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SUITABLE FEEDING SYSTEMS FOR FAT LAMB PRODUCTION

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OPSOMMING: GESKIKTE VOERSTELSELS VIR SLAGLAMPRODUKSIE

Ondersoek is ingestel na die ontwikkeling van doeltreffende slaglamproduksierantsoene deur gebruik te maak van verskillende sappige voere. Veertig Dohne Merino ooie is jaarliks vir drie jaar onmiddellik na partus in vier groepe van tien elk verdeel. Groep 1 het mieliekuilvoer, Groep 2 Japanse radyse, Groep 3 groen koringweiding en Groep 4 kragvoer as hoof bestanddeel in die rantsoen ontvang. Daar was geen statisties beduidende verskille t.o.v. speengewig van lammers nie maar wel 'n hoogsbeduidende verskil ($P<0,01$) t.o.v. lamkarkasgewigte. Karkasse van Groepe 3 en 1 was swaarder as die van Groepe 2 en 4. Goedkoop geproduseerde sappige voere soos Japanse radyse en mieliekuilvoer in produksierantsoene kan dus ingeskakel word sonder om produksie prys te gee. In die gevalle waar wintergraanweiding doeltreffend benut word deur bv. twee uur weiding per ooi en lam per dag toe te laat kan die ekonomiese lonendheid van die stelsel moeilik oortref word.

SUMMARY

The development of efficient rations for fat lamb production was investigated using a variety of succulent feeds. Forty Dohne Merino were divided annually for three years immediately after parturition into four groups of ten. Group 1 received maize silage, Group 2 Japanese radish, Group 3 green wheat pasture and Group 4 concentrates as the main ingredient in their rations. There was no statistically significant difference in the weaning weight of lambs but there was a highly significant different ($P<0,01$) in carcass weight, those of Groups 1 and 3 being heavier than Groups 2 and 4. Cheap succulent feeds such as Japanese radish and maize silage can therefore be utilized without reducing productivity. It is difficult to improve on the economic return from efficiently utilized winter wheat grazing e.g. two hours grazing per ewe and lamb per day.

The greater part of the eastern Highveld has developed into a mixed farming region where sheep farming plays an important role. Due to different factors such as decreasing wool prices, increased beef prices and a considerable increase in the price of land, a very definite trend towards fat lamb production is evident. Despite the need for supplementary feeding, autumn or early winter lambing is generally recommended due to a lower incidence of internal parasites during this period. Winter cereal pastures are commonly used for this purpose and their value in this regard has been adequately proved. However, the advantages offered by winter cereal pastures have been questioned with regard to both potential and reliability of yield as well as economic utilisation (van Wyk, 1962; Preller & Coetzee, 1964). Maize silage can also be produced in this region which is both a reliable and inexpensive feed (Basson, Hattingh & Tomlinson, 1964). Although a fodder crop such as Japanese radish is also dependent of sufficient moisture during autumn, it would appear that higher yields (dry matter) under similar moisture conditions may be obtained from Japanese radish in comparison with winter cereal pastures (Kolbe & de Vos, 1952).

Intake studies on Japanese radish and maize silage have been conducted and the inadequacy of these succulent feeds when fed without supplements has been shown (Reyneke, 1967). Although poor results with maize silage were obtained by Bosman (1963), the suggestion was made by Barnard (1963) that maize silage together with adequate supplementation may prove efficient. The present investigation was initiated to compare the efficiency of different succulent feeds i.e., winter cereal pasture (*Triticum vulgare*) Japanese radish (*Raphanus* sp.) and maize silage when they constitute a major portion of a fat lamb production ration.

Procedure

Over a period of three consecutive years 40 Döhne Merino ewes with single lambs were annually divided into four comparable groups of ten each, immediately after parturition. Grouping was effected by considering live weight, age and weaning weight of previous offspring. Different ewes were drawn for this experiment from a flock of 200 ewes annually. All experimental animals were penned and fed individually for the first season. During the second and third season group feeding was practised with groups 1, 2 and 3 while group 4 was penned and fed individually. Feed intake of the experimental groups as weighed out daily and the calculated feeding value of the rations are provided in Table 1. Maize silage was produced from SA 4 maize which had been fertilized with 214,5 kg of a 2:3:2 mixture per ha. *Eragrostis curvula* was fertilized with 181 kg of limestone ammonia nitrate annually. Both leaves and tubers of Japanese radishes were sliced with a radish cutter and then weighed before feeding. Wheat pasture was utilized at a leaf length of 10–15 cm.

