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EFFECT OF HUNTER RIVER LUCERNE (MEDICAGO SATIVA L.) ON GRASSES IN RAIN-GROWN PASTURES

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SUMMARY

In an infrequently grazed field experiment at Biloela, in sub-coastal Queensland, six grasses are being observed in simple combinations with good stands of Hunter River lucerne (*Medicago sativa* L.) or poor stands of siratro (*Phaseolus atropurpureus* DC.). Results are presented for a period commencing 18 months after planting.

Where the grasses were associated with lucerne, mean yield of the six grasses was increased at all but one of seven harvests over more than 2 years, the increases ranging from 36 to 74%. Increases due to the presence of lucerne were also recorded in the total dry matter of the pasture. Nitrogen content of the grasses was improved.

There was a significant increase in the yield of seed material by two buffel grass cultivars at one harvest.

The possible effect of above-average winter to early summer rains in two of the three seasons is discussed.

I. INTRODUCTION

The only reliable legume presently available for use in rain-grown pastures in much of central and southern Queensland is Hunter River lucerne (*Medicago sativa* L.). This applies especially to areas receiving less than 30 in. rain per annum. Christian and Shaw (1952) recorded an increase in yield of Rhodes grass (*Chloris gayana* Kunth) when grown with lucerne at Lawes in south-eastern Queensland. Paltridge (1955), however, reported a general depression in yield of scrobic (*Paspalum commersonii* Lam.) when associated with lucerne in a series of experiments in southern Queensland. This was especially so when the two species were grown in alternate rows. It was more erratically expressed in total yield when the two plants were grown in mixed swards.

An experience common to "Brian Pastures" Pasture Research Station and Biloela Research Station (Stonnard and Scateni 1964; Anon. 1966; Cameron

1964; Scateni 1968) is that grass yields are depressed by the inclusion of lucerne. Often the total yield of grass plus lucerne only equals that of pure grass swards. After a time at both centres, however, the total crude protein of the mixture and the crude protein content of the grass itself are increased by the inclusion of lucerne in sown pastures.

The present note records substantial increases in presentation yields of a range of grasses over more than 2 years when these were grown with Hunter River lucerne as two-species mixtures.

II. EXPERIMENTAL

The experiment was sown on March 7, 1963 as a 6 x 2 x 4 randomized block with simple combinations of six grasses and two legumes. The grasses used were Biloela and Molopo buffel grasses (*Cenchrus ciliaris* L.), Callide and Pioneer Rhodes grasses, green panic (*Panicum maximum* var. *trichoglume* (K. Schum.) Eyles) and Gatton panic (*P. maximum* Jacq.). The legumes were Hunter River lucerne and siratro (*Phaseolus atropurpureus* DC.). Legumes were sown at 2 lb/ac and grasses at 3 lb/ac. Plots measured 36 ft x 60·5 ft. Excellent lucerne but weak siratro stands were obtained. With the exception of Gatton panic, grass establishment was good.

The soil is a deep grey brown clay loam typical of the Callide alluvials described by Isbell (1954).

The area has been grazed at irregular intervals by Australian Illawarra Shorthorn dairy cows or weaners. Grazing occurred in August 1963, February and October 1964, January, May and December 1965, February, July and November 1966 and February 1967.

Prior to grazing the area was sampled for forage yield, and a further sampling, when residue warranted, was carried out after grazing. The area was then slashed to 3-4 in. above ground level. Sampling techniques varied from time to time and the before-grazing harvests presented here are as follows:—

Two 16 ft x 4 ft mower strips per plot on January 21, 1965, and May 19, 1965.

One 16 ft x 4 ft mower strip per plot on February 10, 1966, and February 13, 1967.

Two 16 ft x 3 ft mower strips per plot on June 27, 1966, and October 20, 1966.

Six 5 lk x 2 lk quadrats cut with hand-shears per plot on December 7, 1965.

