PERFORMANCE OF FORAGE SORGHUM HYBRIDS AND KATHERINE PEARL MILLET AT BUBIA

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ABSTRACT.

Six varieties of forage sorghum and the Katherine variety of Pearl millet were grown at Bubia. Highly significant responses in yield were obtained from the use of 100 lb. of fertilizer nitrogen as sulphate of ammonia.

The highest yielding variety was Sudax which, with fertilizing, yielded more than 12,000 lb. of dry matter per acre at 12 weeks from planting. The mean at 12 weeks for all fertilized varieties was 9,200 lb. of dry matter per acre and 5,000 lb. dry matter per acre for unfertilized varieties at the same age.

Crude protein levels fell from 22.77 per cent. at four weeks to 7.07 per cent. at 12 weeks on a dry weight basis.

It is suggested that for efficient utilization, such material would have to be cut and fed, rather than grazed.

INTRODUCTION.

In recent years a number of forage sorghum hybrids have been released by seed firms in Australia. Although one of these, Sudax, had been grown in pastures at Munum and Erap, no assessment of yield potential had been made under Territory conditions. Norman and Wetselaar (1960) reported Katherine Pearl millet to be an outstanding fodder plant in trials conducted at Katherine in the Northern Territory.

A trial was laid down at Bubia to assess production of six different forage sorghum hybrids and the Katherine variety of Pearl millet under wet tropical lowland conditions.

MATERIALS AND METHODS.

The following six forage sorghum hybrids were obtained from various seed firms in Australia :—Bonanza, Calala, Forager, Sudax, Suhy 5 and Trudan. At the same time the Katherine strain of Pearl millet (*Pennisetum typhoides*) was obtained.

The treatments were—

Bonanza— Calala Forager	No fertilizer
Katherine Pearl millet— Sudax Suhy 5 Trudan.	100 lb. N/acre (as sulphate of ammonia)

A split block randomized design with four replicates was utilized. The trial was sown on the 18th July, 1968, at Bubia in a light brown clay loam. Varieties were sown at a rate of 10 lb. per acre in main plots 90 ft. x 12 ft., each plot having four rows 3 ft. apart.

Blocks were split for nitrogen, which was applied as a side dressing in a split application of 50 lb. of N as sulphate of ammonia on each occasion ; the first, one week after planting, and the second, three weeks after planting.

The plots were sampled at 4, 8, 12, and 16 weeks after sowing. Three random lengths of 1 yd. were cut from the centre two rows of each sub-plot at each harvest, the same section of row never being resampled. These were bulked and weighed green. A 1 Kg. sub-sample was taken from each sample and dried to constant weight in a forced draft oven at 85 degrees C. Dried samples of all replicates of each variety were bulked and ground for crude protein analysis.

RESULTS AND DISCUSSION.

Progress of Trial.

All varieties showed very marked visual responses to nitrogen ; plants were taller and had more leaf which was darker green in colour

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than unfertilized plants. Growth of Katherine Pearl millet was not as rapid as that of any of the forage sorghums.

Forager, Bonanza, Sudax and Calala were all flowering by the time the plants were 8 weeks of age. All other varieties flowered before the 12 week harvest.

Although there was only slight infection with sorghum rust at 8 weeks, this became more severe by the 12 week harvest and was noticeably more prevalent on plants which had received nitrogen treatments. Katherine Pearl millet, not being a sorghum, was not affected.

By the 16 week harvest, there was a considerable degree of lodging in nitrogen-treated plots, the varieties Suhy 5 and Trudan being less prone to lodging than the others.

Rainfall, mean maximum and minimum temperatures and average hours of sunshine at Bubia during the period of the trial are shown in *Table* 1.

Dry Matter Production.

The mean dry matter production for all varieties for both treatments at all harvests is shown in *Table* 2. *Figure* 1 shows the production of individual varieties with added fertilizer nitrogen. As can be seen, the best variety, Sudax, yielded more than 12,000 lb. of dry matter per acre at 12 weeks.

The noticeable decline in yield of Sudax, Bonanza, Calala and Forager between the 12 and 16 week harvests was probably caused by plants reaching maturity at some point between these two harvests and senesence setting in. Quite apart from considerable loss of quality with age, allowing sorghum to grow beyond 12 weeks would appear to lead to diminished yields.

