AN EVALUATION OF PIGEON PEA (*Cajanus cajan* (L.). MILLSP.) AS A FORAGE FOR GRAZING GOATS

J.S. BINT* and B.W. NORTON*

SUMMARY

Thirty six goats (Mean live weight 15.2kg) of feral origin were grazed (60 goats/ha) on a rattoon crop of Pigeon pea. Three groups of 6 goats were given supplements of either trace minerals, molasses (20GgDM/hd/d)or sorghum grain (200 gDM/hd/d. The remaining goats (18) were unsupplemented. Liveweight change and crop growth were monitored over 10 weeks in summer. There were no significant effects of molasses and mineral on liveweight gain (88g/d) of goats, but supplementation with sorghum significantly increased liveweight gain (119 g/d) in the first 6 weeks of grazing. After 6 weeks forage yields declined with a corresponding decrease in live weight gain in supplemented goats. Mean leaf Nitrogen content was 3.3%, and N:S 35 indicating that forage was sulphur deficient. Seed yields were markedly decreased by grazing treatments.

INTRODUCTION

Pigeon pea (*Cajanus cajan* (L.) Millsp) ranks fifth in importance among edible legumes in the world, and is the most important pulse crop of India. (Morton 1976 Although the major significance of this crop is seed for human consumption, many alternative uses have been reported (Whiteman and Norton 1980). In northern Australia, pigeon pea has been used as a green manure crop for pineapples and bananas, and its value as a forage crop for cattle is well known (Kraus 1921; Akinola et *al*. 1975).

Pigeon pea is an erect perennial shrub, and although frost sensitive thrives in both moist and dry sub-tropical regions under a wide range of rainfall conditions. The cultivar Royes released by the Department of Agriculture, University of Queensland has a high seed yield with pods borne on the top of the canopy facilitating spraying for insect control and mechanical harvesting. In south eastern Queensland, maximum vegetative growth is achieved by November planting, with flowering occuring in April and seed harvest in July. The following experiment was conducted to determine the nutritive value of this crop for growing goats. The effects of grazing in the summer on subsequent seed yields were also measured.

MATERIALS AND METHODS

Experimental site and crop management

The experiment was conducted at Mt. Cotton research farm (University of Queensland) in south east Queensland. The soils are red yellow podzolics and deficient in most plant nutrients (Blunt and Humphreys 1970). Annual average rainfall is 1400 mm with a predominantly summer distribution. Winters are mild (mean minimum 11°) with few frosts. A rattoon pigeon pea (CV Royes) crop (0.8ha) was slashed to 25cm (21/11/1980) and superphosphate (250kg/ha) and KCl (125kg/ha) applied with 114 mm/ha irrigation. Unseasonal rainfall in February 1981 (385 mm) caused localized water logging and some plant deaths. Inter-row spacing was 50cm, and intra-row spacing 8 cm (250000 plants/ha). The crop area was divided into 16 x 0.05 ha plots, fenced and stock water provided in each paddock.

* Department of Agriculture, University of Queensland, St. Lucia, Qld 4067.

Thirty six feral bucks, approximately 6 months old, mean live weight 15.2 kg (range 12.2 to 18.6 kg) were used. The goats of mixed breeding were purchased in the Charleville area 3 months previously, and were accustomed to stock handling. Each goat was given a cobalt bullet and grinder (CoO, ICI), and drenched at 3 weekly intervals with levamisole (Nilverm, ICI) to control intestinal parasites. Goats were weighed every 2 weeks after a 16 hour fast.

Experimental design

Three goats were randomly allocated to each of 12 plots (60 goats/ha), and 3 groups of 6 goats (2 plots) provided with one of the following supplements. A) Minerals - Oral drench (20 ml/goat/14d) of a solution containing 18.2 mg KI, 861 mg $MnSO_4.7H_2O$, 28 mg $CuSO_4.5H_2O$ and 57 mg $NaMoO_4.2H_20$ plus a selenium bullet (Permasel, I.C.I) administered at the beginning of that trial. B) Molasses - 0.286 kg (200 gDM) per goat daily. C) Sorghum -0.220 kg (200 gDM) kibbled sorghum per goat daily. The molasses and sorghum were offered to respective groups twice weekly. The remaining 3 groups (18 goats) were unsupplemented and 4 plots were left ungrazed for the experimental period. Grazing commenced 3 weeks after slashing on 10th December, 1980 and each plot was grazed continuously for 10 weeks.