Rations were readily consumed with less than 2% wastage. Reyneke (1967) determined intake of winter cereal pastures and arrived at a figure of 3,63 kg per ewe during the first 1,5 hours of grazing, which provided 70 to 80% of the lactating ewe's total nutritional requirements. Consequently winter cereal pasture was cut and weighed

Table 1

Daily feed intake of ewes and calculated feeding value of the ration

Group	Item	Quantity	Feeding value		
			DP	TDN	DM
		kg	kg	kg	kg
	Maize silage	2,72	0,065	0,624	0,850
1	*E. curvula*	0,34	0,007	0,183	0,301
	Concentrates	0,68	0,099	0,531	0,593
	Total		0,171	1,338	1,744
	Japanese radish	9,09	0,102	0,555	0,690
2	*E. curvula*	0,68	0,015	0,367	0,602
	Concentrates	0,45	0,051	0,354	0,394
	Total		0,168	1,276	1,686
	Winter cereal pasture	4,54	0,010	0,245	0,401
3	*E. curvula*	0,45	0,163	1,096	1,363
	Total		0,173	1,341	1,764
	E. curvula	0,90	0,020	0,490	0,803
	Concentrates	1,13	0,165	0,886	0,989
	Total		0,185	1,376	1,792

before feeding to group 3 during the first year only. During the second and third years of this experiment the ewes of group 3 had access to the pasture for 1,5 hours per day.

The composition of the rations was based on chemical analyses and was constituted to provide, 1,74 kg DM, 0,172 kg DP and 1,34 kg TDN per ewe and lamb per day. Lambs had access to the following creep feed ration from an age of six weeks:

Maize meal	80%
Lucerne meal	15%
Dicalcium phosphate	3%
Salt	2%

(Coetzee & Vermeulen, 1966).

During the period six to eight weeks of age lambs were given 0,22 kg creep feed daily. This allowance was increased by 0,22 kg for every fortnightly period up to a maximum of 0,66 kg. A mineral lick consisting of equal parts by weight of dicalcium phosphate and salt was provided *ad lib.*

Live weight changes of ewes and lambs were determined by fortnightly weighing after feed and water had been withheld from ewes and lambs for a 14 hour period. Clean wool production per 100 cm^2 skin area was determined at the conclusion of the trial according to the procedure described by Coetzee, Dyason & Vermeulen (1965) and Coetzee & Pieterse (1966). Male lambs were slaughtered on reaching 32 kg live weight and graded according to fat covering and conformation. Due to the fact that lambs were weighed at fortnightly intervals some lambs exceeded 32 kg live weight while other lambs were slaughtered at a weight of slightly less than 32 kg. The number of days taken to reach slaughter weight was recorded for each individual lamb.

Results

Results obtained are summarised in Table 2.

In respect of actual and corrected 120 day weaning weights there were no statistically significant differences between the four groups. There was a tendency for lambs from Group 3 to be slightly heavier than lambs from the other groups. Although no significant differences in respect of average daily weight gains from birth to eight weeks were observed, lambs from group 3 tended to have a higher growth rate.

Lambs from Groups 1 and 3 produced significantly heavier carcasses than those from Groups 2 and 4 ($P<0,01$) Group 3 also required a significantly ($P<0,01$) shorter period than the other groups to reach slaughter weight. Group 4 also required a significantly shorter period than Groups 1 and 2 (P 0,01). Differences in grading and