In *Figure* 2 the mean values are plotted for all varieties, with and without nitrogen. Not only was the absolute production of material far greater with added fertilizer nitrogen (9,200 lb. and 5,000 lb. per acre respectively), but growth of fertilized varieties was far more rapid. At 8 weeks the average production from fertilized plants was in excess of the production from unfertilized plants at 12 weeks. At all harvests the responses to nitrogen were very highly significant ($P<0.001$).

FIGURE 1.

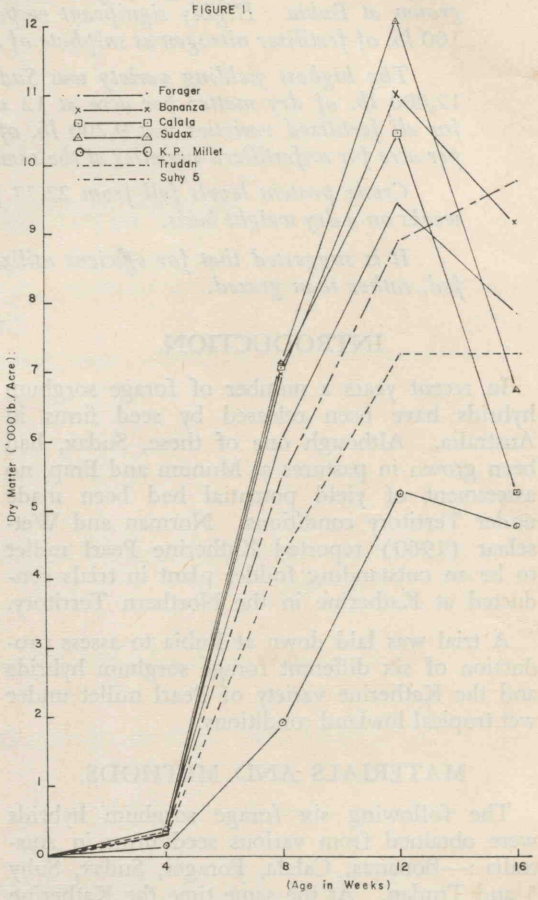
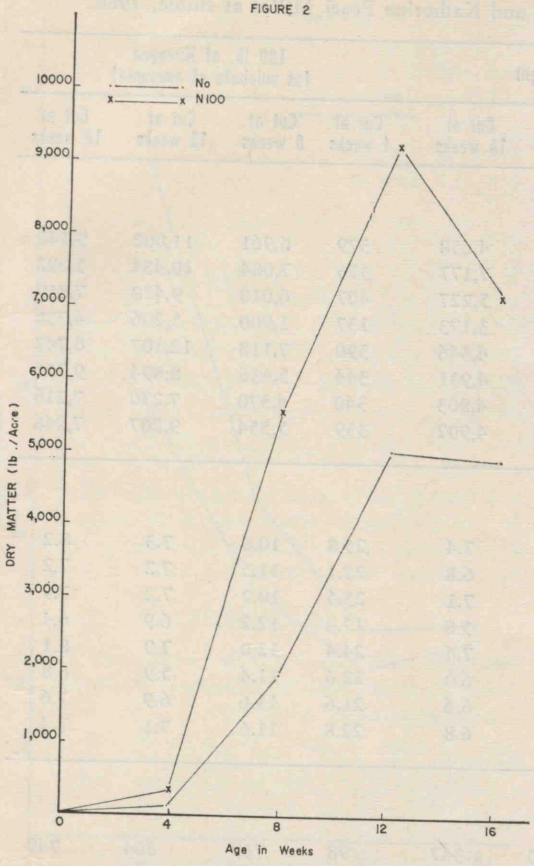


Table 1.—Meteorological Data at Bubia, July-November, 1968.

—	July	Aug.	Sept.	Oct.	Nov.	Total
Rainfall (inches)	10.81	12.35	14.07	9.67	4.34	51.24
Mean max. degrees F.	85.9	88.1	88.9	89.5	89.7	
Mean min. degrees F.	69.6	70.4	69.5	70.4	71.2	
Sunshine (hours)*	3.1	4.9	6.0	5.9	6.0	

* Campbell Stokes recorder.

FIGURE 2



The differences between varieties were significant at the first and fourth harvests ($P<0.05$), and were very highly significant at the second and third harvests ($P<0.001$).

