

FEED INTAKE OF NON-PREGNANT, PREGNANT AND LACTATING EWES ON NATIVE PASTURE AND LUCERNE HAY

Receipt of MS 24-11-1978

E.A.N. Engels and A. Malan
Agricultural Research Institute, Glen, 9360

(Key words: Feed intake, pregnant-and lactating ewes)

(Sleutelwoorde: Voeriname, dragtige- en lakterende ooie)

OPSOMMING: VOERINNAME VAN NIE-DRAGTIGE, DRAGTIGE EN LAKTERENDE OOIE OP VELDWEIDING EN LUSERNHOOI

Ondersoek is ingestel na die vrywillige inname van nie-dragtige, dragtige en lakterende Merino- en S.A. -Vleismerino-ooie op veldweiding en lusernhooi. Die ruproteïëinhoud van die veldweiding het gewissel vanaf 8,6 persent tot 16,2 persent. Die *in vitro* verteerbaarheid van organiese materiaal het 'n laagtepunt van 57,3 persent bereik met 'n hoogste waarde van 69,7 persent. Die verskille in organiese materiaal inname tussen dragtige en nie-dragtige ooie van beide rasse, was nie statisties betekenisvol nie. Die inname van lakterende S.A. -Vleismerino-ooie was ook nie betekenisvol hoër as die van droë ooie nie. Lakterende Merino-ooie het egter betekenisvol meer gevreet as droë ooie van dieselfde ras. Op 'n dieet van lusernhooi is gevind dat die gemiddelde daaglikse inname van ooie plus hul lammers per metaboliese grootte van die ooie, 116 persent hoër was as die van droë ooie. Direk na speen op 'n ouderdom van vier maande, was die gemiddelde daaglikse inname van die lammers 85 persent van die inname van droë ooie terwyl hul gemiddelde liggaamsmassa slegs 50 persent van die massa van die ooie was.

SUMMARY:

The voluntary feed intake of non-pregnant, pregnant and lactating Merino- and S.A. Mutton Merino ewes on native pasture and chopped lucerne hay, was investigated. The crude protein content of the native pasture ranged from 8,6 per cent to 16,2 per cent. The *in vitro* digestibility of organic matter ranged from 57,3 per cent to 69,7 per cent. The average differences in feed intake between pregnant and non-pregnant ewes of both breeds in this study were not statistically significant. The feed intake of lactating S.A. Mutton Merino ewes did not differ significantly from that of dry ewes. However, in the case of the Merino ewes, lactation did increase feed intake significantly. On a lucerne diet it was found that the average feed intake of the ewes plus that of their lambs per metabolic body size of the ewes, was almost 116 per cent higher than that of dry ewes. Directly after weaning at four months of age, the average feed intake of the lambs was 85 per cent of that of dry ewes while their average live mass was only 50 per cent of that of the ewes.

The prime objective in any sheep farming enterprise is a high reproduction rate. The reproduction performance of the ewe is mainly determined by the level of nutrition. Therefore the genetic potential of the ewe can only be exploited if the pasture on which she is kept is of sufficient quality. The seasonal variation in nutritive value of native pasture in the central Orange Free State is well documented. Consequently it is therefore almost impossible for a ewe to rear a lamb successfully at certain times of the year. Therefore management should provide for the planning of the mating season and/or the provision of additional feed in order to satisfy the nutritional requirements of especially lactating ewes.

Under normal conditions lactation causes an increase in feed intake (Engels, Malan & Baard, 1974). However, this does not mean that the increase in feed

intake will be large enough to meet the much higher needs created by lactation. Therefore it was decided to undertake a study on voluntary feed intake of non-pregnant, pregnant and lactating ewes on pasture and also on a diet of chopped lucerne hay.

Procedure

After synchronizing the oestrus of a number of S.A. Mutton Merino and Merino ewes, they were inseminated artificially in December 1972. In April 1973 it was possible to identify the pregnant ewes of each breed.

Voluntary feed intake was estimated monthly for the last two months of pregnancy and also during lactation while the ewes were grazing native pasture. A stocking rate of a ewe per ha was applied in a system of continuous grazing. The feed intake of both the ewes and

their lambs on a diet of chopped ($\pm 2,5$ cm) lucerne hay, was also measured in pens.

Chemical composition of pasture and estimation of feed intake

Three oesophageally fistulated S.A. Mutton Merino wethers were run with the ewes. These animals were used for the collection of grazing samples on three successive days of each month. These samples were analysed for crude protein and *in vitro* digestibility of organic matter (OM).

