Electronic Journal of Plant Breeding, 2(2):270-274 (June 2011)
ISSN 0975-928X

Research Note

Variability among germplasm collections for high biomass traits in *Cenchrus sp.*

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(Received:15Mar 2011; Accepted:01Apr2011)

Abstract:
Sixty germplasm accessions of *Cenchrus ciliaris* and *Cenchrus setigerus* were collected from different habitats in and around Coimbatore and Erode districts and planted in field trials. Based on initial morphological evaluation, four accessions from *Cenchrus setigerus* and three accessions from *Cenchrus ciliaris* showed better biomass. Among the collected germplasm accessions, one among the *Cenchrus setigerus* accessions showed prostrate behaviour which would be of great use in the greening of degraded lands where with few plants entire area can be covered and utilized for grazing. With its high soil binding capacity due to its clustered root system, it will reduce soil erosion also. The germplasm accessions from Sulur and Kangeyam recorded high single plant green fodder yield of 545g and 500 g respectively in single cut compared to the control CO1 (262.5g). Further evaluation is in progress. Variations among the accessions collected from different habitats will be useful to evolve better genotypes than CO-1.

Keywords :
Cenchrus, germplasm, prostrate, biomass

Buffel grass or buffalo grass or African foxtail grass (*Cenchrus ciliaris* L.) plays an important role in the development of grassland or meadows in arid and semi-arid regions. Of the 22 species recognized so far, *Cenchrus cilirais* L. and *C. setigerus* Vahl. have been used as sown pasture with the first being the most prominent component of major Indian grass covers. Like other tropical grasses, *Cenchrus* is also apomictic in nature and hence characterization of accessions and varieties is often difficult due to lack of reliable and distinguishable morphological traits.

Cenchrus is a palatable nutritious and warm season perennial grass species naturally occurring in the drier parts of the country. It grows well on sandy to sandy-loam soils in semiarid and arid regions, forming mats or tussocks. Its high soil binding capacity is due to its clustered root system in the upper 8-10 cm layer of soil. *Cenchrus* is cultivated in paddock area especially in and around the Kangeyam belt. All bullocks and cows around the

Kangeyam area are fed with Cenchrus only. It is highly drought tolerant crop. Plant diversity is seen among the *Cenchrus* accessions in and around Kangeyam, Palladam and Western Ghats.

The concept of germplasm conservation demands that collection methods initially capture maximum variation and subsequently, conservation and regeneration techniques minimize losses and genetic erosion through time. Traditionally diversity is assessed by measuring variation in phenotypic traits which are of direct interest to users.

Performance of *C. ciliaris* in arid region was appreciable in terms of plant height, number of tillers and dry matter yield (Sharma and Verma, 1983). Buffel grass, fed green, is said to increase flow of milk in cattle and impart a sleek and glossy appearance. *Cenchrus* can be used for greening the degraded land. CO 1 *Cenchrus* has been released during 1989. This study is carried out to assess the genetic variability among the different germplasm accessions of *Cenchrus* based on different agro-morphological traits so as to evolve better genotypes than CO 1 buffel grass.

Cenchrus germplasm collections were executed in 2009 and 2010 in different habitats of Erode and Coimbatore districts *viz*. Kangeyam, Dharapuram, Karamadai, Palladam, Mettupalayam, Sirumugai, Pachapalayam, Perur, Nagarajapuram and different

accessions of *Cenchrus ciliaris* L., and *C. setigerus* Vahl. were collected from a range of sites. Because of the overgrazing and severe and prolonged droughts, the seeds of this grass was not available. Consequently the plantlets were uprooted for their multiplication at the grass germplasm nursery.

Sixty accessions of this grass having contrasting characteristics were selected for the present study. The plant samples of each accession were further sub-divided into equal sized plantlets and propagated under randomized complete block design. Plant to plant and row to row distance was maintained at 0.5 m.

