the houses in Manipur for seasoning food. They may be eaten as blanched or green. It also replaces onion in many of the religious feasts where onion is considered as taboo. It has been traditionally used in folklore medicine as diuretic, wormicide, and has antifungal, antibacterial properties. its juice is used to cure baldness. The crop is rich in various nutrients. The young leaves contain Vitamin A, L-Ascorbic Acid and Calcium. The seed contains high

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amount of oil (15.8%), dietary fibre (18.2%) and crude protein (12.3%). Seeds oil is composed of 10% saturated and 90% unsaturated fatty acid. The leaves is an excellent source of calcium, phosphorus, zinc and iron. It also contains antioxidants and amino acids. The crushed leaves is directly applied on the head for improving hair growth and help in reducing tension. Fresh or boiled leaves are used for normal flow of urine (Singh et al. 2012). In Peru, it is being used for bronchitis and asthma (Bussmann and Glenn 2010). It is commonly seen in the local markets preferred by the local people in North Eastern Region. Its cultivation is mostly concentrated around the cities and towns where the market facility is available. In spite of its immense potential, the crop has not yet been grown commercially by the farmers due to lack of knowledge on production technology. Given this backdrop, an attempt has been made to standardize the production technology with special emphasis on spacing and nitrogen dose for *Allium odorosum* under foot hill conditions of Manipur.

MATERIALS AND METHODS

The study was carried out at Langol Hill Research Farm of ICAR Research Complex for North East Hill Region, Manipur Centre, located between 23.83^{0}N and 25.68^{0}N latitude and 93.03^{0}E and 94.78^0 E longitudes at an elevation of 790 m above mean sea level. The site experienced temperatures ranging from 3.6^{0}C-30.2^{0}C and average rainfall of 1340.6 mm during the experimental period. The soils at the site were acidic in nature with pH 5.00 and shallow in depth. The experiment was laid out in split plot design with three replications. The treatments involved three nitrogen doses as main plots viz., N_1-45 kg/ha, N_2-60 kg/ha and N_3-75 kg/ha and six spacing as sub plots viz., S1-15x7.50 cm^2, S2- 15x10 cm^2, S3-15x12.50 cm^2, S4-20x7.50 cm^2, S5-20x10 cm^2 and S6-20x12.50 cm^2. Suckers of *Allium odorosum* were planted on raised beds of 1.20x1.50 m^2 size during April and the study was continued for two years. The plots were top dressed with urea after each harvest as per the treatments. Phosphorous and potassium fertilizers were applied uniformly to all plots @ 60 kg/ha along with 10 t/ha FYM before planting. Weeding and earthing up was done in all the plots uniformly. Matured leaves were harvested regularly at lush green stage (before turning into yellow) and weighed on a digital balance. Growth and yield characters were recorded on ten randomly selected plants in all the treatments such as number of suckers per plant, leaves per plant, weight of harvested leaves per plant, length of leaf, width of leaf and leaf yield/ha. Data were analyzed by Statistical Analysis System (SAS) software (Version 9.1) for analysis of variance and differences among means were compared at $P<0.05$.

RESULTS AND DISCUSSION

The experimental results indicated that nitrogen and spacing significantly influenced growth and yield of *Allium odorosum* (Table 1). Spacing also influenced all the characters except width of leaf. The number of suckers and leaves per plant increased progressively with increase in nitrogen dose. Irrespective of spacing, maximum number of suckers/plant (6.15), leaves/plant (29.27), length of leaves (26.27 cm) and width of leaves (0.60 cm) were recorded with higher nitrogen dose of 75 kg/ha; whereas, minimum number of suckers per plant (5.14), number of leaves per plant (25.59) and shortest (23.8 cm) and narrow leaves (0.49cm) were found in plants grown with low nitrogen dose (45kg/ha). Kumar et al. (1998) reported higher number of leaves with higher dose of nitrogen in onion. Wilman and Joy Pearse (1984) also observed increased number of tillers and rate of emergence of new tillers in field swards by application of nitrogen. Purushotham et al. (1992) also reported that the plant height and tiller number improved with increase in nitrogen dose in hybrid napier grass.

Spacing also significantly affected the number of suckers per plant, length of leaf and number of leaves per plant. Irrespective of nitrogen dose, highest number suckers per plant (5.82) and length of leaf (25.20 cm) was recorded with a spacing of 20x10 cm^2; whereas, maximum number of leaves per plant (28.21) was associated with wider spacing (20x12.50 cm^2). The results are similar to Weerasinghe et al. (1994), They reported that increasing plant competition significantly decreases seedling leaf number in onion. Mari et al. (1997) and Rizk (1997) also reported that lower planting density resulted in higher number of leaves per plant of onion. The assumptions are also similar to Singh

Table 1 : Effect of nitrogen and spacing on growth and yield in *Allium odorosum*