The average daily organic matter intake (OMI) of at least six S.A. Mutton Merino ewes for each physiological stage (i.e. non-pregnant, pregnant and lactating), was estimated. In the case of the Merino, OMI was estimated for six non-pregnant, three pregnant and only two lactating ewes. Feed intake was estimated according to the following equation:

$$\text{OMI (g/day)} = \frac{100}{100 - \% \text{ digestibility of OM}} \times \frac{\text{OM excreted (g/day)}}{1}$$

Daily excretion of OM was estimated from the Cr_2O_3 concentration in faecal grab samples. Gelatine capsules, each containing 1,0 g of Cr_2O_3 , were dosed twice daily for 12 days at 08h00 and 17h00. During the last five days grab samples were taken from the rectum of each ewe at the time of Cr_2O_3 administration. The individual samples of each ewe were pooled on an even mass basis after drying and grinding. Cr_2O_3 concentration was determined by means of atomic absorption spectrophotometry. The technique described by Williams, David and Iismaa (1962) was used for the preparation of the samples for analysis. However, the range of standards in this study were prepared in a different way in the sense that faeces from sheep getting no Cr_2O_3 that were run with the experimental sheep, was always used.

The digestibility of OM was estimated from *in vitro* digestibility using an appropriate regression equation (Engels, Baard & Malan, 1974). The *in vitro* technique of Tilley and Terry (1963) was used with slight modifications as suggested by Engels and Van der Merwe (1967).

On the lucerne diet the total feed intake of the ewe plus lamb was measured. Feed intake of individual lambs was also measured immediately after weaning at four months of age.

Results

The crude protein content and *in vitro* digestibility of organic matter (IDOM) of the samples collected

by the oesophageally fistulated sheep are presented in Table 1.

Table 1

The crude protein content and in vitro digestibility of organic matter (IDOM) of samples collected by oesophageally fistulated sheep

Month	Crude protein	IDOM
	%	%
April '73	16,2($\pm 1,91$)	69,7($\pm 4,1$)
May '73	13,0($\pm 3,60$)	65,5($\pm 3,1$)
June '73	8,6($\pm 0,92$)	62,2($\pm 2,8$)
July '73	9,6($\pm 1,11$)	61,7($\pm 2,4$)
Aug. '73	9,3($\pm 1,27$)	57,3($\pm 2,0$)

Crude protein content is expressed on an ash-free basis.

The results in Table 1 show a decline in both protein content and IDOM as the season progressed.

The average daily OM intake of the ewes in the different physiological stages is presented in Table 2.

The results in Table 2 show that the differences in feed intake between pregnant and non-pregnant S.A. Mutton Merino ewes were not pronounced. These differences were not statistically significant. Although the differences were greater for the Merino, they were also not statistically significant.

The feed intake of lactating S.A. Mutton Merino ewes was consistently greater than that of non-pregnant ewes. However, these differences were not significant. On the other hand the feed intake of the lactating Merino ewes was significantly greater than that of non-pregnant ewes. During the period April '73 to May '73 the feed intake of the Merino ewes was significantly greater than that of the S.A. Mutton Merino ewes for both pregnant and non-pregnant ewes. The differences in feed intake between non-pregnant Merino and S.A. Mutton Merino ewes were not statistically significant for the period June, July and August. In the case of the lactating ewes, the feed intake of the Merino was significantly greater than that of the S.A. Mutton Merino.

The changes in the average live mass of the ewes are given in Table 3.

The decrease in live mass was of the same magnitude for the two breeds. The daily requirements and in-

Table 2

The average daily organic matter intake (OMI) of Merino and S.A. Mutton Merino ewes at different physiological stages

Month		Average daily OMI/W ^{0,75} _{kg}			
		S.A.-Mutton Merino		Merino	
		Non-pregnant	Pregnant	Non-pregnant	Pregnant
April	'73	g 57,0 (± 18,6)	g 51,8 (± 18,7)	g 68,6 (± 21,5)	g 59,0 (± 22,2)
May	'73	75,7 (± 14,5)	72,5 (± 14,3)	90,4 (± 20,0)	102,7 (± 15,3)
		Non-pregnant	Lactating	Non-pregnant	Lactating
		June	'73	65,9 (± 13,8)	67,8 (± 16,0)
July	'73	59,7 (± 7,0)	80,0 (± 26,5)	73,7 (± 19,4)	121,9 (± 19,4)
August	'73	53,7 (± 16,3)	65,4 (± 16,3)	58,2 (± 7,8)	95,3 (± 3,6)

Table 3

Changes in live mass of lactating and dry Merino and S.A. Mutton Merino ewes grazing native pasture

Month	Average live mass			
	S.A. Mutton Merino		Merino	
	Lactating	Dry	Lactating	Dry
	kg	kg	kg	kg
June '73	60	67	48	57
July '73	56	64	46	55
August '73	51	63	41	53

according to NRC (1968) standards. Crude protein intake was adequate (NRC, 1968).

