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A STUDY OF THREE IMPORTANT PASTURE MIXTURES IN THE QUEENSLAND SUB-TROPICS: PROGRESS REPORT 1958-1963

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SUMMARY

The last 5 years' results of a 9-year grazing experiment comparing the productivity of three pasture mixtures—Rhodes grass, green panic and Gayndah buffel grass, each sown with Hunter River lucerne and phasey bean—are reported.

Pasture mixtures failed to recover their former productivity following a severe drought. The recovery of Rhodes grass was markedly inferior to that of green panic and buffel grass, although the proportion of both of these sown grasses also declined with time. Lucerne compatibility varied as the pastures aged. Lucerne yields in the Rhodes grass treatment were initially lower than in other treatments, but were superior in the Rhodes grass treatment in later years, when least lucerne occurred in the buffel grass treatment. Lucerne sown in January 1954 remained productive until the summer of 1958-59, and the legume was successfully reseeded in 1960. However, dry conditions following re-establishment limited its development and decline in pasture productivity continued.

The buffel grass mixture produced more dry matter and crude protein in the years 1958 and 1959, but consistent treatment differences in these parameters were not displayed in the final years of the experiment.

The green panic mixture produced the greatest overall liveweight gain. Animal liveweight increases per acre on sown pastures were approximately 2½ times as great as those on native pasture grazed at the rate normal for the district, which was one half the stocking intensity of the sown pastures.

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I. INTRODUCTION

In a previous paper (Young, Fox, and Burns 1959), the first 4 years' results of a grazing experiment comparing the productivity of three pasture mixtures at the "Brian Pastures" Research Station, Gayndah, were reported. The mixtures were Rhodes grass (*Chloris gayana* Kunth), green panic (*Panicum maximum* var. *trichoglume* (K.Schum.) Eyles), and buffel grass (*Cenchrus ciliaris* L. cv. Gayndah), each sown with lucerne (*Medicago sativa* L. cv. Hunter River) and phasey bean (*Phaseolus lathyroides* L.). This paper presents results obtained from the experiment during the period August 1958 to October 1963.

II. MATERIALS AND METHODS

Experimental procedures were detailed in the previous paper.

Management.—The decline in lucerne productivity described in the initial report continued during 1958 and 1959, necessitating the resowing of lucerne over the whole area. In the autumn of 1960 the area was chisel-renovated twice and lucerne drilled at 1 lb/ac into the three pasture mixtures. Experimental grazing was suspended for the period January 29, 1960, to February 3, 1961; the area was heavily grazed prior to lucerne establishment and intermittently grazed subsequently to control surplus growth.

During the period covered by this report, six groups of animals were depastured on the experiment as listed in Table 1, and no hay was conserved from the area.

TABLE 1

STOCKING SEQUENCES

Group No.	Period of Grazing	Duration of Grazing (weeks)	No. of Animals per 20-ac Treatment Initial Age; Liveweight
6	15.viii.58–14.viii.59 ..	52	8 weaner Hereford steers; 9 months; 411 lb
7	14.viii.59–29.i.60	24	8 weaner Hereford steers; 8 months; 359 lb
8	3.ii.61–9.vi.61	18	6 yearling Hereford steers; 16 months; 577 lb
9	9.vi.61–24.v.62	50	8 weaner Hereford heifers; 6 months; 356 lb
10	25.v.62–7.vi.63	54	8 weaner Hereford heifers; 6 months; 306 lb
11	7.vi.63–1.x.63	16	8 weaner Hereford heifers; 6 months; 316 lb

Records.—Sampling of pastures immediately before and after each grazing continued until January 29, 1960. Sampling intensity was reduced when experimental grazing recommenced on February 3, 1961, presentation yields before grazing only being estimated thereafter.

Seasonal conditions.—Over the duration of the experiment very large fluctuations in rainfall occurred (see Table 2). For the last 4 years, below-average rainfall was recorded.

TABLE 2

MONTHLY RAINFALL (IN.) AT "BRIAN PASTURES" AND MEAN VALUES FOR GAYNDAH (86 YEARS)

Month	"Brian Pastures"						Gayndah Mean
	1958	1959	1960	1961	1962	1963	
January	3·36	12·09	3·79	3·59	3·05	2·06	4·70
February	8·15	3·84	5·08	5·84	3·27	1·24	4·20
March	2·78	2·93	2·36	0·78	4·59	3·46	3·10
April	1·39	0·48	1·08	0·78	1·37	0·72	1·46
May	0·11	1·84	1·64	0·47	0·96	1·09	1·55
June	5·99	0·03	0·53	0·20	1·06	1·13	1·82
July	0·17	2·14	0·43	1·70	1·05	0·05	1·47
August	1·57	0·28	0·34	0·56	0·63	1·34	1·12
September	1·51	1·12	0·41	0·70	1·69	1·43	1·47
October	2·99	2·70	3·37	3·35	0·63	0·46	2·37
November	0·08	4·94	1·18	1·18	1·47	0·81	2·97
December	4·46	7·41	2·52	2·52	4·86	2·82	4·21
Total	32·56	39·80	22·73	28·69	24·63	16·61	30·44

Annual Rainfall (in.)