Plant height, apical internodal length, number of tillers and number of leaves per plant were counted or measured on the intact plants. Leaf area was taken as maximum leaf length X maximum width X 0.68 (correction factor). Leaf hairiness was observed under the microscope. Fresh weight of shoot was taken immediately after cutting the shoots at ground level. Data on fresh green fodder yield and other morphological characters were recorded and analysed.

The collected sixty germplasm accessions belong to two species namely, *Cenchrus ciliaris* L. and *C. setigerus* Vahl. Based on initial morphological evaluation, four accessions in *Cenchrus ciliaris* L. and three accessions in *Cenchrus setigerus* Vahl. performed better in terms of leaf biomass growth.

Buffel grass is thought to be highly drought tolerant with regard to plant height (Machado *et al.*, 1983). Resistance against drought in *Cenchrus ciliaris* based on decrease in plant height, leaf area and yield is less than Bermuda grass (Okamoto *et al*., 1976). Germplasm collections with decreased plant height and lesser internodal length were identified which would exhibit tolerance to drought.

Increased hairiness appears to be a good indicator of droughted state of germplasm because its dense growth can check transpiration to some extent (Martin and Juniper, 1974; Grace and Russel, 1977; Cutler, 1978). The hairiness observed in the leaves of some germplasm collections alludes to its role in the enhanced drought tolerance of *Cenchrus ciliarus*. This provides additional aid in minimizing water loss from leaf surface and improving the plant water status under drought.

Regarding single plant green fodder yield, the germplasm accession from Sulur recorded 545g (Fig. 1) on an average from two cuts, in comparison to the control which recorded 262.5g. Similarly another accession from Kangeyam recorded 500g (Fig. 2) on an average from two cuts and possessed high biomass yielding characteristics. The increase in biomass attributes to the increase in green fodder yield.

High tillering capactity was observed among certain accessions after the first cut. This shows the chances of doubling of yield in the subsequent cuts which would lead to an increase in green fodder yield. *Cenchrus*, being a perennial is amenable for several cuts and since it is rich in calcium, it is found to improve milk yield of dairy cattle.

Another variability observed among the germplasm accessions was the increase in leaf breadth of one accession collected from Kangeyam which measured 0.78 cm (Fig. 3) when compare to control (0.6 cm). This in turn will increase the leaf area, therby improving the photosynthetic efficiency. Increased photosynthetic activity results in the accumulation of photosynthates which in turn improve the nutritional status of the green fodder.

One germplasm accession among *Cenchrus setigerus* Vahl. from Sivanmalai was of highly spreading type and prostrate behaviour (Fig. 4). Such prostrate type plants would be of great value in arresting soil erosion in dry lands as well as steep, arid and areas with insufficient soil depth with its hair like roots. The adventitious roots bind to the soil and prevent the top soil erosion by floods, heavy wind or rains. Perramond (1998) confirmed these results that buffelgrass is a very effective soil cover and that soil fertility rates are twice as high in native vegetation.

Buffelgrass, like other perennial grasses, is an efficient plant for its rooting structure and its tenacious hold on soils (Bock and Bock 1995; Martin *et al.,* 1998). Buffelgrass is also fire-tolerant and will expand into annual grasslands, at the expense of native grasses (Cox *et al.,* 1990; Ibarra *et al.,* 1995).

Prostrate types would be of immense help in the greening of degraded waste lands. A few number of plants are enough to cover the entire area so as to obtain pastures for the grazing cattle. Being drought tolerant and hardy in nature, prostrate *Cenchrus* would be valued for the production of palatable forage and intermittent grazing during drought periods in the tropics.

The germplasm accessions have been evaluated for morphological and yield attributes so far upto the second cut. They will be subjected to quality analysis after the third cut for assessing the quality parameters

such as crude protein, crude fibre, crude fat, HCN and minerals. Then the accessions showing better yield as well as quality characteristics than the check would be used to evolve best genotypes than CO 1.

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Fig. 1 Germplasm accession from Sulur with highest single plant green fodder yield

Fig. 2 Germplasm accession from Kangeyam with high biomass

Fig. 3 Germplasm accession showing increased leaf thickness against control leaf

Fig.4 Germplasm accession from Sivanmalai with spreading characteristics