Both crude protein and DOM intake was insufficient for maintenance of lactating S.A. Mutton Merino ewes. According to Table 4 the Merino ewes experienced a crude protein deficiency in June. Due to the sharp drop in live mass of the lactating ewes from July to August it was decided to put all the ewes on a diet of chopped lucerne hay. The ewes were fed individually in pens. The average daily feed intake of the ewes plus their lambs and that of non-pregnant dry ewes are presented in Table 5.

The results in Table 5 show that in both breeds the feed intake of the ewe plus the lamb was more than double that of the non-pregnant ewes. These differences were statistically significant. The differences in feed intake between breeds were not significant.

take of digestible organic matter (DOM) and crude protein, are presented in Table 4.

According to the results in Table 4 the intake of both crude protein and DOM was sufficient to meet the maintenance needs of non-pregnant ewes (NRC, 1968). During the period June, July and August 1973 the DOM intake was apparently sufficient for non-pregnant ewes but crude protein intake was inadequate in August.

In both breeds the DOM intake was insufficient to supply maintenance needs of ewes in late-pregnancy

Discussion

Considering the crude protein content and the IDOM of the samples collected by the oesophageally sheep, a relative high feed intake could be expected on the native pasture. Engels and Malan (1978) found that the feed intake of Merino wethers grazing native pasture, was insufficient to meet maintenance needs even when quality appeared to be satisfactory according to chemical analyses on samples collected by oesophageally fistulated animals. The feed intake of the ewes in the present study was rather low. However, sheep are very selective

Table 4

The average daily requirements and intake of digestible organic matter (DOM) and crude protein (CP) of Merino and S.A. Mutton Merino ewes

Month		Average daily requirement and intake per $W^{0,75}$ kg																	
		S.A. Mutton Merino								Merino									
		Non-pregnant				Pregnant				Non-pregnant				Pregnant					
		Intake		Require- ment		Intake		Require- ment		Intake		Require- ment		Intake		Require- ment			
DOM		CP		DOM		CP		DOM		CP		DOM		CP		DOM		CP	
g		g		g		g		g		g		g		g		g		g	
April	'73	39,3	9,2	32,0	5,5	35,7	8,4	49,5	8,3	47,2	11,1	32,0	5,5	40,7	9,6	49,5	8,3		
May	'73	50,0	9,8	32,0	5,5	47,9	9,4	49,5	8,3	59,8	11,8	32,0	5,5	67,9	13,4	49,5	8,3		
		Non-pregnant				Lactating				Non-pregnant				Lactating					
June	'73	42,0	5,7	32,0	5,5	43,3	5,8	67,0	10,4	43,4	5,9	32,0	5,5	75,4	10,2	67,0	10,4		
July	'73	37,8	5,7	32,0	5,5	50,7	7,7	67,0	10,4	46,7	7,1	32,0	5,5	77,3	11,7	67,0	10,4		
August	'73	32,5	5,0	32,0	5,5	39,6	6,1	49,5	8,3	35,2	5,4	32,0	5,5	57,7	8,9	49,5	8,3		

Requirements according to NRC (1968)

1 g DOM taken as 19,4 kJ digestible energy (Engels & Malan, 1975).

Table 5

The average daily dry matter (DM) intake of non-pregnant and lactating Merino and S.A. Mutton Merino ewes plus their lambs on a diet of chopped lucerne hay

Average daily DM intake per $W^{0,75}$ kg			
S.A. Mutton Merino		Merino	
Non-pregnant	Lactating ewe plus lamb ^a	Non-pregnant	Lactating ewe plus lamb
g	g	g	g
68,0(± 13,5)	146,8(± 38,8)	67,3(± 5,0)	140,3(± 1,3)

^aDM intake of ewe plus lamb calculated as intake per $W^{0,75}$ of the ewe.
kg

in their grazing behaviour and therefore they concentrate on the highly palatable plants and even parts of plants. When the material preferred by the grazing sheep, becomes limited, a decline in feed intake occurs since they spend most of their time searching for the palatable species (Arnold, 1970).