Treatments	No. of suckers /plant	No. of leaves / plant	Length of leaf (cm)	Width of leaf (cm)	Weight of leaves /plant (g)	Green leaf Yield / ha (t)
Nitrogen dose (N)						
N_1 (45kg/ha)	5.14	25.59	23.81	0.49	10.15	5.98
N_2 (60kg/ha)	5.52	26.99	24.22	0.52	11.81	7.21
N_3 (75kg/ha)	6.15	29.27	26.21	0.60	13.26	8.00
CD (P=0.05)	0.20	0.73	0.34	0.01	0.47	0.45
Spacing (S)						
S_1 (15x7.5 cm^2)	5.53	26.38	24.6	0.54	11.66	10.28
S_2 (15x10 cm^2)	5.49	26.86	24.2	0.53	11.68	7.78
S_3 (15x12.5 cm^2)	5.41	27.23	24.7	0.54	11.72	6.27
S_4 (20x7.5 cm^2)	5.57	27.09	24.7	0.53	11.68	7.35
S_5 (20x10 cm^2)	5.82	27.93	25.2	0.54	11.87	5.94
S_6 (20x12.5 cm^2)	5.80	28.21	25.0	0.53	11.84	4.77
CD (P=0.05)	0.23	0.33	0.43	NS	0.13	0.32
Nitrogen x Spacing (N X S)						
N_1 x S_1	5.19	25.70	24.41	0.51	10.18	9.05
N_1 x S_2	5.10	25.27	23.13	0.50	10.56	7.02
N_1 x S_3	4.80	25.13	23.71	0.47	10.03	5.38
N_1 x S_4	5.13	24.93	23.90	0.49	10.09	5.41
N_1 x S_5	5.40	26.60	24.23	0.51	10.08	5.04
N_1 x S_6	5.24	25.90	23.46	0.46	9.97	3.99
N_2 x S_1	5.46	26.43	23.68	0.53	11.90	10.58
N_2 x S_2	5.26	26.13	23.58	0.51	11.53	7.69
N_2 x S_3	5.23	26.70	24.20	0.53	11.70	6.24
N_2 x S_4	5.58	27.50	23.86	0.51	11.80	7.87
N_2 x S_5	5.76	27.30	24.75	0.52	12.00	6.00
N_2 x S_6	5.80	27.90	25.23	0.52	11.95	4.88
N_3 x S_1	5.94	27.00	25.71	0.58	12.91	11.20
N_3 x S_2	6.10	29.17	25.86	0.59	12.96	8.64
N_3 x S_3	6.21	29.87	26.18	0.61	13.42	7.17
N_3 x S_4	5.99	28.83	26.45	0.60	13.14	8.76
N_3 x S_5	6.31	29.90	26.76	0.60	13.54	6.77
N_3 x S_6	6.36	30.83	26.28	0.61	13.61	5.44
CD (P=0.05)	NS	0.57	0.75	0.02	0.22	0.56

NS = Non-significant

and Sachan (1999) who stated that greater number of onion leaves was found at wider spacing.

The interaction between nitrogen dose and spacing was also found to be significant for all the growth and yield characters under study except suckers per plant. Among the treatment combinations, maximum number of leaves per plant (30.83) and broadest leaves (0.61 cm) were recorded with 75 kg N/ha and 20x12.50 cm^2 spacing; whereas, longest leaves (26.76 cm) were found with 75 kg N/ha and 20x10 cm^2 spacing. Although wider spacing recorded longer leaves it was not conspicuous.

Leaf yield was also significantly influenced by nitrogen dose and plant spacing. Maximum weight of leaves per plant (13.26 g) and green leaf yield (8.00 t/ha) was recorded with higher nitrogen dose (75 kg/ha) while the minimum weight of leaves per plant (10.15g) and leaf yield (5.98 t/ha) was observed with the application of 45 kg N/ha. Spacing significantly influenced the weight of leaves and green leaf yield. The weight of leaves was increased with increase in plant spacing and maximum weight of leaves per plant (11.87 g) was recorded at wider spacing (20x10 cm^2), which is statistically at par with 20X12.50 cm^2 spacing. Rao

et al. (2006) also reported similar results in *Allium odorosum*. However, maximum green leaf yield (10.28 t/ha) was recorded with 15x7.50 cm^2 spacing. Minimum yield of green leaf (4.77 t/ha) was associated with 20x12.50 cm^2 spacing due to lowest plant population. Increase in weight of leaves is obvious with increase in spacing due to the fact that competition for nutrition will be more at higher plant population. This may be attributed to the fact that leaf in *Allium odorosum* acts as both photosynthetic site as well as sink.

Interaction between nitrogen dose and plant spacing was found to be significant for weight of leaves per plant and green leaf yield. Maximum weight of leaves per plant (13.61g) was recorded with the application of 75 kg N/ha and 20x12.50 cm^2 spacing; whereas, minimum weight of leaves (9.97 g) was found in plants grown with 75 kg N/ ha and spaced at 15x7.50 cm^2. Contrary to this, highest green leaf yield of 11.20 t/ha was recorded with 75 kg N/ha and 15x7.50 cm^2 spacing; followed by 10.58 t/ha with 60 kg N/ha and 15x7.50 cm^2 spacing and 9.05 t/ha with 45 kg N/ha and 15x7.50 cm^2 spacing. Plant population was found to show more influence than nitrogen dose in maximizing the green leaf yield. The lowest leaf yield (3.99 t/ ha) was associated with 45 kg N/ha and 20x12.50 cm^2 spacing. Although number of leaves and weight of leaves per plant increased with spacing it could not compensate the yield of closely spaced plants due to higher plant population. The interaction effect of nitrogen dose and plant spacing on sucker production was found to be insignificant. Hence, the study suggests that growing *Allium odorosum* at a spacing of 15x7.50 cm^2 and application of nitrogen at 75 kg/ha would be helpful to enhance the green leaf yield under foothill condition of Manipur.

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