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THE EFFECT OF BODY CONDITION AS INFLUENCED BY WINTER NUTRITION, ON THE REPRODUCTIVE PERFORMANCE OF THE BEEF COW

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OPSOMMING: DIE INVLOED VAN LIGGAAMSKONDISIE, SOOS BEINVLOED DEUR WINTERVOEDING, OP DIE REPRODUKSIEVERMOË VAN DIE VLEISBEESKOEI

Vyf-en-sewentig dragtige en 63 nie-dragtige Simmentaler koeie in verskillende aanvangs kondisies, soos bepaal deur 'n kondisie telling, is in 4 verskillende groepe gevoer om 'n kondisie telling van 3,0 te behaal. Die hoeveelheid voer en tyd benodig om dié teikentelling te behaal is aangeteken.

Geen betekenisvolle verskille in droëmateriaal inname tussen die dragtige en nie-dragtige koeie is aangeteken nie. Oor die algemeen was dit die helfte goedkoper om 'n koei op 'n kondisie telling van 3,0 te onderhou as om 'n koei se kondisie telling van 1,5 tot 3,0 te verbeter. Slegs 8% van die koeie wat 'n kondisie telling van 1,5 gedurende die teelseisoen gehad het, het 'n kalf gelewer. Die syfer het verbeter met 'n verbetering in koei kondisie, byvoorbeels 43% met 'n kondisie telling van 2,0; 64% met 'n kondisie telling van 2,5 en 78% met 'n kondisie telling van 3,0. Die tydperk tussen die begin van die teelseisoen en kalwing het afgeneem vanaf 316 dae tot 293 dae met 'n verbetering in kondisie telling van 2,0 tot 4,0.

SUMMARY:

Seventy five gestating and 63 dry Simmentaler cows were allocated to 4 different feed groups on the basis of their condition as determined by a condition score (CS). The cows were fed to achieve a CS of 3,0. The time and amount of feed required to achieve the "target" score was recorded for each cow.

There was no significant difference in dry matter intake between pregnant and non-pregnant cows. The feed costs involved in maintaining a cow's condition at a CS of 3,0 amounted to half that required to raise a cow's condition from 1,5 to 3,0. Only 8% of the cows mated at a CS of 1,5 produced a calf. This figure increased to 43% at a CS of 2,0; 64% at a CS of 2,5 and 78% at a CS of 3,0. The inverval from the start of the mating season to parturition decreased from 316 days to 293 days as the condition of the cows improved from CS 2,0 to 4,0.

The function of a cow in the breeding herd is to produce and raise a calf successfully each and every year of her breeding cycle. The problem of low calving percentages can often be ascribed to poor nutrition at critical stages of the cow's production cycle. It is often accepted that a cow should be on a rising plane of nutrition and gaining mass during the mating season if conception is to be successful. However, Richardson, Oliver & Clarke (1976) concluded from their results that the ability of a cow to conceive was a function of body mass *per se* and not rate of gain during the mating season. This view is supported by Lamond (1970); Topps (1976) and Frood & Croxton (1978), who go still further and describe body condition of the cow at mating as being one of the most significant factors likely to affect the cow's ability to reconceive.

Currently the use of condition scoring (Lowman, Scott & Sommerville, 1976; van Niekerk & Louw, 1980), is being applied to indicate nutritional status of the cow. The use of such a system has reduced differences in interpretation with regard to body condition. The aim of this experiment was to establish nutritional requirements for cows in various body conditions in order to achieve certain "target" condition scores by the time of parturition or by the end of winter.

Procedure

Animals and treatments

Seventy five pregnant and 63 non-pregnant Simmentaler cows were used in the experiment which commenced at the beginning of winter during 1981. The age of the cows varied between 4 and 7 years. The animals were allocated to one of 4 different feed groups on the basis of their condition score (CS). The animals were scored according to van Niekerk & Louw (1980), using a 9 point scale with half point increments; 1 represents an animal in an emaciated condition and 5 an extremely fat animal. The animals in feed groups 1, 2 and 3 were fed *ad lib.* diets of *E. curvula* hay and maize silage. The differences between each feed group was the amount of high energy concentrate fed, which was dependant upon the condition of the cows; thin cows (CS 1,5) received on average 3,5 kg per head per day whilst the cows in better condition (CS 2,5) recieved 1,05 kg per head per day. The cows were fed until parturition or, in the case of non-pregnant cows, until they achieved a CS of 3,0. They were then maintained in that condition. The cows in group 4 were fed diets of *E. curvula* hay and maize silage so as to maintain a CS of 3,0. The different feed groups are summarised in Table 1.