Only at the second harvest was the varieties by nitrogen interaction significant ($P<0.05$). Therefore, in general, the seven varieties were responding in a similar manner to the added fertilizer nitrogen.

Crude Protein Levels.

The crude protein levels at different harvests for the various varieties with and without nitrogen are shown in *Table* 2.

In *Figure* 3 are plotted the crude protein levels for fertilized plots of all varieties.

The mean value fell from 22.77 per cent. at 4 weeks to 7.07 per cent. at 12 weeks. The small rise in protein levels between 12 and 16 weeks is probably due to sampling variation. On the basis of these figures, fertilized material at 8 weeks would be suitable forage for growing cattle, and 12 week material would be suitable for maintenance of mature animals. Whyte *et al.* (1959) give the crude protein requirement for maintenance of mature cattle as 6 to 6.7 per cent., and for growth, 10 per cent.

In *Figure* 4, the mean protein contents for all varieties, both fertilized and unfertilized, are plotted. The unfertilized plants had a consistently lower crude protein level than the fertilized plants. On the basis of the above values, the unfertilized material would have to be grazed between 4 and 8 weeks to provide suitable forage for growing stock, and by 12 weeks would probably not even be suitable for maintenance of mature animals, unless supplemented with a suitable protein concentrate.

FIGURE 3

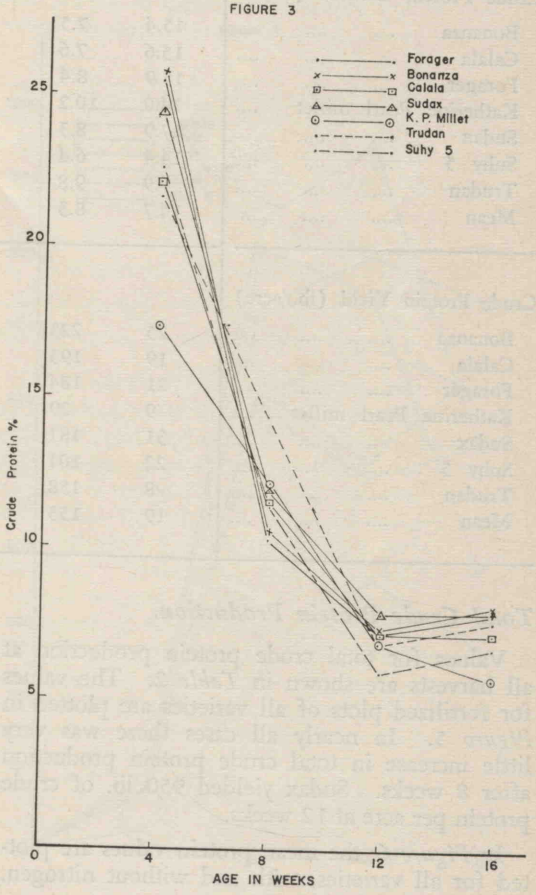


Table 2.—Production of Forage Sorghum Varieties and Katherine Pearl Millet at Bubia, 1968.

Variety	No Nitrogen Treatment				100 lb. of Nitrogen (as sulphate of ammonia)			
	Cut at 4 weeks	Cut at 8 weeks	Cut at 12 weeks	Cut at 16 weeks	Cut at 4 weeks	Cut at 8 weeks	Cut at 12 weeks	Cut at 16 weeks
Dry Matter Yield (lb./acre)								
Bonanza	161	2,968	6,025	4,658	379	6,961	11,002	9,140
Calala	120	2,550	7,742	7,177	375	7,084	10,454	5,292
Forager	133	2,176	4,884	5,227	407	6,010	9,428	7,819
Katherine Pearl millet	62	285	2,059	3,173	137	1,900	5,296	4,756
Sudax	172	2,176	6,040	4,346	390	7,118	12,107	6,747
Suhy 5	152	1,572	4,732	4,931	344	5,436	8,894	9,750
Trudan	76	1,626	3,745	4,803	340	4,370	7,270	7,216
Mean	125	1,908	5,032	4,902	339	5,554	9,207	7,246
Crude Protein Content (%)								
Bonanza	15.4	7.5	6.1	7.4	25.8	10.6	7.3	8.2
Calala	15.6	7.6	6.4	6.8	22.1	11.5	7.2	7.2
Forager	15.9	8.4	5.5	7.1	25.5	10.2	7.2	7.9
Katherine Pearl millet	14.0	10.2	5.9	5.8	17.4	12.2	6.9	6.4
Sudax	17.9	8.3	5.9	7.4	24.4	12.0	7.9	8.1
Suhy 5	14.4	6.4	5.2	6.0	22.6	11.4	5.9	6.8
Trudan	9.9	9.8	5.5	6.6	21.6	13.6	6.9	7.6
Mean	14.7	8.3	5.8	6.8	22.8	11.6	7.1	7.4
Crude Protein Yield (lb./acre)								
Bonanza	25	223	365	347	98	739	804	749
Calala	19	193	498	489	83	815	758	384
Forager	21	184	269	372	104	616	684	621
Katherine Pearl millet	9	29	122	204	24	232	368	273
Sudax	31	181	359	320	95	854	954	548
Suhy 5	22	101	246	296	78	619	528	658
Trudan	8	158	206	315	74	595	504	550
Mean	19	153	295	335	79	639	657	540

