

Chapter - V

EFFECT OF VARIATION OF SPACING ON THE GROWTH AND DEVELOPMENT OF *Cymbopogon pendulus* (Nees ex Steudel) W. Watson IN DARJEELING CONDITION.

INTRODUCTION

Cymbopogon pendulus (Nees ex Steudel) W. Watson grows as a weed in Darjeeling district of West Bengal. As the plants are tall and spreading and having with a number of tillers, it is necessary to select suitable spacing for growing the plants so that maximum number of tillers and herbage ^{ie} yield could be possible to be obtained at the time of harvest.

It has been noted that various spacing has so far been taken into consideration specially in connection with different commercial species of *Cymbopogon* (Dimri et al, 1973; Ganguly, 1973; Bommegowda et al, 1983; Verma et al, 1984; Virmani et al, 1977) including *Cymbopogon pendulus* in Jammu Tawi condition (Singh et al, 1982).

No report has so far been made to select suitable spacing for cultivation of *C. pendulus* (Nees ex Steudel) W. Watson in the ecological condition of Darjeeling district. As the plant has the potentiality to be utilised commercially in the region, the determination of suitable spacing for its cultivation is very much needed. This part of work deals with the effect of variation of spacing on the growth and development of the plant.

MATERIALS AND METHODS :

Materials : Slips of *C. pendulus* (Nees ex Steudel) W. Watson were obtained by the splitting of individual clumps and they were multiplied by vegetative propagation in nursery beds of the Dept. of Botany, North Bengal University in Darjeeling district, West Bengal. Rooted slips were used for different experiments.

Methods :

Experimental design : The plots were arranged in a randomized block design with three replications. Three treatments of spacings were allocated at random in each replica.

Size of the plot : Each plot was 4m x 5m.

Total number of plants : Ten plants were raised in each plot.

Spacing : Three treatments of spacing were considered in between plant to plant and row to row. These are 75cm x 75cm, 60cm x 60 cm and 50cmx 50cm.

Years of experimentation : The experiment was repeated in two consecutive years 1995 and 1996.

Transplanting time : 30 days old rooted slips with an average height of 20 cm were transplanted to the experimental plot in the month of May.

Cultural practice : Weeding, aeration of soil and watering were regularly done to keep the soil in moist conditions.

The following characters were considered during the spacing trial of the plant.

1. Plant height : The height of the plant was measured in centimeter scale from ground level to the top of the plant at the time of flowering. Each value of the plant height represents average of 10 replications.

2. Number of tillers per plant : Number of tillers produced in each plant were counted.

3. Number of leaves : Number of leaves on each of the tiller were counted.

4. Developmental phases of the plant : Three developmental phases were distinguished on the basis of the following characters :

(a) **Vegetative :** From early stage of vegetatively propagated slips to the stage before initiation of floral bud.

(b) **Pre-reproductive :** From the initiation of floral bud upto the development stage of the plant bearing 70% buds and 30% flower.

(c) **Reproductive :** Developmental stage of the plant bearing 20% bud, 70% flower and 10% fruits were considered.

RESULTS :**Table - 13**

Effect of spacing on yield attributes in *C. pendulus* (Nees ex Steudel) W. Watson at the vegetative stage.

Spacing	Height of the plant (cm)	Number of tillers per plant	Number of leaves per tiller
75cm x 75cm	95.20	10.20	6.00
60cm x 60cm	96.10	11.10	7.00
50cm x 50cm	99.30	13.50	9.50
S.E.	1.42	0.91	0.65
C.D. at 5%	1.73	1.38	1.17
C. D. at 1%	3.35	1.88	1.59

Table - 14

Effect of spacing on yield attributes in *C. pendulus* (Nees ex Steudel) W. Watson at the pre-reproductive stage.

Spacing	Height of the plant (cm)	Number of tillers per plant	Number of leaves per tiller
75cm x 75cm	114.50	13.50	6.34
60cm x 60cm	120.00	14.50	7.50
50cm x 50cm	128.00	15.80	8.89
S.E.	3.04	1.59	0.99
C.D. at 5%	2.53	1.83	1.44
C. D. at 1%	3.44	2.48	1.96

Table - 15

Effect of spacing on yield attributes in *C. pendulus* (Nees ex Steudel) W. Watson at the reproductive stage.

Spacing	Height of the plant (cm)	Number of tillers per plant	Number of leaves per tiller
75cm x 75cm	136.50	18.00	7.00
60cm x 60cm	140.00	19.00	7.80
50cm x 50cm	145.80	21.75	8.90
S.E.	2.48	2.23	1.17
C.D. at 5%	2.29	2.17	1.57
C.D. at 1%	3.11	2.95	2.13

DISCUSSION :

The plant to plant and row to row spacing has a significant role in growth performance of the grass. In order to select a suitable spacing for maximum performance of *C. pendulus* (Nees ex. Steudel) W. Watson in Darjeeling conditions, trials have been made with three spacing, 75cm x 75cm, 60cm x 60cm and 50cm x 50cm.

The height of the plants, number of tillers per plant and number of leaves per tiller have been observed to show comparatively good growth at all the three stages of development i.e., vegetative, pre-reproductive and reproductive stage due to treatment of 50cm x 50cm than other treatments (Table - 13, 14, 15). All the values for yield attributes have been reduced according to the increase of distance involved in spacing.