To reduce competition for feed, particularly amongst the very thin cows, animals were fed in groups each having the same condition score. Once the required CS was achieved the animal was transferred to the subsequent feed group where all the cows in that particular group had the same CS. Thus a cow in group 1 with an initial CS of 1,5, on attaining the required CS of 2,0, was transferred to group 2 and received *ad lib.* hay and silage plus 2,27 kg of concentrates until she reached a CS of 2,5 whereupon she was transferred to group 3 and fed the ration pertaining to that group. Once a CS of 3,0 was attained the cow was transferred to group 4 and maintained in that condition. The same procedure was adopted for cows that started the experiment with an initial CS of 2,0 or 2,5.

Table 1

Feeding regimes employed to improve animals condition from 1,5 to 3,0

		Pregnant	Dry cows
Group 1	n	12	7
Initial condition score	1,5		
E. curvula hay		*ad lib.*	*ad lib.*
Maize silage		*ad lib.*	*ad lib.*
Concentrate*	kg/day	3,5	3,0
Group 2	n	20	17
Initial condition score	2,0		
E. curvula hay		*ad lib.*	*ad lib.*
Maize silage		*ad lib.*	*ad lib.*
Concentrate	kg/day	2,27	2,27
Group 3	n	23	18
Initial condition score	2,5		
E. curvula hay		*ad lib.*	*ad lib.*
Maize silage		*ad lib.*	*ad lib.*
concentrate	kg/day	1,05	1,05
Group 4	n	20	21
Condition score	3,0		
E. curvula hay	kg/day	6	6
Maize silage	kg/day	8	8
Concentrate		nil	nil

* The concentrate fed in the experiment, comprised 80% maize meal, 10% urea, 10% molasses meal. A lick consisting of 50% salt and 50% dicalcium phosphate was available at all times.

The cows were weighed and condition scored fortnightly. Feed intakes were recorded daily.

Calving and mating data

As soon as possible after parturition all calves and their dams were weighed. The cows were then also condition scored. Five hundred and fifty breeding records over 2 breeding seasons were examined to determine optimum condition score at mating for successful conception and the effect of condition at mating on claving distribution.

Results

At the start of the experiment the gestating cows were 6 - 7 months pregnant. Gestating cows were significantly ($P \leq 0{,}01$) heavier than dry cows at an initial CS of 1,5 (Tables 2). However, the time required to achieve a CS of 3,0 was 85 days for both pregnant and non-pregnant cows. These figures suggest that the difference in mass between the pregnant and non-pregnant cows initially, could be ascribed to the mass of the uterus and foetus. Although the pregnant cows gained 84,09 kg over the 85 days compared with 75,29 kg for the non-gestating cows, the difference was not statistically significant.

Table 2

Mass and condition score changes for cows with an initial condition score of 1,5

		Pregnant	Non-pregnant
Initial mass (CS 1,5)	(kg)	$407{,}9^{a*}$	$377{,}7^{b}$
Mass at CS 2,0	(kg)	$422{,}3^{a}$	$404{,}9^{b}$
Mass gain	(kg)	$34{,}3^{a}$	$27{,}2^{a}$
No. of days CS 1,5 - 2,0		32	29
Mass at CS 2,5	(kg)	$472{,}0^{a}$	$427{,}3^{b}$
Mass gain	(kg)	$27{,}7^{a}$	$22{,}4^{a}$
No. of days CS 2,0 - 2,5		34	35
Mass at CS 3,0	(kg)	$492{,}9^{a}$	$452{,}0^{b}$
Mass gain	(kg)	$20{,}1^{a}$	$25{,}7^{a}$
No. of days 2,5 - 3,0		19	21
Total mass gain 1,5 - 3,0	(kg)	$85{,}1^{a}$	$75{,}3^{a}$
No. of days		85	85

* Figures within rows having differend superscripts differ significantly ($P \leq 0{,}01$).

In contrast with those cows with an initial CS of 1,5, the cows with an initial CS of 2,0 gained mass significantly ($P \leq 0,01$) faster during the period required to obtain a CS of 3,0 (Table 3). This condition was achieved in a period of 49 days for both pregnant and non-pregnant cows. Pregnant cows were once again significantly ($P \leq 0,01$) heavier at the commencement of the trial than the dry cows (Table 3).

