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THE EFFECTS OF FODDER CONSERVATION ON THE PRODUCTION OF SHEEP GRAZING FOUR TEMPERATE PERENNIAL GRASSES

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Summary

A system of conserving hay in spring, and feeding the whole crop in late autumn and winter was compared with no conservation, using pure swards of four temperate perennial grasses grazed continuously at two stocking levels. There was no evidence that the effects of conservation on wool production were different for the four pasture species. There were significant increases in sheep survival and wool production in a year of very low rainfall following satisfactory hay crops. However in a year of normal rainfall there was no evidence of gains from the practice. These results emphasize that an optimum fodder conservation strategy should provide for some carryover of conserved material from year to year.

I. INTRODUCTION

In Australia the effects of fodder conservation on sheep production have been generally small and variable. Responses have been related to yearly rainfall, the percentage area conserved and the overall stocking intensity (Willoughby 1958; Hutchinson 1966; Bishop, Birrell, and Tew 1968). The effect of conservation may be subdivided into components that include hay making and feeding operations, and behavioural and nutritional responses in the flock (Hutchinson 197 1) .

Pasture species may have different seasonal growth rhythms that substantially influence animal production (Hamilton, Hutchinson, and Swain 1970) . A study of the possible advantages of combining fodder conservation, as hay making, with particular species was the aim of this experiment.

II. MATERIALS AND METHODS

At Armidale, well established monospecific swards of ***Phalaris*** *tuberosa, Fes:uca arundinacea* Schreb. (tall fescue), *Lolium perenne* L. (perennial ryegrass) and *Dactylis glomerata* L. (cocksfoot) were sub-divided to give 32 plots each of 0.154 ha. The plots were grazed continuously between October 1964 and September 1965 with Merino wethers at 19.5/ha (medium) and 39.0/ha (high), and on half the total number of plots, hay was conserved. Treatments were repli-

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cated and grass species and site were confounded in the design. Following a prolonged drought the total area of 4.8 ha was cultivated and resown in May 1966 with the same treatment combinations allocated as a randomized block. The areas were grazed continuously between October 1967 and September 1968 with 13 and 26 ewes and lambs/ha, designated medium and high, with or without fodder conservation. Lambs were weaned in December at 8 weeks of age by placing udder covers on the ewes. The wether lambs were removed in April. The pastures were fertilized annually with superphosphate and potash, and 69 kg nitrogen per ha was applied every 3 months.

The peak growth rates of each of the four species occurs in the spring, and the fodder conservation practice involved enclosing 40 per cent of each conservation plot from the second week in September until the end of November when hay was made. During this time grazing was restricted to the remaining 60 per cent. The hay crops were barn dried, stored separately and were fed back to sheep on the same plot during the following autumn and winter. Yields, feed refusals and *in* vivo digestibilities of the hays were determined.

Periodic wool growth was estimated by dyebanding (Chapman and Wheeler 1963), and used to calculate fleece corrected Iiveweight. For individual plots, the sheep that died were replaced until 33 per cent or less of the experimental animals survived. At this level all sheep were removed, and a value of zero for survival was assigned. No data were collected from replacement sheep.

III. RESULTS

The annual rainfall for year 1 (October 1964 to Septemebr 1965) was 430 mm; whereas the mean annual rainfall for Armidale is 750 mm. The year was

TABLE 1

Hay yields, feeding efficiencies and dry matter digestibilities of hay conserved from four temperate perennial grasses in two years

	Tall fescue	Phalaris	Cocksfoot	Perennial ryegrass
1964/65				
Medium stocking rate				
Hay yield (kg/ha)	1825	1610	740	1656
Hay eaten (%)	79	93	95	100
High stocking rate				
Hay yield (kg/ha)	1630	1623	857	1279
Hay eaten (%)	100	100	100	100
1967/68				
Medium stocking rate				
Hay yield (kg/ha)	3182	1903	2396	2084
Hay eaten (%)	22	49	28	59
High stocking rate				
Hay yield (kg/ha)	2494	1896	2130	1877
Hay eaten (%)	93	41	—	67
Dry matter digestibility (%)				
1964/65	57.1	57.0	57.6	63.4
1967/68	58.2	66.1	60.5	65.7