Measurements and analysis

Leaf samples were collected every month from 40 randomly selected plants in each plot, and after drying (60° for 48h) analyzed for total N after Kjeldahl digestion by an autoanalyzer technique (Henzell et *al*. 1968) and ash by incineration at 600° for 3h. Sulphur was determined after Nitric. perchloric and digestion spectrophotometrically. At maturity, pod and seed were harvested from 40 randomly selected plants in each plot and components weighed. Leaf and seed yield were calculated from plant density. Analysis of variance and the Duncans Multiple range test were used to determine significant differences between treatment means (Steel and Torrie 1960).

RESULTS

Table 1 shows mean values, with LSD, for the yields of available green leaf at different times throughout the experiment, and the subsequent seed yields obtained after the various supplementation treatments. At the beginning of the experiment, there were no significant differences between treatments for leaf available for grazing, but available yield had declined to low levels after 6 weeks of grazing, and remained low thereafter. The leaf available to goats supplemented with sorghum was significantly ($P < 0.05$) greater in the last 4 weeks than that available to goats in the other treatments. In the last 2 weeks of the experiment, water logging caused the death of approximately 13% of the plants in the nil and molasses treatments, and may have contributed to the general decline in leaf yield in all plots. Estimates of seed yield were highly variable, particularly in the grazed treatments, where seed yields were much lower than in the ungrazed crop.

The mean nitrogen content of leaf from the grazed plots was 3.3% (20.6% CP), and showed little significant variation with either time or treatment. Leaf in the ungrazed plots progressively declined in N content with time, and was significantly ($P < 0.05$) lower in N content at the final sampling when compared with that from the grazed plots. The mean S content of the leaf was 0.14% (range 0.05 to 0.27%), and the N:S ratio varied significantly ($P < 0.05$) between treatments (Table 1) and independantly of N content.

TABLE 1 Mean values for the yield of pigeon pea-leaf, seed and leaf composition from plots grazed by goats and ungrazed

	Ungrazed	Supplement nil	Molasses	Sorghum	Minerals	LSD (P<0.05)
Green leaf (kg/ha)						
10 Dec. 1980	1502	1993	1742	1684	1669	503
7 Jan. 1981	3259a ø	1633b	1706b	1659b	1823b	1343*
4 Feb. 1981	1895a	612b	706b	1283c	663b	410*
18 Feb. 1981	2180	636bc	423b	996c	446b	534
Seed Yield (kg/ha)						
1 Aug. 1981	1700	1132	501	700	748	1247
Leaf N (g/kg)						
7 Jan. 1981	38.2a	37.1a	36.6a	26.1b	35.2ab	10.0*
4 Feb. 1981	30.9a	33.4ab	29.3a	26.9a	37.4b	4.8*
18 Feb. 1981	23.4a	37.8b	32.8b	32.3b	35.5b	9.4*
Leaf N:S						
7 Jan. 1981	20.1a	22.5a	35.8b	44.9b	21.4a	12.6*
4 Feb. 1981	25.7	33.3	49.5	40.9	40.6	27.0
18 Feb. 1981	9.3a	21.8b	19.9b	22.8b	14.8ab	6.5*

*P < 0.05 ø Values with dissimilar subscripts differ significantly (P < 0.05)

Table 2 gives mean values, with LSD, for the liveweight changes of goats in the first 6 and second 4 weeks of the experimental period. In the first 6 weeks, goats supplemented with sorghum grew significantly (P < 0.05) better than those on the other treatments, and during this period there was no significant effect of either molasses or mineral supplementation on liveweight gain. In the final 4 weeks, the groups supplemented with sorghum and molasses continued to increase in weight at a slower rate than previously, unsupplemented goats maintained weight and the mineral supplemented group lost weight rapidly.