The energy requirements of pregnant and lactating animals are higher than those of non-pregnant dry animals. Consequently feed intake increases during lactation and pregnancy. The results of the present study indicate that pregnancy had no effect on the feed intake of grazing Merino and S.A. Mutton Merino ewes. This is in agreement with the results of Ferreira (1975). Owen and Ingleton (1963) found an increase in feed intake of grazing ewes during early and mid-pregnancy. During late pregnancy and especially in ewes carrying twins, feed intake decreases (Owen & Ingleton, 1963; Hadji-pieres & Holmes, 1966). A similar decline in feed intake was found with cows in late pregnancy (Campling, 1966).

An increase in feed intake occurs almost immediately post partum, (Hutton, 1963; Hadjipieris & Holmes, 1966; Arnold & Dudzinski, 1967; Owen, Miller & Bridge, 1968). This increase continues until milk production reaches a peak, then remains constant for a while (Stone, Trimberger, Henderson & Turk, 1959) or may start to decline gradually (Hutton, 1963). With ewes at pasture, lactation stimulated intake of grass by 42 per cent (Arnold & Dudzinski 1967) or 26 per cent (Cook, Mattox & Harris, 1961). Hadjipieris and Holmes (1966) showed that on a diet of grass pellets, the feed intake of ewes with twins was 80 per cent higher, and that of ewes with single lambs 60 per cent higher, than that of dry ewes. However, these workers found that on a diet of medium quality hay, lactation stimulated feed intake by 10 per cent only. Hutton (1963) found that the feed intake of lactating cows was 50 per cent higher than that of dry cows under grazing conditions. In a study on native pasture of the central Orange Free State, Engels, Malan and Baard (1974) found that feed intake of lactating cows was on average 45 per cent greater than that of dry cows. When the feed intake of the calves was added to that of their mothers during the fifth and sixth months of lactation, the increase in intake was almost 80 per cent.

The main object of this study was to determine whether the increase in feed intake as a result of lactation was large enough to provide sufficient nutrients for maintenance. According to the results in Table 2, lactation did not result in a significant increase in feed intake in S.A. Mutton Merino ewes. In the Merino ewes a dramatic increase in feed intake was found during lactation. However, only 2 lactating Merino ewes were available and therefore a definite conclusion is not possible from the results of the present study.

The results in Table 4 show that the lactating ewes were not able to satisfy their nutritional needs with regard to both crude protein and energy. The increase in energy requirements of sheep under grazing conditions was not taken into account in the estimation of the maintenance needs. A dramatic increase in energy needs under grazing conditions has been demonstrated (Young & Corbett, 1968; Engels, 1972, Benjamin, Chen, Degen, Abdul Aziz & Al Hadad, 1977).

When the ewes were put on a diet of chopped lucerne hay it was found that the voluntary intake of dry ewes was of the same magnitude as that on the native pasture during the period June to August 1973 (Tables 4 and 5). The average daily intake of the lactating ewes plus that of their lambs, calculated as DM intake per $W^{0,75}$ of the ewes, were 115,9 and 108,5 kg

per cent greater than that of the corresponding dry ewes for the S.A. Mutton Merino and Merino, respectively. The feed intake of ewes with twins exceeded that of dry ewes by 177,8 per cent. The corresponding difference for ewes with single lambs was 78,8 per cent. The average daily feed intake of 11 lambs immediately after weaning at four months of age, was 97,1 g per $W^{0,75}$ on the same lucerne diet. The average intake of kg

dry ewes on this diet was 68,0 g per $W^{0,75}$. The average kg

body mass of the lambs was only 50,3 per cent of that of the dry ewes (30,6 kg vs 60,8 kg) while their average daily feed intake amounted to 85 per cent of that of the ewes (1 253 g vs 1 474 g). This finding is of great significance since it implies almost the same feed intake for a ewe and a four month old lamb under grazing conditions. However, it is doubtful whether the lamb will maintain this relatively high intake on kinds of grazing subjected to quality limitations. This aspect needs to be investigated since seasonal variation in quality of grazing is pertinent in this country.

The results of this study indicate that it is impossible from a nutritional point of view for a ewe to nurse a lamb successfully on native pasture consisting mainly of grass in the central Orange Free State in winter time. The growth rate of the lamb will be low and the drop in body mass of the ewe will have a detrimental affect on both wool growth and quality. Furthermore very favourable nutritional conditions will have to prevail after weaning in order to allow a high conception rate in the mating season. It is evident that lactating ewes will have to be supplemented with protein and energy under these conditions. However, it is possible that the returns on supplementary feeding at the required levels would perhaps not be economically justified. Therefore research on the level of supplementary feeding and also on the method of supplementation is necessary. The economy and feasibility of such a system will determine whether it might be accepted in practice.

