RESEARCH ARTICLE

Effect of Grazing on Vegetative traits of *Cichorium intybus* L.

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Manuscript details:

Available online on http://www.ijlsci.in

ISSN: 2320-964X (Online)
ISSN: 2320-7817 (Print)

Editor: Dr. Chavhan Arvind

Cite this article as:
Bhambri Megha, Bajaj Amarjeet and Cherian KJ (2016) Effect of Grazing on Vegetative traits of *Cichorium intybus* L., *Int. J. of Life Sciences*, A6:51-54.

Acknowledgements
Authors are thankful to UGC SAP DRS I for providing us financial assistance and Department of Botany, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur for providing us necessary facilities during the study period.

ABSTRACT

Cichorium intybus L. belongs to family Asteraceae. It is one of the most promising novel plant with great medicinal value. It is best known for its use as caffeine free coffee substitute. Chicory is very palatable to animals in general and farm animals in particular. It is grown as a major fodder crop alongside leguminous plants in Europe and Americas. Where chicory is grown for roots, grazing adversely affects the vegetative growth and root yield. An experiment was designed to assess the need of grazing control. It was observed that the differences in the mean values among the protected and unprotected plots were significant for the above ground vegetative parts. Hence it can be stated that the grazing significantly reduces the vegetative growth of *Cichorium intybus* L.

Keywords: *Cichorium intybus* L., Asteraceae, Caffeine, Palatable, Grazing.

INTRODUCTION

Cichorium intybus L. belongs to family Asteraceae which is the largest plant family. The Genus name *Cichorium* is derived from the ancient Arabic word Chikourych, which was the name for a species of salad vegetable, for chicory (Quattrocchi, 1999- in CRC World Dictionary of Plant Names). Common names for *Cichorium intybus* L. are Chicory; succory; blue sailor; coffee weed; and witloof (Quattrocchi, 1999). Chicory, (*Cichorium intybus* L.) has originated in the Mediterranean, Central Asia and Northern Africa. Cultivation of this plant has been reported as early as the ancient Roman and Greek eras (Mulabaga et.al., 2009 and Plumier 1972). Its cultivation was first observed in Germany (1616) and in India it is found in the north- western regions like Kashmir and Punjab and in areas of South India. The ash obtained from roots by ignition in the furnace is mixed with butter to prepare an ointment for wound healing (Sezik et al., 1991) or decoction prepared from the roots is consumed against kidney stones and cancer. Fresh leaves of the plant is consumed as salad; the dried leaves are used for wound healing after mixing with Anchusa roots, pineres in and butter (Sezik et al., 2001); the decoction from the aerial parts is also used against haemorrhoids and eczema (Yesilada et al., 1999); while latex at the tipoff leaf stalk when cut is used for warts (Tuzlacı et al., 2010).

Chicory is very palatable to animals in general and farm animals in particular. It is grown as a major fodder crop alongside leguminous plants in Europe and Americas. Where chicory is grown for roots, grazing adversely affects the vegetative growth (Plate 1 and 2) and root yield in the same manner as diseases affects the crop yield of some important medicinal plants like aphids in *Ammi majus* L. (Megha et al., 2015). It becomes extremely difficult to manage Chicory from grazing as all type of herbivores starting with goats, cows to squirrels and rabbits that were digging the roots out attacked the crop. An experiment was designed to assess the need of grazing control.

MATERIAL AND METHODS

Experimental Site and Design

The present experiment was carried out at the Farm located at Gorewada, Nagpur (M.S.) to assess the need of grazing control by growing chicory in protected and unprotected plots. The experimental field (Farm) was divided into 20 plots of $2m^2$. The field was divided into 4 blocks, each block having five plots.

Collection of seed material

Seed material for cultivation of *C. intybus* L. was purchased from "Spring Haven" Jamnagar, India.

Preparation of field and sowing

For cultivation the field was ploughed to clear off the weeds and also for polarization of the underneath soil layer to get rid of the unwanted soil fungal flora. The soil used in the experiment was sandy loam. The field was ploughed to a fine tilth. Farmyard manure of well-rotted compost at the rate of 10-12 q/hectare was added to prepare the plots. Basal fertilizers N: P: K and a basal dose of 120 kg/ha Neem and Mustard cake was incorporated.

For sowing *Cichorium intybus*, seeds are sown in a fine-textured seed bed, at a depth of 1 cm in rows spaced 25-30 cm apart. Seed were sown by broadcasting at the rate of 2 kg/hectare. The seed start germinating within 3 to 10 days after sowing. When plants reach the 3rd leaf stage they are thinned to stand 15 -20 cm apart in the row. Thinning should not be too late, as thinning may disturb roots of remaining plants.

Irrigation

Maintenance of moisture plays a major role in growth of this crop. Hence, irrigation frequency is to be matched according to water retention of soil. Periodic watering was done preferably in the evening around 4 o' clock to keep the soil appropriately moist.

Weeding

The care is to be taken to control the growth of weeds during initial period of growth and hence, 2-3 weeding are to be carried out. Two hoeing followed by manual weeding saves labour and also keeps soil loose and moist, allows aeration to roots and prevents hardening of the soil.

Collection of Data for Morphological studies

Various morphological traits were scored on the basis of 25 plants selected randomly per replicate per treatment. The observations on vegetative growth of plants were recorded after 2 months of sowing.

Length and Breadth of fully developed leaf

It was measured by a scale at the site after selecting 100 fully grown leaves from plants and measuring their length and breadth.