1954	1955	1956	1957
32·06	36·06	44·85	9·16

III. RESULTS

(a) Pasture Yields

Total pasture.—Marked seasonal changes in the amount of available forage present before grazing occurred in all treatments, as shown in Figure 1. The curves were calculated from the moving means of five successive fortnightly samplings and the actual growth of the pasture was even more seasonal than as represented.

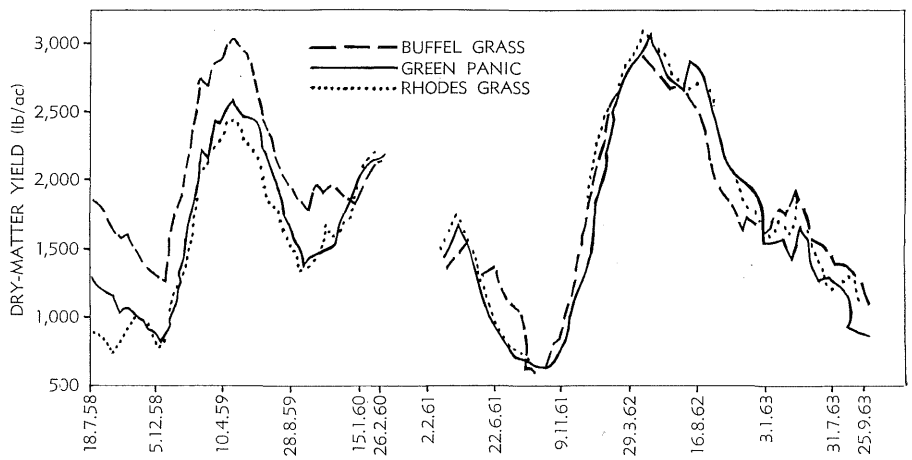

Fig. 1.—Dry-matter yield of pasture mixtures before grazing.

The superior drought tolerance of buffel grass previously reported was reflected in greater productivity in the 2-year period subsequent to the 1957 drought, when peak presentation yields in this pasture mixture reached 3,660 lb dry matter per acre. No real difference in pasture growth between mixtures was measured during the final 3-year period subsequent to renovation and spelling for lucerne establishment in the autumn of 1960. During 1962, pasture yields reached approximately 3,000 lb dry matter per acre and approached yields measured in the initial years of the experiment.

However, this is not necessarily an indication of the maintenance of pasture productivity. The proportion of the yield of sown grass species to total production during the later period of the trial was markedly reduced. At the termination of experimental grazing in October 1963, total dry matter available at grazing was 1,109, 1,103 and 944 lb dry matter per acre, of which only 4%, 26% and 22% was sown grass in the Rhodes grass, buffel grass and green panic treatments respectively.

Lucerne.— The yield of the lucerne component of the pastures is shown in Figure 2. Lucerne productivity recovered slightly in 1958-59, following the severe depression of lucerne yields during the 1957 drought. However, in the spring of 1959 lucerne seldom yielded in excess of 50 lb dry matter per acre, and with further lucerne mortality during the 1959-60 summer, density declined to a point where re-establishment was considered necessary.

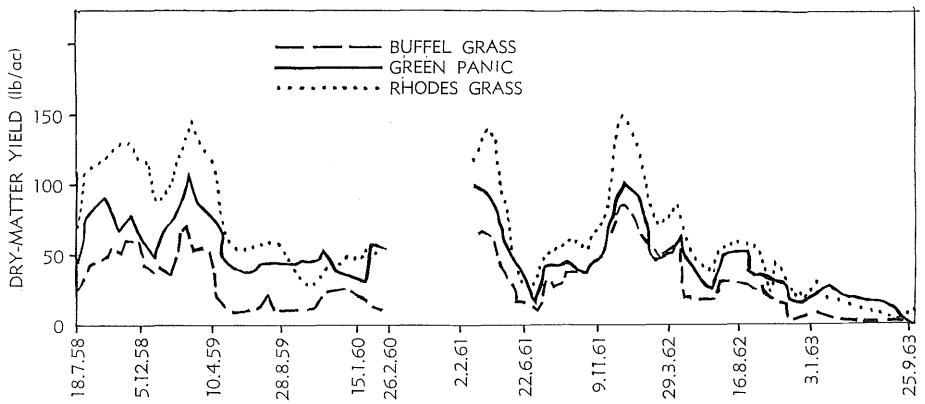

Fig. 2.—Dry-matter yield of lucerne in pasture mixtures before grazing.