Total Crude Protein Production.

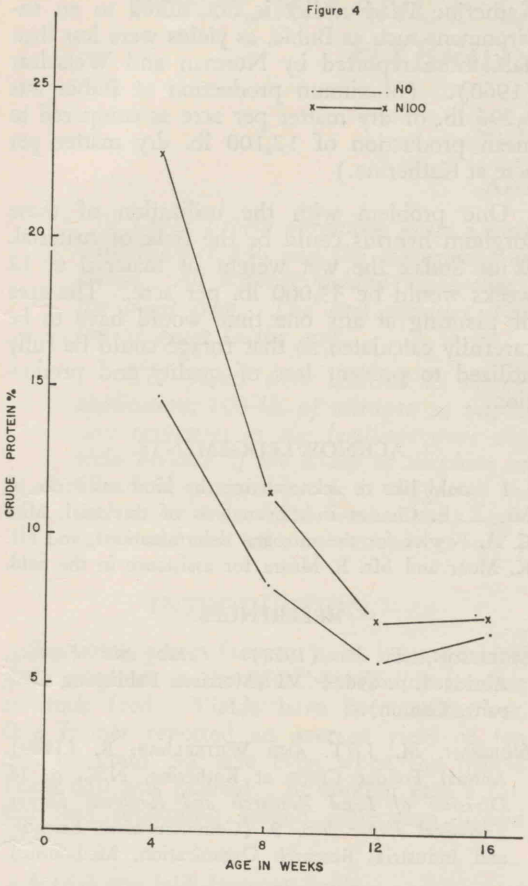
Values for total crude protein production at all harvests are shown in *Table* 2. The values for fertilized plots of all varieties are plotted in *Figure* 5. In nearly all cases there was very little increase in total crude protein production after 8 weeks. Sudax yielded 950 lb. of crude protein per acre at 12 weeks.

In *Figure* 6, the mean protein values are plotted for all varieties, with and without nitrogen. The differences in the total production and the rate of production were very marked, the mean value for all fertilized varieties being 600 lb. per acre at 12 weeks, and the unfertilized plots reaching a maximum of 335 lb. per acre at 16 weeks.

Utilization.

For good untilization the varieties tested would have to be grazed between 4 and 8 weeks of age. Plants at 8 weeks were about 10

Figure 4



ft. high. Grazing would therefore lead to considerable losses as a result of trampling, leading to incomplete untilization of available forage. Moreover, further production would be reduced.

It would appear that for good utilization, forage sorghums would have to be cut and fed to livestock. Fertilized material would be suitable for young animals until it reached an age of 8 weeks, and for use as maintenance rations for mature animals until it was 12 weeks old.

Morrison (1958) states that beef cattle weighing 1,000 lb. fed for rapid growth, require 18.6 to 21 lb. of dry matter per day. Taking the higher value, the mean production for one acre for all fertilized varieties at 8 weeks would give sufficient dry matter for 264 days' feeding. Sudax would provide sufficient matter for 399 days.

If the maintenance requirement for a mature animal weighing 2,000 lb. is taken, the daily dry matter intake requirement is 24.7 to 26.9 lb. of dry matter per day (Morrison 1958). Mature animals could be fed 12-week-old material and each acre would provide 342 days' feeding, using the average of all fertilizer treatments, or 450 days for Sudax.

Costs of Production.