In lemongrass, spacing of 30cm x 30 cm to 60 cm x 60cm has been reported by several workers. Singh et al, (1983) compared three spacings (30cm x 30cm, 45cm x 45cm and 60cm x 60cm) and observed that closer type (30cm

x 30cm) with 1,11,00 plants/ha is optimum for producing maximum herb and oil yield. Results over a period of five years in connection with spacing were obtained on *C. pendulus* Wats cv. RRL -16, by Singh et al, (1982). They showed that narrow spacing in between plants and row gave high yield of herb and oil. According to them, spacing between rows should be kept at 50cm, while plant distance might vary from 30 - 50cm. Sreedharan et al (1973) reported that lemon grass gave the highest yield of grass and oil at a spacing of more close^e i.e., 15cm x 10cm.

But in Darjeeling condition the spreading of clumps are such that less than 50cm x 50cm spacing will not be suitable for working of farmers as too much narrow spacing offers little scope for mechanical work during harvesting of leaves and for other purposes required during cultivation.

Close^e spacing is sometimes supported by several authors according to the necessity of commercially utilised end products of plants. According to some cultivars (Gulati et al, 1977; Sarin et al, 1977) the spacing is dependent on the habit of the plant, times of harvesting and end products. But if the time of harvesting is within a short period, where the end product is leaf, the spacing may be reduced.

Spacing trials were also made by other authors in connection with citronella java and palmarosa. Spacing of 90cm x 60cm which accommodated more than 12000 plants/ha was recorded to show maximum yield of Citronella java in West Bengal (Chatterjee and Ghosh, 1977) and North East Indian condition, (Ganguly, 1973). Dimri et al (1973) however suggested that 60cm x 60cm spacing (27000 plants/ha) was optimum for peninsular India. Experiments conducted at CIMAP, Regional Centre Bangalore, revealed a linear increase in both herb and oil yield due to increase in both herb and oil yield due to increase in the level of plant population from 20,000 to 50,000/ha (Bommegowda et al, 1983). Under Lucknow conditions maximum yield was recorded at 60cm x 30cm spacing (Yadav et al, 1984).

A wider spacing of 60cm x 60cm or 45cm x 45cm was recommended for palmarosa in North India (Virmani et al, 1977). However, a closer spacing of



Fig. 57. Spacing trial on *Cymbopogon pendulus* (Nees ex Steudel) W. Watson in Darjeeling condition.

40cm x 30cm or 30cm x 30cm was found advantageous in Assam (Hazarika and Bora, 1977), Karnataka (Prakasa Rao et al, 1985), Delhi (Pareek et al, 1981), Kerala (Nair et al, 1980) and Punjab (Sarma et al, 1977) conditions.

Thus out of previous observations related to the effect of spacing on growth of various species of *Cymbopogon* specially *C. pendulus*, it may be concluded that in order to get optimum yield of leaves, closure spacing is required. In this connection it may be stated that closure spacing may help to retain moisture in the soil after the formation of continuous canopy formed by leaves of closure bushes of the clumps over the soil (Fig. 57).

According to Bordoloi (1982) higher leaf yields of *Cymbopogon* are obtained in areas with well spread out rainfall to a greater part of the year. It is also observed that high level of atmospheric humidity is responsible for high yield of leaves in grasses. Besides, according to Singh et al (1982) *C. pendulus* require high soil moisture. Thus canopy of leaves formed by the closure bush may help to maintain humidity over the soil surface surrounding the basal region of the bushes and also to help checking evaporation of water from the soil, specially during summer when scarcity of soil moisture is prevalent in Darjeeling district.

Thus in order to obtain maximum yield of herbage and oil, a spacing distance of 50cm x 50cm may be considered during cultivation of *C. pendulus* (Nees ex Steudel) W. Watson in the ecological condition of Darjeeling district, West Bengal.

SUMMARY

Trial has been conducted in order to obtain suitable spacing for maximum growth and productivity of *C. pendulus* (Nees ex Steudel) W. Watson in Darjeeling plains of West Bengal.

Three types of spacing 75cm x 75cm, 60cm x 60cm. and 50cm. x 50cm.

have been taken into consideration. In this connection, 10 plants were raised in each plot of size 4m x 5m.

Height of the plant (99.30 cm.), number of tillers per plant (13.50) and number of leaves per tiller (9.50) were observed to be the maximum at the vegetative stage of the plant due to 50cm. x 50cm. spacing as compared to minimum values 95.20cm., 10.20 and 6.00 respectively observed when 75cm. x 75cm. spacing was considered.

At the pre-reproductive stage, different values observed for height of the plant, number of tillers per plant and number of leaves per tiller are 128.00cm., 15.80 and 8.89 respectively due to 50cm. x 50cm. spacing as compared to 114.50cm., 13.50 and 6.34 respectively observed due to 75cm. x 75cm. spacing.

Maximum values were still maintained at the reproductive stage as regards height of the plant (145.80cm.), number of tillers per plant (21.75) and number of leaves per tiller (8.90) in 50cm. x 50cm. spacing as compared to minimum values of 136.50cm., 18.00 and 7.00 for respective characters in 75cm. x 75cm. spacing