Fresh and Dry weight of all the leaves

The plant samples (leaves) were collected at the time of harvest. 25 plants were taken from each plot randomly. The plants were cut at root-shoot junction weighed to determine their fresh weight and dried in oven at 65±2 until constant weight was reached to determine their dry weight.

RESULT AND DISCUSSION

The plants of *Cichorium intybus*, during this experiment were scored for many vegetative (above ground leafy part) related parameters presented in Table No. 1 and Figure No. 1 and 2. The above ground vegetative parts of *Cichorium intybus* in the vegetative phase consist of a rosette of leaves. The stem is highly compacted and bears a crown of leaves, which give the appearance of radicle leaves.

The numbers of leaves/plant were scored for both types of locations. Maximum mean number of leaves/plant has been recorded as 18.187 in the taxa treated with treatment type T_2 i.e. seeds sown in the protected plots with internal dispersion of SD ± 1.632. Whereas minimum number of leaves/plant 12.875 was recorded in the taxa belonging to treatment type T_1 i.e. seeds sown in the unprotected plots with internal dispersion of SD ±0.873. Length and breadth

of leaves was recorded and presented in Table No. 1 and Figure No. 2. Maximum mean length of leaf 19.590 cm and breadth of 4.975 cm is recorded from the taxa of treatment type T_2 (i.e. seeds sown in the protected plots) with internal dispersion of SD ± 0.609 and SD ±0.263 respectively. While minimum mean length 13.945 cm and mean minimum breadth 4.275 cm is recorded from the leaves of taxa of treatment type T_1 (i.e. seeds sown in the unprotected plots) with internal dispersion of SD ± 0.965 and SD ± 0.299 respectively.

Area of leaves was recorded in cm^2 and presented in Table No. 1. Maximum mean leaf area 97.460 cm^2/leaf was recorded from the taxa of treatment type T_2 (i.e. seeds sown in the protected plots) with internal dispersion of SD ± 1.010. The minimum mean leaf area of 59.614 cm^2 /leaf was recorded from the taxa of treatment type T_1 (i.e. seeds sown in the unprotected plots) with internal dispersion of SD ± 0.793.

Fresh weight and dry weight of leaves (above ground vegetative parts including stem) was recorded and presented in Table 1 and Fig. 2**.** Maximum mean fresh weight 94.890 gm and dry weight 23.775 gm is recorded from the taxa of treatment type T_2 (i.e. seeds sown in the protected field) with internal dispersion of SD ± 1.186 and SD ± 0.585 respectively. Minimum mean fresh weight of leaves (above ground vegetative parts including stem) 45.540 gm and dry weight 15.007 gm is recorded from the taxa of treatment type T_1 (i.e. seeds sown in the unprotected field) with internal dispersion of SD ± 3.771 and SD ± 1.081 respectively.

ANOVA analysis reveals that grazing has shown significant difference for all the parameters analyzed at P<0.001. On pair wise multiple comparisons (Fisher LSD Method) it was observed that the differences in the mean values among the two treatment groups are greater than would be expected by chance; indicating a statistically significant difference in case of number of leaves; length, breadth and area of leaf; fresh and dry weight of the above ground vegetative parts. Hence it can be stated that the grazing significantly reduces the vegetative growth of *C. intybus*.

Table – 1: Effect of Grazing on above Ground Vegetative Traits of *Cichorium intybus* L.

Sr. No.	Treatment	Stats	Number of leaves / plant	Length of mature leaf (cm)	Breadth of mature leaf (cm)	Area of leaves in (cm^2)	Fresh wt. of leaves (gm)	Dry wt. of leaves (gm)
1.	**T_1**(Grazing)	$\bar{x}$	12.875	13.945	4.275	59.614	45.540	15.007
		S_D	0.873	0.965	0.299	0.793	3.771	1.081
		S_{ER}	0.436	0.483	0.149	0.396	1.886	0.540
2.	**T_2**(Control)	$\bar{x}$	18.187	19.590	4.975	97.460	94.890	23.775
		S_D	1.632	0.609	0.263	1.010	1.186	0.585
		S_{ER}	0.816	0.304	0.131	0.505	0.593	0.293
3.	**% decrease in T_1**		29.20	28.81	14.07	38.83	52.00	36.87
4.	**LSD at 5%**		2.264	1.396	0.487	1.571	4.836	1.504

Fig. 1: *C.intybus* L. (Protected Field)

Fig. 2: Grazing in *C.intybus* L. (Unprotected Field)

CONCLUSION

Chicory is a perennial forage herb of high nutritional quality, with a slightly raised crown producing leafy top growth from a thick, deep tap-root with excellent drought tolerance and mineral extraction providing high quality summer-forage. Herbage is of a very high palatability, high digestibility (DMD 86.8%), has a variable crude protein level (CP 15.0-26%) (Terrill et al. 1992) and has high metabolizable energy (ME) values of 12.2% (Stevens et al. 1993). Chemical analysis by Crush & Evans (1990) showed Puna chicory to have higher concentrations of potassium, sodium, calcium, sulphur, boron and zinc than ryegrass and white clover pastures. All other elements, including phosphate, were similar. The high concentrations of zinc and sodium offer potential advantages for animal health and growth rate.

Due to above mentioned facts chicory is a favorite herbage crop exclusively or in mixed cropping with other pasture leguminous plants or grasses in west. As mentioned earlier, chicory can be grown as a root crop, as a salad or vegetable crop, seed crop or as an herbage crop due its multipurpose utility. The high palatability, high digestibility to herbivores causes a problem when it is grown especially for root or seed production. Utmost appropriate grazing management is required so that the root yield is not affected. Hence it is very important to keep proper care and arrangement to save the crop from herbivores like any other root crop.

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