

Forage sorghum: potential yield and nutritive value

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The Queensland Department of Agriculture and Fisheries (DAF) C4Milk team conducted an experiment on forage sorghum at the DAF Gatton Research Facility from September 2016 until January 2017. The experiment investigated the effect of the stage of growth (grazing vs silage), nitrogen application (Low and High), plant density (Low and High) and variety (Mega Sweet vs Graze-N-Sile) on yield and nutritive value of forage sorghum in a fully irrigated crop.

The experiment

The seeding rates used were 9 and 26 kg/ha for the low and high plant density treatments with target plant populations of 100,000 and 450,000 plants per hectare respectively. The experiment started with a full soil profile and the plots were irrigated on a weekly basis using a drip irrigation system. The irrigation began immediately after planting and was applied to replace the water lost due to evapotranspiration. The plots were cut when the plants reached approximately 1 m height for the grazing stage plots and soft dough for the silage stage plots (Image 1).

Liquid Nitrogen (Easy N) was applied throughout the experiment at 456 kg/ha (high) and 44 kg/ha (low). The proportion of nitrogen recovered at harvest was on average 72 and 100 % for the high and low nitrogen application treatments respectively.

The two varieties assessed in this experiment were a sweet sorghum x sweet sorghum hybrid (Mega Sweet) and a sorghum x sorghum hybrid (Graze-N-Sile). These two varieties were chosen due to their regular use in the northern Australian dairy industry. Also, there are clear differences between hybrids in terms of plant structure (Image 2). Mega Sweet is a taller crop than Graze-N-Sile which not only influences their total yield but also the proportion of seed head, stem and leaves which determine their nutritive value.

Results

The silage plots were cut once in January. The grazing plots were cut when they reached 1m, which was multiple times. Therefore, the yield values shown in Figure 1 are the result of one cut for the silage stage plots and the accumulated yield of several cuts for the grazing stage plots (3 and 4 cuts for low and high nitrogen treatments, respectively).

Stage of growth

Table 1 below shows average values across the trial. The lower NDF for the silage is due to the high grain content in the silage, which offsets the larger amounts of structural NDF that is present in silage plants.

Table 1. Average yield and nutritive values across the trial including both varieties and the two levels of nitrogen application and plant population.

	Grazing	Silage
Yield (t DM/ha)	9	18
CP (% DM)	18	8
NDF (% DM)	61	46
ME (MJ/kg DM)	9.6	9.6

Nitrogen application

High nitrogen applications had a very positive affect on the yield for grazing or silage, also boosting the crude protein levels of the plant material. It also increased the total grain production, resulting in a higher energy level in the high nitrogen treatment (Table 2, Figure 1). These results suggest that nitrogen is an important aspect of forage sorghum management.

Table 2. Average yield and nutritive values across the trial including both varieties and the two growth stages (grazing and silage) and plant populations.

	High N	Low N
Yield (t DM/ha)	18	8
CP (% DM)	13	8
NDF (% DM)	54	58
ME (MJ/kg DM)	9.6	9.1

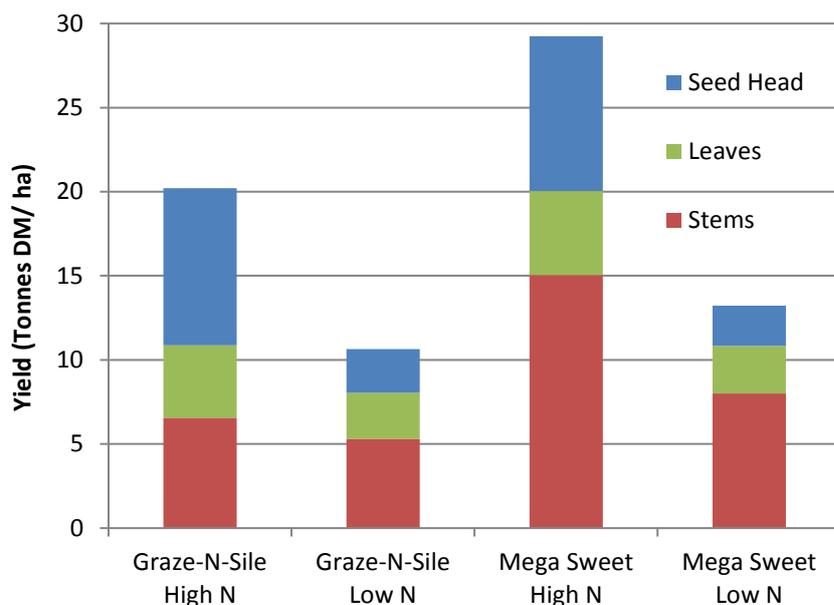


Figure 1. Average yield values for both varieties and nitrogen applications at the silage stage across the trial including both plant populations.

Varieties

There was very little difference between varieties under grazing conditions, however, Mega Sweet yielded more than Graze-N-Sile for silage (29 vs 20 t DM/ha) (Figure 1). While there was no significant difference in forage quality between varieties at the grazing stage, forage quality at the silage stage was higher for Graze-N-Sile than for Mega Sweet (Table 3). At the silage stage with high nitrogen application Graze-N-Sile had higher crude protein content (8.6 vs 7.2 %), slightly lower NDF (45 vs 47 %) and slightly higher energy content than Mega Sweet (9.7 vs 9.4 MJ ME/kg DM). This lower forage quality of Mega Sweet was due to its lower proportion of seed heads.

Table 3. Average yield and nutritive values for both varieties at the silage stage across the trial including both plant populations.

	Graze-N-Sile	Mega Sweet
Yield (t DM/ha)	20	29
CP (% DM)	8.6	7.2
NDF (% DM)	45	47
ME (MJ/kg DM)	9.7	9.4

Plant density

Overall plant density had a small or insignificant effect on both yield and forage quality when compared to other factors such as stage of maturity, nitrogen application and variety.

Conclusions

This experiment looked at the potential yield and nutritive value of forage sorghum when it is fully irrigated. The conclusions are:

- a fully irrigated crop of forage sorghum can result in high yield of good forage quality;
- when water is not a limiting factor for growth, nitrogen is essential to achieve not only high yields, but also it has a positive impact on forage quality when the crop is used either for grazing or silage;
- there is no difference in yield or forage quality between varieties at the grazing stage. At the silage stage, Mega Sweet had higher yield but lower quality than Graze-N-Sile;
- plant density has a small or insignificant effect on both yield and forage quality when compared to other factors such as stage of maturity, nitrogen application and variety.



Image 1. The plots were cut when the plants reached approximately 1 m height for the grazing stage plots and soft dough for the silage stage plots.



Image 2. Plots were irrigated on a weekly basis using a drip irrigation system. Left plot: Mega Sweet, right plot: Graze-N-Sile.

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The project is funded and supported by the Department of Agriculture and Fisheries and Dairy Australia.

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