The green yield of each sampling strip was weighed in the field and one bulked subsample for each plot was hand-separated and oven-dried at 95°C for determination of botanical composition and oven-dry dry-matter respectively. Prior to February 1966, one bulked subsample of the grass separate for each treatment was analysed for nitrogen. From February 1966 onwards a subsample of the grass from each plot was analysed.

On January 14, 1966, all seed-head material, mature or green, was harvested from seven 21 in. x 42 in. quadrats placed in a regular pattern around the centre of each buffel grass plot. This material was bulked for each plot, oven-dried and weighed.

Over winter to early summer—the period most suited to vigorous lucerne growth—rainfall was considerably above average in two of three seasons (Table 1). On the other hand, the second half of summer and autumn each year was drier than normal. As a result, in contrast to the excellent lucerne growth each spring, the initially weaker stand of siratro virtually disappeared.

TABLE 1

MONTHLY RAINFALL (IN.) AT BILOELA RESEARCH STATION, JULY 1964 TO JUNE 1967

Month	1964–65	1965–66	1966–67	Mean (1924–1965)
July	3·96*	0·05	1·35*	1·31
August ..	1·29*	0·14	2·78*	0·74
September ..	2·56*	1·17*	0·93*	0·85
October ..	4·53*	0·59	3·11*	2·01
November ..	1·17	1·26	2·80*	2·78
December ..	4·38*	5·33*	5·44*	3·71
January ..	6·72*	2·83	3·39	4·13
February ..	0·21	2·23	2·02	4·63
March ..	1·76	5·28*	0·47	2·67
April ..	4·01*	1·03	0·20	1·66
May	0·19	0·84	0·94	1·51
June	1·00	2·91*	4·45*	1·44
Total ..	31·78	23·66	27·88	27·44

* Months above average rainfall.

III. RESULTS

The comparison presented here, for all practical purposes, is of lucerne-grass swards compared with pure grass swards. Certainly at no stage was there sufficient siratro to suggest that depression of grass yields by this species could have occurred.

On all occasions the total dry-matter yield increases due to the presence of lucerne were highly significant (Table 2). This was brought about not only by significantly greater lucerne than siratro yields but also by significantly greater grass yields when the grasses were associated with lucerne on six of the seven occasions. On no occasion was there a significant difference in the other species and inert separate due to the presence of either legume. Increase in the percentage nitrogen in the grass separates due to the presence of lucerne reached highly significant levels on two occasions.

TABLE 2

EFFECT OF SOWN LEGUMES ON YIELD ATTRIBUTES
OVEN-DRY DRY-MATTER (LB/AC)

Sampling date	21.i.65	19.v.65	7.xii.65	10.ii.66	27.vi.66	20.x.66	13.ii.67
Total dry matter							
With lucerne	1,950	1,729	267	3,235	924	1,369	2,297
With siratro	1,205	1,143	124	2,178	601	931	1,576
L.S.D. 5%	389	235	51	619	141	251	371
L.S.D. 1%	522	316	68	832	189	338	498
Mean grass yield							
With lucerne	1,262	1,115	90	2,436	478	270	1,756
With siratro	847	821	111	1,719	317	178	1,008
L.S.D. 5%	276	157	25	519	109	72	356
L.S.D. 1%	371	211	34	697	147	97	478
Mean legume yield							
Lucerne	499	398	177	454	184	1,004	176
Siratro	100	120	14	119	5	3	29
L.S.D. 5%	159	122	42	117	Not analysed		
L.S.D. 1%	214	164	56	157			
Mean % N in grass separate							
With lucerne	0·98	1·18	..	1·06	1·36	1·60	n.a.
With siratro	0·87	1·08	..	0·95	1·19	1·27	n.a.
L.S.D. 5%				0·14	0·13	0·08	
L.S.D. 1%				0·19	0·17	0·11	

This effect of lucerne on total dry-matter and grass yields is shown more clearly in Table 3, where the yields with siratro are used as a base and changes due to the presence of lucerne are expressed as a percentage of these.