Although the gestating cows with an initial CS of 2,5 were heavier than the dry cows at the start of the trial, the difference was not statistically significant. (Table 4)

It is apparent from Tables 2 and 4 that the time required for a cow to improve her condition from 1,5 to 3,0 was nearly 3 times as long as the time required for a cow to improve her condition from 2,5 to 3,0. This obviously has a considerable influence on the feed intake and feed costs involved in achieving the required score. Whilst it is appreciated that feed costs will change frequently they have nevertheless been included to serve as a guide, to enable herd feed costs to be calculated. The feed intakes and the cost involved in feeding cows of varying initial conditions. to achieve a CS of 3,0, are summarised in Table 5. As expected cows with an initial CS of 1,5 consumed significantly ($P \leq 0,01$) more dry matter than the cows with an initial CS of 2,0. The latter, in turn consumed significantly ($P \leq 0,01$) more dry matter than the cows with an initial CS of 2,5. There was no significant difference in dry matter intake between gestating and dry cows. As can be seen from Table 5 the cost involved in raising a cow's condition from CS 1,5 to 3,0 was R4,51 higher for gestating cows than for dry cows. The condition score improvement from 2,0 to 3,0 was realized at a cost which was not influenced by pregnancy status as was the cost of the 30 days the cows were maintained at a CS of 3,0.

Birth mass of the calves born to cows with an initial CS of 1,5; 2,0 and 2,5 are summarised in Table 6. It is apparent from these data that the claves born to cows which had recieved the additional nutrition (initial CS 1,5 and 2,0) were on average 4 kg heavier at birth than the calves born to cows with an initial CS of 2,5.

The importance of cow condition during the mating season on conception is clearly demonstrated in Table 7. As the condition of the cows improved from a CS of 2,0 to 4,0 at mating the interval from day 1 of the mating season to date of calving was reduced from 316 days to 292 days. These figures must be viewed in conjunction with the data presented in Table 8 where the calving percentages of cows in various conditions at mating are summarised.

The highest calving percentages were obtained from cows with a CS of 3,0 and 3,5 at mating. It is therefore apparent from Tables 7 and 8 that those cows that did conceive at a lower CS viz. CS 1,5 and CS 2,0, conceived later in the mating season and consequently their calving intervals were extended.

Table 3

Mass and condition score changes of cows with an initial condition score of 2,0

		Pregnant	Non-pregnant
Initial mass at CS 2,0	(kg)	$445,7^{a*}$	$404,4^{b}$
Mass at CS 2,5	(kg)	$473,1^{a}$	$422,4^{b}$
Mass gain	(kg)	$27,4^{a}$	$17,9^{b}$
No. of days CS 2,0 - 25		26	21
Mass at CS 3,0	(kg)	$494,8^{a}$	$443,3^{b}$
Mass gain	(kg)	$21,6^{a}$	$20,9^{a}$
No. of days CS 2,5 - 3,0		23	28
Total mass gain CS 2,0 - 3,0	(kg)	49,1	38,8
No. of days		49	49

* Figures within rows having different superscripts differ significantly ($P \leq 0,01$).

Discussion

The results of this study underline the importance of body condition of the cow at parturition and at mating on her subsequent reproductive performance. As cow condition is largely dependant upon nutritional status, the use of condition scoring can simplify feeding strategies and therefore provide a useful management tool for improving feed efficiency. The condition of the cow at the end of winter will determine the feeding regime that will be necessary if the cow is to calve down in optimum condition in the spring. Experience has shown that a cow loses half a CS at parturition and maintain this lower condition through to mating, provided postpartum nutrition is adequate. Any shortfall in nutrition during this critical stage will result in a further loss in condition and consequently reconception may be severly affected.

Table 4

Mass gains and condition score changes of cows with an initial condition score of 2,5

		Pregnant	Non-pregnant
Initial mass at CS 2,5	(kg)	$438,9^{a*}$	$428,0^{a}$
Mass at CS 3,0	(kg)	$468,3^{a}$	$452,1^{a}$
Mass gain	(kg)	$29,3^{a}$	$24,1^{a}$
No. of days		26	30

* Figures within rows having different superscripts differ significantly ($P < 0,01$).