References

- ARNOLD, G.W., 1970. Regulation of food intake in grazing ruminants. In: *Physiology of digestion and metabolism in the ruminant*. Ed. A.T. Phillipson, England: Oriel Press.
- ARNOLD, G.W. & DUDZINSKI, M.L., 1967. Studies on the diet of the grazing animal. II. The effect of physiological status in ewes and pasture availability on herbage intake. *Aust. J. agric. Res.* 18, 239.
- BENJAMIN, R.W., CHEN, M., DEGEN, A.A., ABDUL AZIZ, N. & AL HADAD, M.J., 1977. Estimation of the dry- and organic matter intake of young sheep grazing a dry Mediterranean pasture and their maintenance requirements. *J. agric. Sci. Camb.*, 88, 513.
- CAMPLING, R.C., 1966. A preliminary study of the effect of pregnancy and lactation on the voluntary intake of food by cows. *Br. J. Nutr.* 20, 25.
- COOK, C.W., MATTOX, J.E. & HARRIS, L.E., 1961. Comparative daily consumption and digestibility of summer range forage by wet and dry ewes. *J. Anim. Sci.* 20, 866.
- ENGELS, E.A.N., 1972. *A study of the nutritive value of natural and sown pastures in the central Orange Free State with special reference to the energy requirements of sheep*. Ph. D. (Agric.) Thesis Univ. of Stellenbosch.
- ENGELS, E.A.N., BAARD, MARGARIETHA A. & MALAN, A., 1974. Estimation of forage intake on pasture using faecal nitrogen concentration and *in vitro* digestibility results. *Agroanimalia*, 6, 81.
- ENGELS, E.A.N. & MALAN, A., 1975. The energy intake and excretion of sheep grazing oat pasture. *Agroanimalia*, 7, 81.
- ENGELS, E.A.N. & MALAN, A., 1978. Die invloed van twee veebeladings op die samestelling van die dieet en inname van skape in 'n driekampstelsel in die sentrale Oranje-Vrystaat. *S. Afr. Tydskr. Veek.* 8, 19.
- ENGELS, E.A.N., MALAN, A. & BAARD, MARGARIETHA A., 1974. The voluntary feed intake of dry and lactating cows on natural pasture. *S. Afr. J. Anim. Sci.* 4, 113.
- ENGELS, E.A.N. & VAN DER MERWE, F.J., 1967. Application of an *in vitro* technique to South African forages with special reference to the effect of certain factors on the results. *S. Afr. J. agric. Sci.* 10, 983.
- FERREIRA, B., 1975. *Die invloed van dragtigheid en laktasie op die vrywillige inname en verteerbaarheid van voere deur Merino-ooie*. M. Sc. (Land) Tesis Univ. Stellenbosch.
- HADJIPIERES, G. & HOLMES, W., 1966. Studies on feed intake and feed utilization by sheep. I. The voluntary feed intake of dry, pregnant and lactating ewes. *J. agric. Sci. Camb.*, 66, 217.
- HUTTON, J.B., 1963. The effect of lactation on intake in the dairy cow. *Proc. N.Z. Soc. Anim. Prod.* 23, 39.
- NATIONAL RESEARCH COUNCIL, 1968. Nutrient requirements of domestic animals. 5. Nutrient requirements of sheep. Publ. 1963. Washington, D.C.: National Academy of Science.
- OWEN, J.B. & INGLETON, J.W., 1963. A study of food intake and production of grazing ewes. *J. agric. Sci. Camb.*, 61, 267.
- OWEN, J.B., MILLER, E.L. & BRIDGE, P.S., 1968. A study of the voluntary intake of food and water and the lactation performance of cows given diets varying in roughage content *ad libitum*. *J. agric. Sci. Camb.*, 70, 267.
- STONE, J.B., TRIMBERGER, G.W., HENDERSON, C.R. & TURK, K.L., 1959. Roughage capacity and efficiency of feed utilization in dairy cattle. *J. Dairy Sci.*, 42, 915.
- TILLEY, J.M.A. & TERRY, R.A., 1963. A two-stage technique for the *in vitro* digestion of forage crops. *J. Br. Grassld. Soc.*, 18, 104.
- WILLIAMS, C.H., DAVID, D.J. & IISMAA, O., 1962. The determination of chromic oxide in faeces samples by atomic absorption spectrophotometry. *J. agric. Sci. Camb.*, 59, 381.
- YOUNG, B.A. & CORBETT, J.L., 1968. Energy requirement for maintenance of grazing sheep measured by calorimetric techniques. *Proc. Aust. Soc. Anim. Prod.*, VII, 327.