TABLE 3

PERCENTAGE INCREASE IN YIELDS OF TOTAL DRY-MATTER AND GRASS COMPONENT WHEN LUCERNE IS PRESENT COMPARED WITH SIRATRO

Sampling date	21.i.65	19.v.65	7.xii.65	10.ii.66	27.vi.66	20.x.66	13.ii.67
Total dry-matter	61·8	51·3	115·3	48·5	53·7	47·0	45·7
Mean grass yield	49·0	35·8	−18·9	41·7	50·8	51·7	74·2

At six of the seven samplings the total dry-matter increase ranged from 45·7 to 61·8%, with the sampling at the end of the drought in December 1965 showing a 115·3% increase in favour of lucerne. At these same six samplings

grass yields showed increases ranging from 35·8 to 74·2% as a result of association with lucerne. The only depression in grass yield in association with lucerne—18·9%—occurred at the sampling at the end of the drought. This fall, however, was not of a significant magnitude.

In mid-January 1966, it was noticed that the two buffel grass cultivars were seeding much more profusely when associated with lucerne. The harvesting of all seed-head material carried out on January 14 confirmed a significant effect from association with lucerne (Table 4).

TABLE 4

EFFECT OF SOWN LEGUMES ON A HARVEST OF SEED MATERIAL ON BUFFEL GRASS CULTIVARS, 14.i.66

Lb/ac

Legume	Buffel Grass	
	Biloela	Molopo
Lucerne	126·4	32·5
Siratro	47·4	3·7
L.S.D. 5% ..	20·5	
L.S.D. 1% ..	31·1	

IV. DISCUSSION

Visually, the effect of the lucerne on grass growth was spectacular, especially when plots of the same grass and different legumes occurred side by side. The grass in a lucerne plot was 6–9 in. taller when well-grown than the same species in a siratro plot and distinctly dark green, especially in the case of green panic. The plot edges were very distinct, this change taking place within a foot or so. It would appear that the stimulation, almost certainly a nitrogen effect, was by way of underground transference, as the whole experiment was bulk grazed.

The only occasion on which a significant interaction of grass cultivar by legume was recorded in the grass yields was in May 1965, when the two buffel grasses responded significantly to the presence of lucerne, while the Rhodes grasses and panics did not. In February 1966, the lucerne yields were significantly better with Rhodes grasses than with the other cultivars, an expression of the lack of vigorous competition from the Rhodes grass weakened by the drought in 1965.

Simpson (1965) measured the greatest transference of nitrogen from lucerne to associated grass in a pot study under conditions of infrequent defoliation and the absence of moisture stress. The frequency of grazing in the present experiment was somewhat less than that normally recommended for lucerne-grass pastures, with 2 weeks grazing and 8 or 10 weeks recovery. As well, winter to early summer rainfalls were above average in two of the three years.

Contrary to Simpson's results, Paltridge (1955) indicated that he only obtained increases in total pasturage from the presence of lucerne with scrobic

when he used year-long grazing and special management tending towards overgrazing, almost the opposite of the grazing management used in the present experiment. He considered, however, that he had two incompatible species and could only expect an increase in yield when he used heavy grazing to prevent the lucerne from competing strongly with the grass for moisture. He did not indicate actual increases in grass yield due to lucerne—only total forage was recorded.

There can be no doubt, however, that under suitable climatic and management conditions lucerne can function as a very effective pasture legume. How much the infrequent grazing and how much the above-average rainfall in the later half of two of the years contributed towards the results recorded is not known, but it is highly probable that the major effect was the excellent winter-spring conditions for lucerne growth.

At only one harvest (early December 1965), when drought conditions had existed for the previous 7 months, was no increase in the mean yield of the six grasses recorded. Even on this occasion, however, total yield was increased by the far better yield of lucerne than of siratro.

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