Table 2

Production results

Item	Groups 1	2	3	4	Statistical Significance(1)
Number of lambs per group	30	30	30	30	
Weaning weight of lambs (kg)	30,64	29,60	32,69	30,58	
Corrected 120 day weaning weight (kg)	28,94	32,01	34,02	30,87	.....
Average daily gain birth to eight weeks (g)	219	223	247	245	.....
Average daily gain eight to 16 weeks (g)	169	210	241	190	.....
Average daily gain birth to 16 weeks (g)	196	216	245	220	.....
Carcass weight of lambs (kg)	15,20	13,54	15,54	14,54	3 & 1 > 4 & 2**
Dressing percentage (%)	49,60	45,74	47,53	47,54	.....
Number of days to reach slaughter weight	128,08	112,00	109,13	117,71	3 > 4 > 1; 2 > 1**
Average grades (points out of 20)	16,91	15,86	17,96	16,75	.....
Weight change of ewes during lactation (kg)	+1,14	+1,50	+1,80	+5,07	4 > 3 & 2 & 1**
Raw wool yield per 100 cm^2 (mg)	10 236	10 286	12 338	11 555	.....
Clean wool yield per 100 cm^2 (mg)	4 863	4 614	5 687	5 104	.....
Mean clean wool yield (%)	47,35	44,88	46,39	44,14	.....
Carcass value (R)	7,03	6,35	8,73	8,03	.....

(1) Differences marked with asterisks were significant at 1% level

Table 3

Total feed costs for ewes and lambs from parturition to slaughter with feeds valued at three price levels

Group	Item	Intake	Valuation of feed at three price levels			Cost		
			1	2	3	1	2	3
		kg	c/ kg	c/kg	c/kg	R c	R c	R c
	Maize silage	327	0,22	0,33	0,44	0,72	1,08	1,44
	E. curvula	41	1,10	1,65	2,20	0,45	0,70	0,90
1	Concentrate	82	3,96	3,96	3,96	3,24	3,24	3,24
	Creep feed	42	3,52	3,52	3,52	1,47	1,47	1,47
	Total					5,88	6,49	7.05
	Japanese radish	1090	0,066	0,11	0,154	0,72	1,20	1,67
	E. curvula	82	1,10	1,65	2,20	0,90	1,35	1,80
2	Concentrate	54	3,96	3,96	3,96	2,13	2,13	2,13
	Creep feed	42	3,52	3,52	3,52	1,47	1,47	1,47
	Total					5,22	6,15	7,07
	E. curvula	54	1,10	1,65	2,20	0,59	0,89	1,19
3	Winter cereal pasture	545	0,11	0,22	0,33	0,60	1,20	1,80
	Creep feed	42	3,52	3,52	3,52	1,47	1,47	1,47
	Total					2,66	3,56	4,46
	E. curvula	108	1,10	1,65	2,20	1,19	1,78	2,38
4	Concentrate	136	3,96	3,96	3,96	5,38	5,38	5,38
	Creep feed	42	3,52	3,52	3.52	1,47	1,47	1,47
	Total					8,04	8,63	9,23

dressing percentage were not statistically significant. Ewes in all four experimental groups showed slight weight increases during the lactation period, Group 4 however showed a significantly greater increase than Groups 1, 2 and 3 ($P<0,01$). The greater weight gain of the ewes in Group 4 was however not revealed in the weight gains of their lambs. In spite of the fact that there was a difference of 23% in clean wool yield between the highest and lowest producing groups i.e., Groups 3 and 2 respectively, this difference was not statistically significant.

Figures on feeding costs are provided in Table 3. These costs were calculated for a feeding period of 120 days for each group.

From Table 3 it is apparent that Group 3 had the lowest feeding costs followed by Groups 2, 1 and 4. In respect of amount of winter cereal pasture required per ewe and lamb very interesting results were obtained. During the last two years of the present study 20 ewes and 20 lambs required 1 ha for 120 days at the rate of 1,5 hr grazing per day. Efficient utilization resulted in this favourable carrying capacity.

In Table 4 figures on the profitability of the different groups are provided and it is clearly shown that Group 3 was the most profitable even when winter cereal pasture was valued at 0,33 c/kg (R3/ton) green material.

Discussion

The present study reveals that succulent feeds other than winter cereal pastures may be included in properly balanced rations without any noticeable detrimental effect on lamb growth rate or grading or on wool production of ewes. Since the growth rate of lambs is almost entirely dependant on plane of nutrition after parturition (Coop, 1950), the present investigation indicates that rations containing different succulent feeds, when properly balanced, produce similar results.

Lamb carcass weights of Groups 3 and 1 exceeded those of Groups 2 and 4, differences being significant ($P<0,01$). These differences resulted from the difference in final live weights which were determined at fortnightly intervals and consequently allowed some individual animals to exceed the prescribed final slaughter weight.

