KENYA WHITE CLOVER (TRIFOLIUM SEMIPILOSUM) - A PROMISING LEGUME FOR DAIRY PRODUCTION IN SUB-TROPICAL ENVIRONMENTS

T.H. STOBBS+

Summary

The nutritive value of Kenya white clover/Paspalum dilatatum, white clover/Paspalum dilatatum and nitrogen fertilized Rhodes grass pasture was assessed in spring, summer and autumn by measuring milk production per cow and milk composition.

Cows grazing Kenya white clover-based pastures gave more milk than those grazing Rhodes grass pastures. Jersey cows on white clover-based pastures produced similar high yields in spring (15.9 kg cow^{-1} day^{-1}) but white clover yields in summer and autumn were low and milk production correspondingly low and similar to yields from cows grazing grass pastures. In summer and autumn milk from cows grazing Kenya white clover-based pastures had a higher solids-not-fat content,

I. INTRODUCTION

Kenya white clover (Trifolium semipilosum var. glabrescens) has shown promise in wet sub-tropical and elevated tropical areas of Australia, particularly in areas where white clover (T. repens) has naturalised ('t Mannetje 1964; Evans 1967; Jones 1972). One introduction of this species (cv. Safari) has recently been released. Laboratory analyses (Dougall 1962; Jones 1972) and preliminary beef production studies (Jones and Jones 1975) suggest that it has a high nutritive value. The value of this species for milk production is the subject of this paper.

II. MATERIALS AND METHODS

The experiment was conducted on alluvial soils at the C.S.I.R.O. Pasture Research Station, Samford Queensland (lat. 27°22', long. 152°53', mean annual rainfall 1030 mm, alt. 50 m).

Five 0.15 ha replicates of both Kenya white clover cv. Safari/ Paspalum dilatatum and white clover cv. Ladino/Paspalum dilatatum were established in a randomised block layout in April 1972. The third treatment was five adjacent paddocks of Rhodes grass (Chloris gayana cv. Pioneer), which had been established in pure stand in 1967 and received nitrogen (58 kg ha^{-1}) as urea at monthly intervals, except during May, June and July.

Milk production per cow was determined with feed not limiting (a minimum of 40 kg of dry green feed was available per cow per day). Jersey cows in their 4th-12th week of lactation were blocked according to stage of lactation, milk yield and liveweight and after a preliminary period on pangola grass (Digitaria decumbens) swards were randomly assigned to the three pasture treatments of a 3 x 3 latin square. Experimental periods were of 14 days duration consisting of a 9-day standardisation period followed by a 5-day measurement period. In spring

+C.S.I.R.O. Division of Tropical Agronomy, Cunningham Laboratory, Brisbane, 4067.

(Aug., Sept.) 1972 18 cows (6 animal blocks) rotationally-grazed 2-3 week regrowths of the three pastures. Excess feed was removed by non-experimental animals. Rugose leaf curl virus (Grylls, Galletly and Campbell 1972) seriously affected growth of the Kenya white clover in 1973 but subsequent growth in summer (Jan, Feb) 1974 was good and 12 cows (4 animal blocks) were used to evaluate 3-week regrowth of the pastures. The third evaluation of 3-4 week regrowth was conducted in autumn (March, April) 1974 with 9 cows.

Pasture yields before and after grazing were estimated by cutting 6 quadrats, each 0.37 m^2 in area, during the measurement periods. Composite herbage samples from each measurement period were separated into grass and legume components, dried and analysed for *in vitro* digestibility, nitrogen and mineral composition (P, Ca, Na, K, Mg).

The milk yield of individual cows was recorded and composite samples (2% aliquots) were taken at morning and evening milking and bulked for each measurement period. These samples were analysed for butterfat, solids-not-fat, protein and casein contents.

III. RESULTS

The proportion of Kenya white clover (54.8%) and white clover (57.6%) in the swards during the spring was high (Table 1). The amount of white

TABLE 1

Yield, *in vitro* digestibility and mineral composition of herbage

Season and variables	Kenya white clover / *P. dilatatum*		White Clover / *P. dilatatum*		Rhodes grass
1. Spring					
Herbage yield ($kg\ D.M.\ ha^{-1}$)	1171 (54.8)+	966	1393 (57.6)	1026	2137
Digestibility (%)	69.8	62.7	74.1	62.6	61.5
Nitrogen (%)	3.61	2.61	3.73	2.68	2.20
2. Summer					
Herbage yield ($kg\ D.M.\ ha^{-1}$)	712 (21.9)	2538	320 (8.7)	3041	3426
Digestibility (%)	72.4	56.5	77.7	55.3	57.8
Nitrogen (%)	3.40	2.04	3.52	1.95	2.13
3. Autumn					
Herbage yield ($kg\ D.M.\ ha^{-1}$)	260 (7.3)	3302	Trace	2987	3462
Digestibility (%)	74.3	55.1	-	54.8	57.9
Nitrogen (%)	3.28	1.87	-	1.94	2.14
4. Mean mineral composition (all seasons)					
Phosphorus (%)	0.37	0.41	0.42	0.42	0.27
Calcium (%)	1.36	0.34	1.03	0.36	0.37
Sodium (%)	0.09	0.26	0.40	0.27	1.01
Potassium (%)	2.67	2.65	3.03	2.72	1.39
Magnesium (%)	0.30	0.21	0.35	0.23	0.14

+ percent legume

clover declined rapidly in summer and by autumn contributed very little to production whereas the Kenya white clover continued to give some valuable growth over the summer and autumn. Nutritive value of both white clover and Kenya white clover was high with *in vitro* digestibilities of 70 percent or higher and nitrogen content above 3%. The digestibility. of Kenya white clover was lower in spring than in summer and autumn and was regularly lower in digestibility than the white clover. Digestibilities of Rhodes grass and *P. dilatatum* were low and similar. Mineral composition of all species varied only slightly between seasons and was adequate for production although Kenya white clover had a low sodium content.