TABLE 2 Mean values for the live weight change (g/d) of goats grazing pigeon pea

	Nil	Supplement Molasses	Sorghum	Minerals	LSD (P < 0.05)
No. of Goats	18	6	6	6	
Grazing Period (days)					
0-42	88a ø	88a	119b	80a	29*
42-70	7a	42b	31ab	-35c	31*

* P < 0.05 Values with dissimilar subscripts differ significantly (P < 0.05)

DISCUSSION

After 3 weeks regrowth, Pigeon pea had produced sufficient leaf to maintain continuous liveweight gain of goats over 6 weeks at a high stocking rate (60goats/ha). The average daily gain made by unsupplemented goats on Pigeon pea (88 g/d) was similar to that made by other goats grazing Pangola grass pastures (79g/d) at the same time but was slightly lower than that recorded for Saanen wether goats (106 g/d) on irrigated temperate pastures (McGregor 1980). After 6 weeks grazing, leaf yields had declined to low levels (10-12 kg leaf/hd) and resulted in decreased weight gains in the sorghum, molasses and nil supplemented groups in the final 4 weeks of grazing. Weight loss in the mineral supplemented group during this period suggests a detrimental effect of supplementation where feed availability was low.

Molasses was provided as an additional source of both digestible energy and sulphur (S) (Wythes et al. 1978) in anticipation of previously experienced low S levels in the forage. However despite low S and high N:S in the leaf, there was no liveweight response to molasses supplementation. Wheeler et al. (1980) found a significant growth response to supplemental S in sheep fed sorghum forage with a lower N:S (19) than that found for Pigeon pea (35). It would seem that goats may have either lower dietary requirements for S than sheep or that they selected leaf and stem material of higher S content than that sampled. Further studies with goats fed Pigeon pea hay and supplemented with sulphur are being conducted to clarify this aspect.

Since supplemented goats were consuming the same intakes of energy from sorghum and molasses, the better growth of the sorghum supplemented group cannot easily be ascribed to additional energy intake alone. Two possible explanations of this differential response may be advanced. Firstly, sorghum grain may have partially escaped digestion in the rumen thus providing an additional source of glucose and protein for absorption in the intestinal tract, thereby stimulating growth. Secondly, molasses which may have formed up to 30% of the goats daily intake may have decreased the intake and/or digestibility of the forage consumed. The higher leaf yields remaining in the plots grazed by the sorghum supplemented goats suggests that substitution feeding was being practised by these animals, but similar effects were not observed in plots grazed by molasses supplemented goats. It may be concluded that Pigeon pea was a useful forage for goats, although grazing resulted in heavy penalties in final seed yield. The erect habit of Pigeon pea and the browsing behaviour of goats suggests that avoidance of intestinal parasite burdens may be an important additional benefit in the use of this crop for grazing goats. Further studies are needed to evaluate the use of this crop as a protein source for animals during winter.

ACKNOWLEDGEMENTS

The authors wish to thank Mr. Ray Harris for his care in management of the goats and Mr. J.W. Hales for practical supervision of the project.

REFERENCES

AKINOLA, J.P., BIRCH, C.J., WHITEMAN, P.C. and WALLIS E.S. (1975) Proc Aust. Conf. Trop. Past. Townsville

BLUNT, G.G., and HUMPHREYS, L.R. (1970) Aust. J. Exp. Agric. Anim. Husb. 10:431.

HENZELL, E.F., WALLIS, E. and LINQUIST, J.E. (1968) Trans. Soil Sci. Cong. 2:513.

KRAUS, F.G. (1921) Hawaii Agric. Exp. Stn. Bull. No.46.

McGREGOR, B.A. (1980) Proc. Aust. Soc. Anim. Prod. 13:345.

MORTON, J.R. (1976) Hort. Sci. 11:11.

STEEL , R.G.D. and TORRIE, J.H. (1960) "Principles and Procedures of Statistics" McGraw Hill Book Company, Inc. New York.

WHEELER, J.L., ROCKS, R.L. and HEDGES D.A. (1980) Proc.Aust.Soc.Anim.Prod.13:297.

WHITEMAN, P.C. and NORTON, B.W. (1980) Proc. Inter. Pigeon Pea Workshop ICRISAT, Hyderabad, India, p97.

WYTHES, J.R., WAINWRIGHT, D.M. and BLIGHT, G.W. (1978) Aust. J. Exp. Agric. Anim. Husb. 18:629.