Several researchers (Copeland, Cullity, Miller & Pearce

Table 4

Nett income per lamb (carcass value at two price levels) after deduction of feeding costs (feeds valued at three price levels)

		Groups							
		1		2		3		4	
Carcass value (two price levels)	c/kg	44	55	44	55	44	55	44	55
Valuation of main components of rations									
Maize silage	0,22 c/kg (R2/ton)	0,80	2,48						
Japanese radish 0	0,066 c/kg (R0,6/ton)			0,73	2,22				
Winter cereal pasture	0,11 c/kg (R1/ton)					4,17	5,88		
E. curvula	1,10 c/kg (R10/ton)							-1,65	-0,05
Maize silage	0,33 c/kg (R3/ton)	0,19	1,87						
Japanese radish	0,11 c/kg (R1/ton)			-0,20	1,29				
Winter cereal pasture	0,22 c/kg (R2/ton)					3,27	4,98		
E curvula	1,65 c/kg (R15/ton)							-2,24	-0,64
Maize silage	0,44 c/kg (R4/ton)	-0,37	1,31						
Japanese radish	0,15 c/kg (R1,4/ton)			-1,12	0,37				
Winter cereal pastures	0,33 c/kg (R3/ton)				2,37	4,08			
E. curvula	2,20 c/kg (R20/ton)							-2,84	-1,24

cited by Owen, 1964; Rollins, Hoveland, Langford & Burdett, 1960) have indicated the superior qualities of winter cereal pastures without supplementary feeding. These results are in agreement, as lambs from Group 3 reached slaughter weight 19, 8 and 3 days sooner than Groups 1, 4 and 2 respectively.

Ewes in Group 4 gained significantly ($P<0,01$) more in weight during lactation than Groups 3, 2 and 1 respectively. This difference can probably be ascribed to the fact that ewes from group 4 were individually penned during all three seasons with complete lack of exercise while the other groups were group fed and were allowed more exercise. It is known that the energy requirements of grazing sheep are approximately 10 to 20% higher than those of housed sheep (Lambourne, 1961; Langlands, Corbett, McDonald & Reid, 1963). However, as indicated in Table 1, a slightly higher T.D.N. and DP intake was calculated for group 4 in comparison with the other groups. This could have produced the higher weight gain. The slight weight gains of ewes in all groups together with the excellent performance of the lambs, indicates that the four rations as compiled and given in Table 1 satisfied the nutrient requirements of lactating ewes as indicated by Morrison (1954). It is clear also that ewes were not overfed with concentrates as they did not show excessive weight gains.

Considerable differences with respect to feeding costs were observed between the different groups as shown in Table 3. When the actual breakdown of feeding costs is considered it is evident that succulent feeds did not influence total feeding costs materially. However, when concentrates were included in order to provide sufficient nutrients, feeding costs increased considerably. Ewes in Group 4 received a ration consisting of 64% concentrates and 36% roughage. This ration closely resembles those of Moose & Ross (1964) and Brent, Richardson, Tsien & Menzies (1961) which contained up to 70% concentrates.

Conclusions

Succulent feeds such as maize silage and Japanese radish can be included in properly balanced rations for fat lamb production. Production traits such as lamb carcass weights, wool production of ewes and weight loss of ewes during lactation were not influenced detrimentally but the profit margin, although greater than for ewes fed a high level of concentrate, was considerably less than that for ewes grazed on winter cereal pastures. Results in the present study also clearly indicate that winter cereal pasture was the most efficient of the different feeding systems compared. The group which had access to winter cereal pasture produced the greatest margin of income over feeding costs and lambs from this group required a significantly shorter period than the other groups to reach slaughter weight.

Where moisture conservation is practised through efficient cultivation and where a reasonably reliable rainfall is experienced in autumn, excellent results both from a production and economic point of view may be obtained from winter cereal pastures. Due to the high nutritive value and palatability of winter cereal pastures efficient utilization may be effected through a system of approximately two hours grazing plus access to spared veld or other dry forages. It should also be borne in mind that with early weaning systems, as propounded by Van Niekerk & Barnard (1969) a further saving and more efficient utilization of

winter cereal pastures may be effected where lambs are weaned at an age of eight weeks and then allowed access to the pasture without the ewes. Considering that winter cereal pastures are not always available and that yields are extremely variable, the further development of suitable fat lamb production rations where other succulent feeds such as maize silage or Japanese radish constitute a major portion of the ration require further investigation.

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