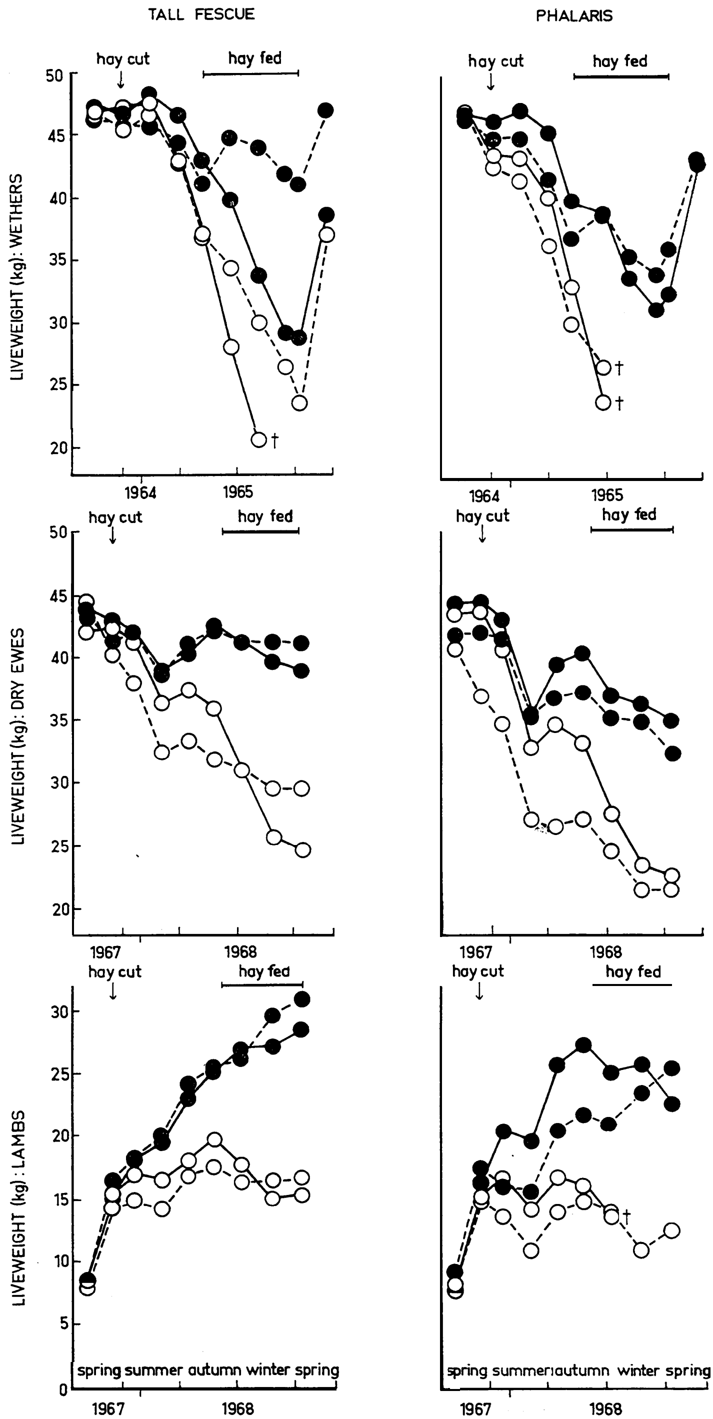