Hybrid forage sorghum seed from Australia costs about 29c per lb. and 100 lb. of N as sulphate of ammonia currently costs about $25 at Lae. Total costs of materials per acre would therefore be in the vicinity of $28 for fertilized sorghum or $3 for unfertilized. As other costs such as ground preparation and harvesting would be the same, the use of fertilizer nitrogen is fully economic and is strongly recommended.

FIGURE 5

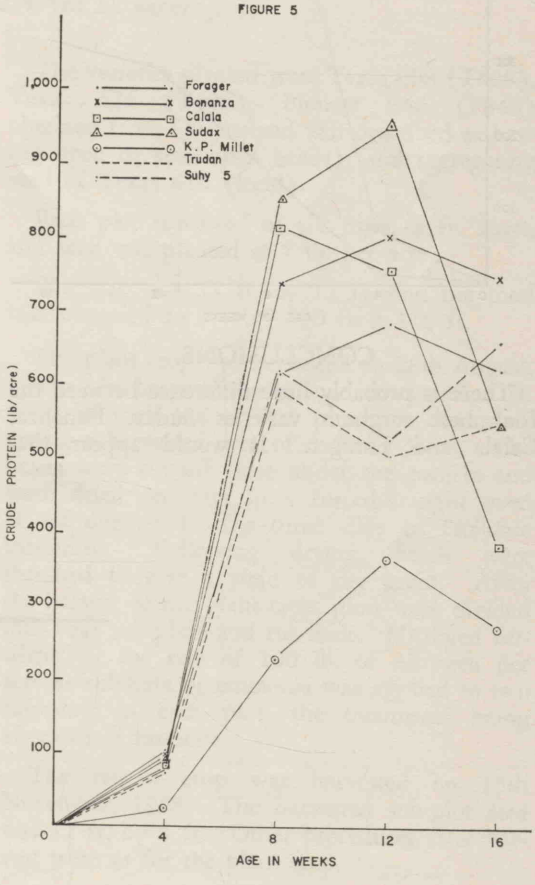
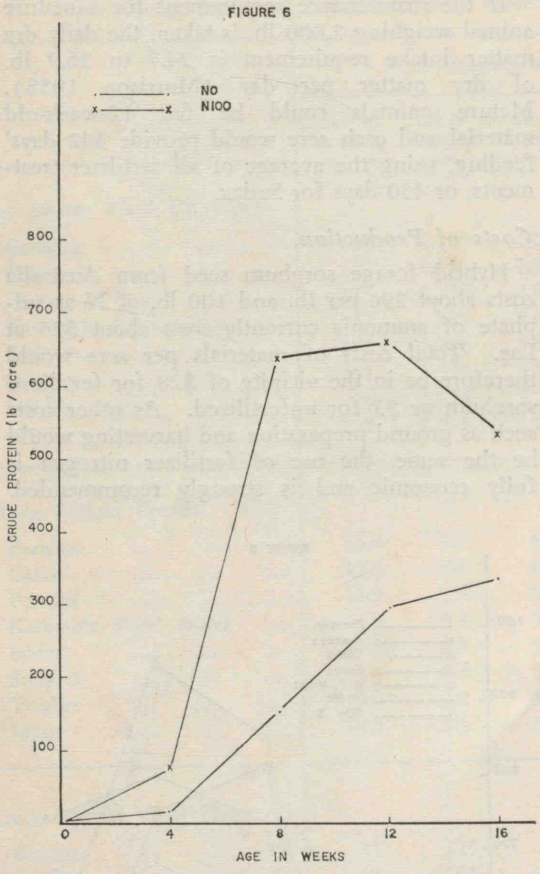


FIGURE 6



CONCLUSIONS.

There is probably little difference between the four best sorghum varieties Sudax, Bonanza, Calala and Forager. It would appear that Katherine Pearl millet is not suited to an environment such as Bubia, as yields were less than half those reported by Norman and Wetselaar (1960). (Maximum production at Bubia was 5,296 lb. of dry matter per acre as compared to mean production of 12,100 lb. dry matter per acre at Katherine.)

One problem with the utilization of these sorghum hybrids could be the bulk of material. With Sudax the wet weight of material at 12 weeks would be 33,000 lb. per acre. The area of planting at any one time would have to be carefully calculated so that forage could be fully utilized to prevent loss of quality and production.

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