

## Comparative Analysis of Forage Sorghum for Best Cutting Time

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**Abstract:** Forage sorghum was evaluated at different growth stages at Shambat, Sudan, to establish a proper cutting time for optimum yield and nutritive value. The fresh forage yield increased with the crop age till the maturity, but the difference was not significant for the late growth stages. Per cent crude protein decreased with age and the differences were significantly higher for vegetative and ear initiation than late stages of growth. The interception between crude protein yield and fresh forage yield, at the milk stage, showed the best indication for economically equating quantity and quality. The tenth week cutting was the best compensation. Crude protein yield reached the maximum at this stage. Similarly, the highest per cent of reducing sugars and total sugars were obtained at the tenth week (milk stage).

**Key words:** Sorghum, forage, protein, sugars, growth stages, cutting.

Forage sorghum (*Sorghum bicolor* (L) Moench), locally known as Abu sabien, is the most widely grown fodder crop in Khartoum area. The crop is normally utilized as a green fresh matter. Due to demand for feed, the fodder was cut either early when the quality was high or late to increase the yield. This practice results in a very low biomass or very low quality fodder. Holt and Alton (1968) found the best yield at maturity, but the quality decreased. The same results were reported by Ibrahim *et al.* (1993) and Ibrahim (1996).

Research highlights (Anonymous, 1991) clearly showed that harvest of sorghum at flowering stage substantially increased green forage yield as compared to the yield at boot and silage stage. However, dry matter yield was significantly higher at silage stage as compared to that at the flowering stage. Ibrahim (1996) found that the

best time of cutting sorghum was at 25% flowering. This time did not give the highest forage yield, but it gave the best compensation. Ibrahim *et al.* (1993) stated that for the best results of fodder, comparison between quality and quantity should be performed. Research highlights (Anonymous, 1991) recorded the highest protein yield at flowering.

To avoid very low quality fodder, the forage should be cut before maturity. At the same time, biomass has to be considered and quality has to be compensated. The aim of this work is to know the proper time of cutting that can compensate the loss of both quantity and quality. The best cutting regime of the crop, in respect of biomass and fodder quality, is essential for profitable forage production.

### Materials and Methods

The experiment was carried out in 1989 and 1990 at Shambat demonstration farm, Faculty of Agricultural Studies, Khartoum

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North, Sudan. Sorghum was planted in a clay soil on 15 and 20 May in respective years, with spacing of 25 cm between rows and 20 cm between plants at a seed rate of 50 kg ha<sup>-1</sup>. The field was fertilized with 120 kg N ha<sup>-1</sup> in three equal doses; before planting, after germination, and at heading. Super phosphate was added before planting at a rate of 80 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>. The layout was a randomized complete block design with four replications. The treatments were seven different growth stages; vegetative stage (four weeks from planting), boot stage (eight weeks from planting), milk stage (ten weeks from planting), dough stage (twelve weeks from planting), hard dough stage (fourteen weeks from planting) and maturity stage (sixteen weeks from planting). The crop was irrigated as required to the field capacity. Other cultural operations were performed as practiced in the area.

At each growth stage, the crop was cut to the ground level and the fresh forage weight was recorded. The same samples were dried and taken to the laboratory for quality analysis. The data were subjected to statistical analysis with the aid of MSTAT through computer.

## Results and Discussion

The green forage yield of sorghum increased with growth stage (Table 1) but the increase was significantly different for the 4th, 6th, and 8th weeks. There was no significant differences among week 8, 10, 12, 14, and 16 for forage yield. However, boot stage (8th week) was significantly different from weeks 14 and 16. Table 1 also shows that the moisture (per cent, fresh weight) decreased with age, but the

decrease was not significant till the 10th week. Weeks 12, 14, and 16 were not different, but they were significantly lower than others. The crude protein yield increased with age and reached maximum at 10th week, and then decreased (Table 1). Weeks 6, 8, and 14 were at par, but they were significantly different from weeks 10, 12, and 16. However, per cent crude protein content decreased with age and values for weeks 4 and 6 were significantly higher than all others (Table 1). There was no significant difference among weeks 8, 10, 12, 14, and 16.

Table 1 indicated that crude fibre increased with age. However, the values for weeks 5, 6, 8 were statistically the same, while weeks 6, 8, 10, and 12 were at par. At the same time weeks 8, 10, 12, and 14 were not different, and week 10, 12, 14, and 16 were also at par. Hence, week 10 was significantly different from weeks 4, 6, and 8 and not significantly different from weeks 12, 14, and 16. The reducing sugars (per cent glucose) increased with age, reached the maximum at 10th week, and then dropped (Table 1). Weeks 10 and 12, which were similar, had a significantly higher sugar than others. The same trend was repeated for total sugars (per cent dry weight) as shown in Table 1. However, week 10 had a significantly higher total sugar than others (38.1%), while week 12 had a higher value (14.7%) than those in the other growth stages.