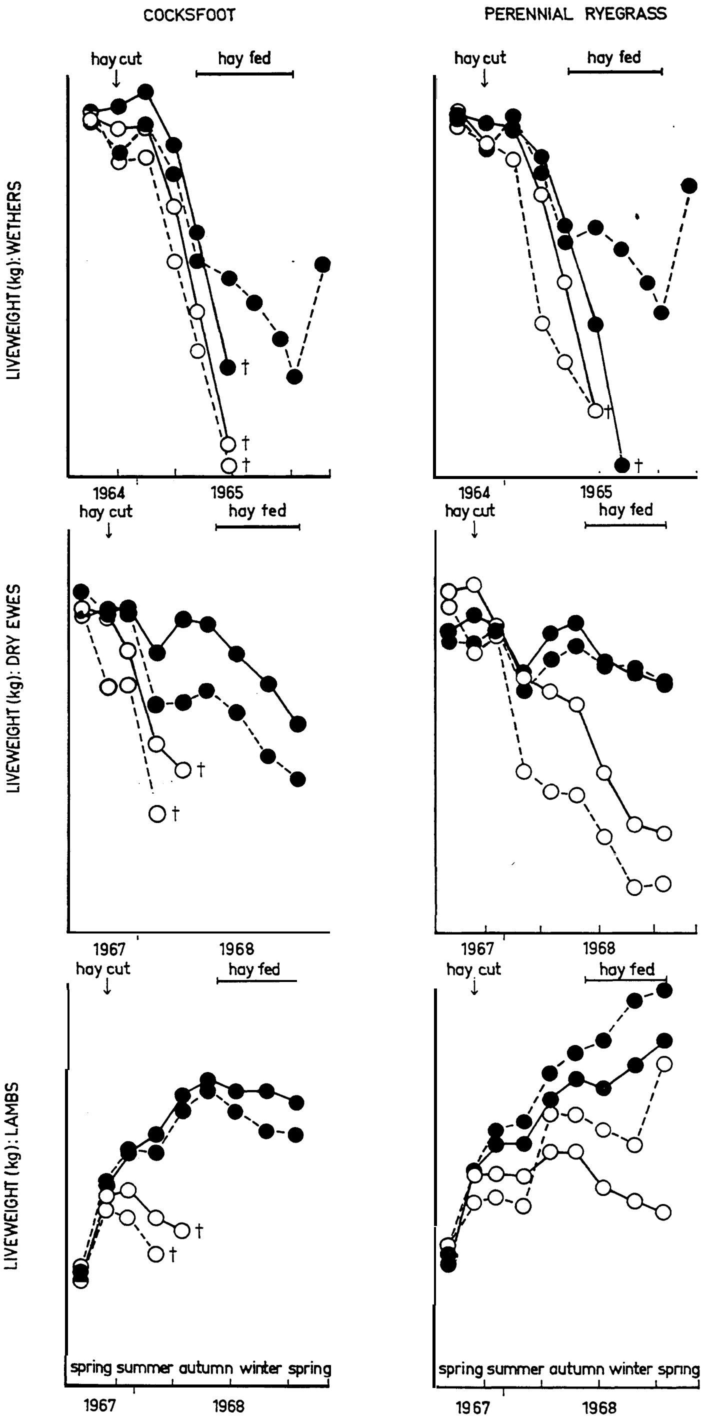


