# EFFECT OF NITROGEN AND CUTTING ON FORAGE AND GRAIN CHARACTERS OF MILLETS

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## Abstract

Two commercial millets, Japanese (*Echinochloa utilis)* and Siberian (*E. frumentacea*), and four *Setaria italica* accessions (79.20, 85.13, 85.14 and 85.16) were evaluated for the effects of cutting (at seven weeks) and nitrogen application (100 kg N/ha at planting and after cutting) on forage quantity and quality and grain yield at the University of Queensland, Gatton College. Accessions 85.14 and 85.16 showed potential as dual purpose cultivars. Both produced more dry matter than Siberian at seven weeks with a trend to lower lignin content. Accession 85.16 was similar to Siberian for leaf-to-stem ratio and tended to be higher in protein. Regrowth of 85.16 compared favourably with Siberian millet and suggests the need for further dry matter evaluation. Grain yield of 85.16 was higher than Siberian without cutting but reacted poorly to cutting resulting in no difference.

*Key Words: Millet, Echinochloa utilis, E. frumentacea, Setaria italica, dry matter, grain yield, protein, NDF, lignin*

## Introduction

Millets have potential in the northern grain belt with adaptation to semi-arid areas due to their early maturity for grain, forage or for both. As a dual purpose crop, millets may be grazed one or more times before harvesting the grain for the birdseed market.

The main objective of this study was to determine the dual purpose value of six millet genotypes by measuring the effects of cutting (above 20 cm at seven weeks) and nitrogen (N) fertiliser (100 kg N/ha as Nitram applied at planting and after cutting) on forage quality and quantity and grain yield in a trial with a randomised complete block design of four replications.

Two commercial millets, Japanese (*Echinochloa utilis*) and Siberian (*Echinochloa frumentacea*), were compared with four accessions of *Setaria italica* (79.20, 85.13, 85.14 and 85.16). These accessions were identified as potential forage types from assessment of 230 accessions for grain production in the University of Queensland Grain Millet Improvement Program (S. Mitchell, *pers. comm*.).

The trial was planted on November 25, 1996 at the University of Queensland, Gatton, on an alluvial soil. Plots were four metres long with six rows planted at 18.5 cm spacing. Supplementary irrigation was applied to avoid moisture stress.

## Results

A summary of the results is given in Table 1. All Setaria accessions except 79.20 produced more tillers than the commercial millets and nitrogen fertiliser at planting increased mean tiller number from 9.8 to 10.6 tillers/plant. This tillering ability enabled 85.13 and 85.16 to compensate for poorer establishment

Dry matter accumulation at seven weeks of 85.14 was superior to that of Japanese millet and all accessions produced more dry matter than Siberian millet. Nitrogen fertiliser had no effect which was most likely due to the high N status of the vertisol soil.

At seven weeks, the commercial millets contained less NDF than the accessions, of which 85.14 was lowest. The commercial millets also had the lowest cellulose and hemicellulose content while 79.20 and 85.16 had the highest. Lignin content (measured on a composite sample from four replications) tended to be lower for 85.14 and 85.16. There was no difference in crude protein among genotypes and no effect due to N fertiliser at planting.

Siberian millet had the highest leaf-to-stem ratio although it was not significantly different from

Table 1. Agronomic characters for six millet genotypes

| Character | Millet Genotypes | | | | | | lsd ($p<0.05$) |
|---|---|---|---|---|---|---|---|
| ? | Japanese | Siberian | 79.20 | 85.13 | 85.14 | 85.16 | ? |
| Establishment (plants/m) | 8.4 | 8.1 | 9.0 | 6.7 | 9.1 | 5.7 | 1.4 |
| Tiller number/plant | 8.4 | 8.1 | 9.2 | 12.6 | 12.2 | 11.0 | 2.5 |
| Dry matter accumulation (t/ha) | 10.2 | 7.9 | 13.7 | 13.3 | 14.3 | 13.8 | 3.6 |
| Neutral detergent fibre (%) | 47.3 | 46.6 | 52.4 | 50.8 | 49.9 | 51.1 | 2.0 |
| Lignin (%) | 4.0 | 4.0 | 3.9 | 4.1 | 3.4 | 2.8 | - |
| Cellulose and hemicellulose (%) | 43.4 | 42.6 | 48.5 | 46.6 | 46.4 | 48.2 | 2.2 |
| Crude protein (%) | 16.3 | 16.1 | 16.0 | 16.6 | 15.8 | 17.1 | ns |
| Leaf-to-stem ratio (%) | 35 | 48 | 40 | 46 | 46 | 47 | 2 |
| Leaf length (cm) | - | 25 | 40 | 44 | 48 | 36 | 4 |
| Leaf width (cm) | - | 1.9 | 2.6 | 2.3 | 2.4 | 2.7 | 0.3 |
| Regrowth after cutting | none- cut too late | excellent - high tiller number | poor | moderate | moderate | good - high tiller number | ? |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Days to 50% flowering | 40 | 82 | 93 | 92 | 93 | 82 | 1.5 |
| Grain yield (t/ha) | - | 4.2 | 6.2 | 4.6 | 4.6 | 5.5 | 1.0 |

85.16, 85.13 and 85.14. Accessions 85.13 and 85.14 were not different from each other, but were higher than 79.20. All accessions had higher leaf-to-stem ratios than Japanese millet.

At 50% anthesis, 85.13 and 85.14 had the longest leaves and 85.16 the shortest. All accessions had longer leaves than Siberian millet (leaf and yield characters of Japanese millet were not measured due to workload commitments). Cutting reduced the mean leaf length from 41 to 38 cm. The accessions produced wider leaves than Siberian millet with 79.20 and 85.16 being widest. Cutting reduced mean leaf width from 2.5 cm to 2.3 cm.

Japanese millet was quickest to 50% flowering, followed by Siberian millet and 85.16 and then 79.20, 85.13 and 85.14. Cutting prolonged time to 50% flowering from 78.2 days to 85.1 days. Cutting extended the time to 50% flowering of the accessions but had no effect on the commercial millets.

Accessions 79.20 and 85.16 produced the most grain with the other accessions producing similar yields to Siberian millet (Table 1). Cutting reduced yield from 6.7 t/ha to 3.5 t/ha. Cutting reduced the grain yield of the accessions but not Siberian millet.

## Conclusions

Accessions 85.14 and 85.16 showed promise as potential dual purpose types. Both 85.14 and 85.16 produced more dry matter than Siberian at seven weeks. Although these accessions had higher NDF contents than Siberian millet, they tended to have lower lignin content which increases digestibility of cell wall constituents. This, in turn, would lead to higher voluntary intake. Accession 85.16 was similar to Siberian millet for leaf-to-stem ratio and tended to be higher in protein, characters important to forage quality. Further study is needed to determine the digestibilities of these accessions.

Grain yield of 85.16 was higher than Siberian millet but after cutting, there was no difference indicating minimal effect of cutting on the semi-prostrate Siberian millet. Regrowth of 85.16 after cutting compared favourably with Siberian millet and suggests the need for further dry matter measurements for a range of cutting intervals.