Following reseeding, good emergence and initial seedling growth occurred. However, as seen from Table 2, the 1960 winter and spring months immediately following resowing were abnormally dry and many seedlings failed to persist until good rain was received in October of that year. Subsequent lucerne productivity did not approach the peak yields obtained in the spring of 1956, and 3 years after resowing, the drought of 1963 finally reduced lucerne density to the point where it made a negligible contribution to stock diet during the winter of 1963.

The compatibility of lucerne with the three grasses studied is of interest. Immediately subsequent to the sowing of the experiment in 1954, the establishment and colonization of Rhodes grass was superior to those of green panic and buffel grass, and for the first 2½ years lucerne productivity was inferior when associated with Rhodes grass. However, as previously reported, the drought tolerance of Rhodes grass during the 1957 drought was greatly inferior to that of either buffel grass or green panic. Consequently Rhodes grass provided much less competition to lucerne during the period of moisture stress, and lucerne survival and production subsequent to 1957 were superior when associated with this species. Conversely, buffel grass, which exhibited remarkable drought tolerance, provided very strong competition to the legume over the later months of the drought, and lucerne production subsequent to 1957 was greatly reduced in the buffel grass treatment.

Although lucerne productivity subsequent to re-establishment never reached the levels measured in the earlier years of the trial, a cultural practice enabling lucerne to be re-established into sown pastures was demonstrated.

Lucerne yields in the summer of 1961-62 exceeded 120 lb/ac in the Rhodes grass and green panic treatments, and the reduced vigour was largely attributable to below-average rainfall recorded for the 4 years subsequent to re-establishment.

Phasey bean was present in only neglibible proportions during the period covered by this report.

Intrusion of native species.—Native species intrusion was initially more severe in the green panic and buffel grass treatments, which had poorer initial establishment than Rhodes grass. However, subsequent to the drought, severe intrusion of native species occurred in the Rhodes grass treatments.

The failure of the native species to occupy completely the space previously supporting sown grass species resulted in a large decline in the percentage total basal cover, a further reflection of the general loss of vigour measured during the final stages of the experiment (see Table 3).

TABLE 3

PERCENTAGE BASAL COVER

Time of Sampling	Rhodes Grass Treatment		Buffel Grass Treatment		Green Panic Treatment	
	Total Pasture	Sown Grass	Total Pasture	Sown Grass	Total Pasture	Sown Grass
1. Jan. 1958. At the peak of the 1957–58 drought stress	8·8	6·5	8·2	5·3	6·6	3·3
2. Sept. 1958. Eight months after break of drought	4·9	1·4	6·8	3·7	6·2	2·6
3. Oct. 1963. At termination of experiment	2·8	0·18	3·3	1·37	2·7	1·07

(b) Protein Content

Seasonal changes in the crude protein content of the pasture available before grazing are shown in Figure 3. The greater absolute yield of lucerne combined with the lower productivity of grass in the Rhodes grass treatment is reflected in the higher percentage protein measured in this pasture during 1958 and 1959. Large seasonal variations in pasture quality were measured. Immediately subsequent to the reseeding of lucerne a higher percentage of crude protein was measured in the green panic and Rhodes grass mixtures. During this period, in the green panic treatment the sown grass constituted a higher proportion of the total yield of the pasture than was presented by either Rhodes grass or buffel grass in their respective mixtures. Seedling regeneration of green panic, following renovation, resulted in a younger age distribution of the sown grass in this treatment, with a consequently higher percentage crude protein.