The data in Table 1 revealed clearly the different trends with age. The best measure for compensation is the interception between different parameters. Per cent crude protein with moisture content gave an early

Table 1. Performance of fresh sorghum at different stages of growth\*

Weeks	Stage of growth	Green forage yield (t ha <sup>-1</sup> )	Moisture (% fresh weight)	Crude protein yield (kg ha <sup>-1</sup> )	Crude protein (%)	Crude fibre (%)	Reducing sugars (% glucose)	Total sugars (% dry weight)
4	Vegetative	25.1	90.6	436.8	22.6	27.0	—	—
6	Ear initiation	40.2	91.6	863.2	14.0	29.1	6.1	8.6
8	Boot	48.4	88.4	1064.0	9.5	30.6	7.5	9.2
10	Milk	52.1	81.9	1220.8	7.3	31.6	12.2	38.1
12	Dough	54.2	78.7	1064.0	5.6	32.9	11.1	14.7
14	Hard dough	55.3	72.1	974.4	4.2	33.4	5.0	7.6
16	Maturity	56.4	68.4	1176.0	4.8	33.9	4.0	6.1
LSD (0.05)		5.7	9.8	237.8	4.3	3.1	4.2	6.7

\* All values were mean of two years.

interception at the 4th week (vegetative stage). The same trend was seen when per cent crude protein was equated with yield or with crude protein yield where the interception was at the 6th week (ear initiation). This early stage had the best forage quality, but the yield was the lowest. At the same time, early stages of growth

had high prussic acid (HCN), which is poisonous to dairy animals.

Figure 1 clearly showed that the best cutting time was week 10, which was the interception between crude protein yield and green forage yield. This result was supported by the data of Table 1. The green forage yield showed a significant

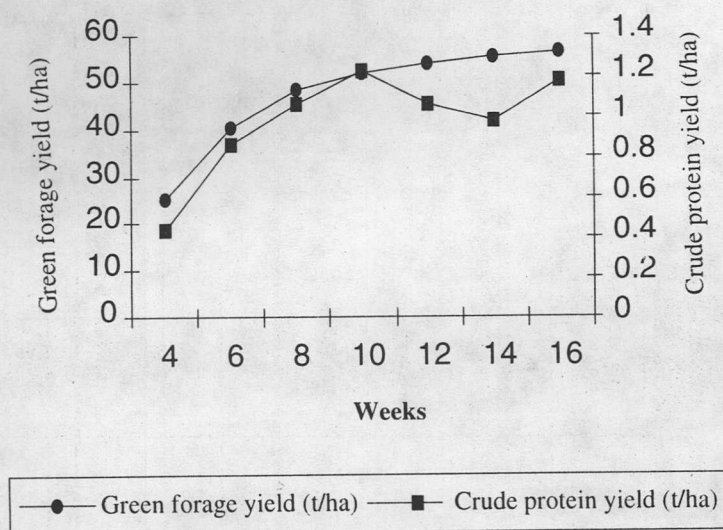


Fig. 1. Sorghum cutting time.

difference between week 10 and early growth stages, while there was no difference for late growth stages. Similarly, the decrease in moisture per cent was not significant till the tenth week. The crude protein yield increased with age, reached its maximum at the tenth week, and then decreased. Per cent crude fibre was significantly different till the tenth week, and not different after that. In addition, the highest per cent of reducing sugars and total sugars were obtained at milk stage (tenth week). This was also supported by Ibrahim *et al.* (1993), who stated that for best results, comparison between quality and quantity should be considered. However, research highlights of (Anonymous 1991) stated that harvest of sorghum at flowering stage substantially increased green forage yield. Similarly, Ibrahim (1996) found 25% flowering as the best time of cutting.

In conclusion, cutting of forage sorghum is a function of yield and quality. The

crop should be treated as a production unit that depends mainly on economics of utilization. Cutting of the crop before the tenth week will tremendously affect its yield, while cutting after that stage will increase the yield but affect the nutritive value. To compensate between the two variables, it is advisable to cut the crop at the milk stage (tenth week).

## References

- Anonymous, 1991. *Research Highlights*. Indian Grassland and Fodder Research Institute, Jhansi, India. 42 p.
- Ibrahim, Y.M., Gafaar, M.O. and wahab, D.A. A. 1993. Yield and fodder quality from single and ratoon harvesting systems of pioneer sorghum. *Annals of Arid Zone* 32: 63-64.
- Ibrahim, Y.M. 1996. Yield and forage quality of fodder sorghum at different stages of growth and different ratoon cuttings. *University of Khartoum Journal of Agricultural Sciences* (Accepted).
- Holt, E.C. and Alton, G.D. 1968. Response of Sudan-grass hybrids to cutting practices. *Agronomy Journal* 60: 303-306.