Fig. 1. — Fleece free liveweights of sheep grazing four temperate perennial grasses at low (●) and high (○) stocking rates, with (- - -) and without (———) fodder conservation. Treatments marked thus (†) were terminated because of low survival of sheep.


COCKSFOOT
PERENNIAL RYEGRASS
LIVEWEIGHT (kg): WETHERS
LIVEWEIGHT (kg): DRY EWES
LIVEWEIGHT (kg): LAMBS
hay cut
hay fed
1964
1965
1967
1968
spring summer autumn winter spring
†

notable for a prolonged dry period starting from December 1964 and the district was proclaimed a drought area in February 1965. The annual rainfall for year 2 (October 1967 to September 1968) was 789 mm.

Hay yields, digestibilities and feeding efficiencies (hay eaten x 100/hay offered) are recorded in Table 1. Feeding efficiencies were high (79 to 100 per cent) in year 1, while in year 2 they were generally lower and more variable (22 per cent to 93 per cent). Hay was fed during drought conditions in year 1, whereas in year 2 the mean. pasture availability (green plus dry) for the medium stocking rate during the feeding period ranged from 850 to 3300 kg/ha of dry matter.

Liveweight changes are shown in Figure 1. There were large differences associated with stocking rate. Liveweights were analysed in late summer each year to assess the accumulated effects of restricting the grazing areas for the hay crops. In both years there were significant reductions in liveweight associated with conservation ($P < 0.01$). In year 2 there was a significant interaction between stocking rate and conservation for both ewes and lambs ($P < 0.05$), due to the reduction in Iiveweight of sheep grazing plots with conservation being greater at the high stocking rate. During the feeding periods there were responses in liveweight, particularly in the drought year and at the higher stocking rates. With the exception of the cocksfoot treatment there were consistent responses by the lambs to fodder conservation during the autumn-winter feeding period.

TABLE 2

Clean wool production and survival of sheep grazing four perennial grasses with and without fodder conservation

	Tall fescue	Phalaris	Cocksfoot	Perennial ryegrass	Mean wool production
1964/65					
Medium stocking rate					
Conserved	61.3* (100†)	53.7 (100)	39.0 (23)	53.2 (100)	51.8
Not conserved	51.9 (67)	49.0 (100)	37.1 (0)	36.6 (0)	43.6
High stocking rate					
Conserved	84.8 (58)	51.4 (0)	47.6 (0)	53.2 (0)	59.3
Not conserved	68.0 (0)	56.2 (0)	50.7 (0)	56.7 (0)	57.9
1967/68					
Medium stocking rate					
Conserved	56.0 (100)	49.8 (100)	45.0 (25)	61.7 (100)	53.1
Not conserved	56.4 (100)	52.1 (100)	50.3 (100)	55.2 (100)	53.5
High stocking rate					
Conserved	70.6 (94)	52.0 (25)	43.4 (0)	59.0 (38)	56.2
Not conserved	74.1 (69)	60.6 (38)	51.1 (0)	76.8 (75)	65.7

*Mean clean wool production per flock (kg/ha)
†Mean survival (%)

The values for annual clean wool production per hectare are presented in Table 2. In year 1 there were significant differences between stocking rates ($P < 0.001$), and in favour of the conservation treatment ($P < 0.05$), with the greater response occurring at 19.5 sheep/ha (+19 per cent). In year 2 there were no significant differences in wool production attributable to stocking rate, conservation or pasture species. Interactions involving wool production were not significant in either year.

Percentage survival for both years is given in Table 2. In year 1 there was a significant difference between stocking rates ($P < 0.001$), and a substantial increase in sheep survival due to conservation ($P < 0.001$). In year 2 the sheep grazing tall fescue and ryegrass had higher survivals ($P < 0.01$) than those grazing cocksfoot. Differences between stocking rates were significant ($P < 0.01$), but there was no effect of fodder conservation on sheep survival.

IV. DISCUSSION

Despite evidence of differences in growth rate between sheep grazing different species (Hamilton et *al.* 1970), the effects of fodder conservation on survival and clean wool production, in this experiment, did not differ for each of the four grass species. Survival and wool production are interdependent in this study because of the practice of measuring wool production until death.

Fodder conservation within a grazing system may cause a loss in production when the flock is restricted to a portion of the total area during the growth and conservation of the pasture hay crop. The occurrence and extent of such a penalty would be related to the percentage of land withdrawn from grazing, climatic factors and the overall stocking intensity. The reductions in the summer liveweight of sheep from the conservation plots indicate that such penalties occurred in this experiment. These penalties have important implications for the practice of conservation, since any loss in production must be recovered during the feeding period before there can be any increase in the total production of the system. Response will also depend on feeding efficiency which in the second year of the present experiment was low. The high refusals of hay may have been associated with levels of pasture availability (Hutchinson 197 1) since these were generally in excess of 1000 kg DM/ha. A further factor reducing responses during feeding would be the operation of substitution effects whereby grazing intake may be reduced according to the level of supplement consumed (Allden and Jennings 1962; Holder 1962; Langlands 1969).

The responses to fodder conservation in terms of survival and wool production were related to annual rainfall. In the year of low rainfall following satisfactory yields of hay, there were substantial gains from fodder conservation, and for the year of normal rainfall there was no response. This result emphasizes that optimum fodder conservation management should provide for conserved material to be carried over from one year to another to be fed only during prolonged dry periods when herbage availability is low.

V. ACKNOWLEDGMENTS

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