In the spring cows grazing the two legume-based pastures produced more milk than those grazing Rhodes grass pastures, with a generally higher butterfat, solids-not-fat, protein and casein content (Table 2).

TABLE 2

Milk yield and composition

Season and variables	Kenya white clover *P. dilatatum*	White clover/ *P. dilatatum*	Rhodes grass	Signif. level	L.S.D. P=0.05
1. Spring					
Milk yield ($kg\ cow^{-1}\ day^{-1}$)	15.7	15.9	14.1	***	0.6
S.C.M. ($kg^{-1}\ cow^{-1}\ day^{-1}$)	17.3	17.2	16.0	***	0.7
B.F. (%)	4.7	4.5	5.0	*	0.3
S.N.F. (%)	9.11	9.21	9.02	*	0.12
Protein (%)	3.41	3.44	3.32	**	0.08
Casein (%)	2.45	2.59	2.46	**	0.08
2. Summer					
Milk yield ($kg\ cow^{-1}\ day^{-1}$)	11.8	10.4	10.5	**	0.7
S.C.M. ($kg^{-1}\ cow^{-1}\ day^{-1}$)	12.9	11.5	11.5	*	0.7
B.F. (%)	4.6	4.7	4.7	n.s.	
S.N.F. (%)	9.20	9.11	9.01	*	0.14
Protein (%)	3.67	3.52	3.41	*	0.12
Casein (%)	2.89	2.72	2.70	*	0.11
3. Autumn					
Milk yield ($kg\ cow^{-1}\ day^{-1}$)	6.6	5.2	5.8	*	0.7
S.C.M. ($kg^{-1}\ cow^{-1}\ day^{-1}$	7.7	6.0	6.7	*	0.8
B.F. (%)	5.1	5.2	5.2	n.s.	
S.N.F. (%)	9.25	9.12	9.18	*	0.03
Protein (%)	3.92	3.90	3.91	n.s.	
Casein (%)	2.84	2.80	2.67	n.s.	

n.s. = $P > 0.05$ * = $P < 0.05$ ** = $P < 0.01$ *** = $P < 0.001$

In summer and autumn, the overall level of milk production was lower but cows grazing the Kenya white clover pastures gave most milk. Solids-not-fat content of milk was higher from cows on the Kenya white clover treatment.

In the spring two mild cases of bloat occurred when cows were grazing Kenya white clover and one when grazing white clover but all responded to treatment with anti-bloat oil.

IV. DISCUSSION

The performance of Kenya white clover based pastures in these experiments-together with the high herbage yields and carrying capacities from such pastures (Jones and Jones 1975) suggests that the legume has considerable promise for dairy production in wet sub-tropical environments. Whereas white clover pastures 'provided nutritious feed in the spring the contribution of this legume during the remainder of the year was low compared with Kenya white clover pastures which provided high quality feed in summer and autumn.

The low solids-not-fat, protein and casein content of milk from cows grazing Rhodes grass pasture and P. dilatatum pastures with a small legume content indicates a low intake of-digestible energy (Stobbs and Brett 1974). This confirms previous findings (Hamilton et al 1970) that intake of digestible energy is more important than protein content as the factor limiting milk production from tropical pastures and the major contribution of the legumes in these experiments was due to a higher intake of digestible energy.

The two weaknesses of Kenya white clover are the initial set-back due to rugose leaf curl virus in the establishing stand and the risk of bloat. Although pastures were badly affected by the virus at establishment once they recovered pastures remained free from re-infection. Kenya white clover has a low sodium content (Dougall 1962; Jones 1972) but in this study the level of sodium was higher than previously reported and provided there is a high sodium content in the companion grass no deficiency is likely to occur in grazing animals.

V. REFERENCES

DOUGALL, H.W. (1962). East African Agricultural and Forestry Journal, 27: 142.

EVANS, T.R. (1967). Tropical Grasslands, 1: 143.

GRYLLS, H.E., GALLETLY, J.C., and CAMPBELL: R.L. (1972). Australian Journal of Experimental Agriculture and Animal Husbandry, 12: 293.

HAMILTON, R.I., LAMBOURNE, L.J., ROE, R. and MINSON, D.J. (1970). Proc. XI Internat. Grassld. Congr. Surfers Paradise 1970. p. 860.

JONES, R.J. (1972). Tropical Grasslands, 7: 277.

JONES, R.J., and JONES, R.M. (1975). Annual Report C.S.I.R.O. Division of Tropical Agronomy 1974-75.

MANNETJE, L. 't (1964). Australian Journal of Experimental Agriculture and Animal Husbandry, 4: 22.

MINSON, D.J., and McLEOD, M.N. (1972). C.S.I.R.O., Division of Tropical Agronomy Technical Paper No. 8.

STOBBS, T.H., and BRETT, D.J. (1974). Australian Journal of Agricultural Research, 25: 657.