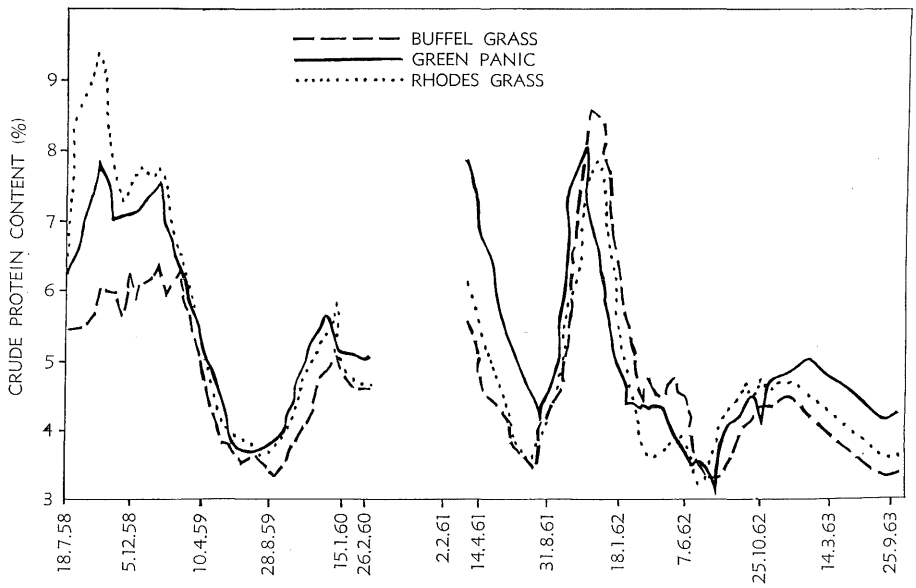

Fig. 3.—Percentage crude protein of pasture mixtures.

The total crude protein yield per acre, a function of percentage crude protein and total dry-matter yield, is shown in Figure 4. During the period 1957-1959, despite the lower yields of lucerne and the lower percentage of crude protein measured in the buffel grass pasture, this mixture was superior to the other two treatments with respect to total yield of protein per acre. This was a direct reflection of the higher dry-matter yields measured in this pasture mixture over that period. Subsequent to the reseeding of lucerne, differences in pasture dry-matter production between mixtures were eliminated and little difference was measured between treatments with respect to crude protein yields.

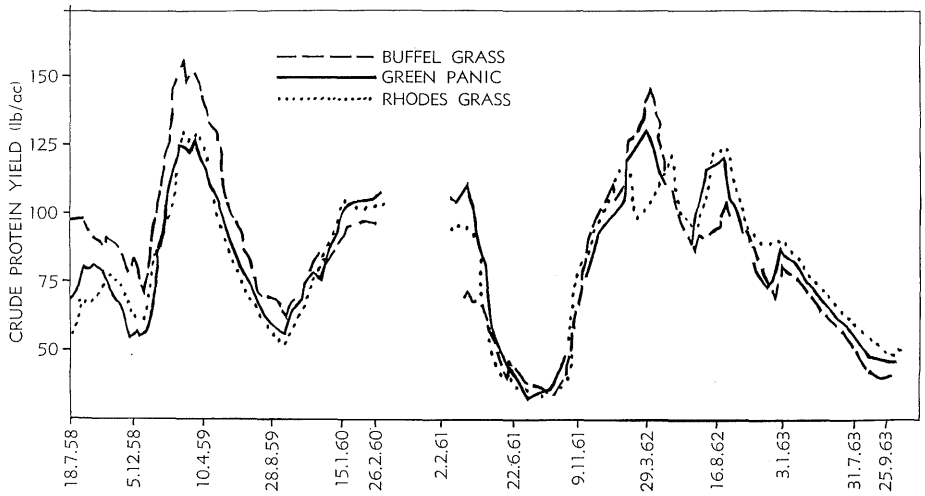

Fig. 4.—Crude protein yield of pasture mixtures.

(c) Animal Liveweight Changes

The liveweight data for all cattle groups not previously reported are summarized in Table 4. The total liveweight changes per acre for the whole period of the experiment are listed in Table 5. Though all groups of cattle were matched for age and weight at the commencement of each grazing cycle, the groups designated native pasture were not under experimentally comparable conditions. Nevertheless, these animals reflect the liveweight changes which occur on native pastures under normal station management at half the stocking rate set on the pastures under study.

TABLE 4

LIVEWEIGHT CHANGES FOR SIX GROUPS OF EXPERIMENTAL ANIMALS
lb/ac

Group	Period	Rhodes Grass Mixture	Green Panic Mixture	Buffel Grass Mixture	Native Pasture
6	15.viii.58–14.viii.59	73	78	73	40
7	14.viii.59–29.i.60 ..	50	55	40	30
8	3.ii.61–8.vi.61 ..	46	49	46	22
9	9.vi.61–24.v.62 ..	88	88	79	26
10	25.v.62–7.vi.63 ..	80	91	66	37
11	7.vi.63–1.x.63 ..	−9	−4	−9	−11
	Total	328	357	295	144

TABLE 5

TOTAL LIVEWEIGHT CHANGE FOR THE DURATION OF THE EXPERIMENT
lb/ac

—	Rhodes Grass Mixture	Green Panic Mixture	Buffel Grass Mixture	Native Pasture
Previously reported: Groups 1–5, 7.i.55–15.viii.58	276	341	356	108
Total all groups: 7.i.55–29.i.60; 3.ii.61–1.x.63 ..	604	698	651	252

The productivity of the pasture in terms of animal liveweight gains is best reflected in groups 6, 9 and 10, which were maintained for full 12-month periods. Weaner steers on sown pasture in group 6 were less productive in the year following the 1957 drought than the 2½-year-old animals in group 1 during the initial period of the trial, which from January 7, 1955, to January 20, 1956, gained 112, 116, 122 and 36·5 lb liveweight per acre for the Rhodes grass, green panic, buffel grass and native pasture groups respectively. In groups 9 and 10, weaner heifers were slightly more productive than animals in group 6 in years subsequent to the resowing of the lucerne.

In the final group 11, heifers weaned onto the sown pasture in June gained approximately 30 lb immediately following weaning. However, with continued below-average rainfall, considerable liveweight losses occurred in late August-September, and at the termination of grazing in October 1963 all groups were below weaning weight. For the duration of the final 10-week grazing cycle, pasture dry-matter available at grazing exceeded 1,000 lb dry matter per acre. However, for the same period a lucerne dry-matter yield below 25 lb per acre was frequently recorded.

In the last 4 years of the experiment, liveweight gain was greatest from the green panic mixture, and the buffel grass mixture showed a decline in performance relative to that of the other two mixtures.

IV. DISCUSSION

The decline in pasture vigour, reflected in dry-matter production, percentage crude protein and pasture density, has been noted. This decline was greatest in the Rhodes grass treatments, which were initially very well established. The effect of the 1957 drought on the productivity of Rhodes grass was previously reported. Recolonization by this species during the high-rainfall years subsequent to the drought was poor. The cheapness of seed, ease of establishment and early vigour of Rhodes grass merit attention, but the poor drought tolerance of this species relative to green panic and buffel grass must be considered when grass species for this environment are selected.

While reductions in the sown grass density were also recorded in the other pasture treatments, the persistence of buffel grass and green panic was markedly superior to that of Rhodes grass. An important factor with regard to persistence of both buffel grass and green panic was the initial stand density. In certain subplots initially well colonized by these species, the persistence of green panic and buffel grass was superior to the mean as reported in Table 3. In these particular subplots this persistence was maintained even during the later years of the trial when the vigour of sown grass had markedly declined.

Considering such factors as persistence, drought tolerance, response to rain following moisture stress, and growth response to brief warm periods during winter, commercial green panic was considered to be the superior grass species of the three studied. Compared with buffel grass, the better compatibility of green panic with lucerne is another factor in favour of its more widespread use, as the critical factor in animal production was lucerne yield. The wider use of this legume is strongly advocated. In years of average rainfall, lucerne can be expected to persist well, particularly if some form of deferred grazing similar to that reported is practised. In this experiment, lucerne sown in 1954 persisted well until late 1957, when only 9 in. of rainfall were recorded for the year. Following this decline, a satisfactory method of re-establishing lucerne into pastures of this type was demonstrated. The subsequent decline in lucerne productivity following this resowing was a reflection of the abnormally dry and hot conditions from early September until late October experienced in the spring immediately following the autumn of sowing. Very heavy grazing pressure was applied to the lucerne during the 1963 drought. With soil moisture frequently limiting for regrowth during the protected phase, more lucerne succumbed under this grazing management regimen during this final year of the trial. Though the decline was more rapid and more severe in Rhodes grass, all pasture mixtures declined in vigour during the course of the experiment. This loss of productivity is shown in Figures 1-4 as lower total dry-matter production, lower lucerne yields and reduced crude protein status of the pasture available to the grazing animal.

The marked decline in vigour and productivity of the pasture in the later years of the trial is not entirely reflected in animal liveweight performance. Although the weaner steers (group 6) and weaner heifers (groups 9 and 10) made lower total liveweight gain per acre per annum than was initially measured using 2½-year-old steers, a portion of this reduction may be a function of their physiological age. This suggests that the pastures were greatly under-utilized during the initial years of the trial, and that heavier stocking rates could have been employed initially with at least no faster loss of pasture productivity.

V. ACKNOWLEDGEMENTS

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