Table 5

Feed intakes and feed costs for cows in initial condition scores 1,5; 2,0 and 2,5 fed to parturition or CS 3,0

Feed costs (wet matter basis)		No. of days	E. curvula hay 4c/kg	Maize silage 1,5c/kg	Concen-trates 20c/kg	Total DM	No. of days	E. curvula hay 4c/kg	Maize silage 1,5c/kg	Concen-trates 20c/kg	Total DM
Initial CS 1,5											
CS change 1,5 - 2,0		32	3,99	11,05	3,22	9,64	29	3,52	1,08	2,97	8,73
Feed costs	R		5,11	5,30	20,60			4,08	4,38	17,22	
CS 2,0 - CS 2,5		34	4,72	9,99	2,01	8,95	35	4,07	10,20	1,90	8,35
Feed costs	R		6,42	5,09	13,67			5,70	5,36	13,30	
CS 2,5 - 3,0		19	3,67	10,24	0,94	7,18	21	4,40	10,26	0,95	7,86
Feed costs	R		2,79	2,92	3,57			3,70	3,23	3,99	
Total feed intake		85	357,89	887,82	189,24	749,20	85	336,93	864,78	172,58	710,19
Total costs	R		14,32	13,31	37,84	65,47		13,48	12,97	34,51	60,96
Initial CS 2,0											
CS 2,0 - 2,5		26	4,39	10,52	2,08	8,87	21	4,44	10,87	2,19	9,12
Feed costs	R		4,57	4,10	10,82			3,73	3,42	9,20	
CS 2,5 - 3,0		23	4,62	8,54	0,98	7,56	28	4,86	9,62	0,95	8,07
Feed costs	R		4,25	2,95	4,51			5,44	4,40	5,32	
Total feed intake		49	220,40	469,94	76,62	404,50	49	229,32	497,63	72,59	417,48
Total feed costs	R		8,82	7,05	15,33	31,20		9,17	7,46	14,52	31,15
Initial CS 2,5											
CS 2,5 - 3,0		26	5,62	9,66	1,05	8,69	30	5,18	8,43	0,83	7,90
Feed costs	R		5,84	3,76	5,46	15,06		6,21	3,79	4,98	14,98
Total feed intake			146,12	251,16	27,30	225,94		155,40	252,90	24,90	237,00
Total feed costs	R		5,84	3,76	5,46	15,06		6,21	3,79	4,98	14,98
Maintain at CS 3,0		30	6,65	8,09	–	8,41	30	6,07	8,07	–	7,88
Feed costs	R		7,98	3,64	–	11,62		7,28	3,63	–	10,92

Table 6

Birth mass of calves born to cows with different initial condition scores at the onset of winter

Initial CS of cow	1,5	2,0	2,5
CS of cow at parturition	3,0	3,0	3,0
Birth mass of calves	36,3 ± 1,2	36,3 ± 1,2	32,8 ± 1,2

Table 7

The effect of cow condition at mating on the number of days from day 1 of the mating season to calving

Condition score at mating	No. of days from the start of mating season to calving
2,0	314,0
2,5	303,5
3,0	297,5
3,5	295,5
4,0	292,0

The extent to which winter feeding becomes necessary is likely to mean the difference between economic success and disaster. The results from this study indicated that a cow, whether gestating or dry, in very thin condition (CS 1,5) at the onset of the winter required nearly 90 days of intensive feeding to achieve a CS of 3,0 at parturition. In contrast, cows in slightly better condition (CS 2,0) achieved a CS of 3,0 in only 49 days, at less than half the cost. These results suggest that it would be uneconomical to allow a cow's condition to fall to a CS of 1,5 and then endeavour to improve it to a CS of 3,0; always presupposing that sufficient time and good quality feed were available.

The difference in initial mass, at a CS of 1,5, between gestating and dry cows (30 kg; P < 0,01) represents the mass of the foetus. This difference in mass is not evident in cows with an initial CS of 2.5. It is acknowledged that the major development of the foetus occurs during the last third of gestation. However, the fact that the cows with an initial CS of 1,5 produced calves which were 4 kg (NS) heavier at birth than cows with an initial CS of 2,5 (Table 6), suggests that much of the additional nutrition fed to thin cows was used for foetal development. Economic aspects aside, the effects of undernutrition on the cow prior to winter feeding may severely affect the cow's ability to reconceive. Symington (1969) has shown that infertility is largely an anoestrus resulting from undernutrition and lactation. Topps (1976) has suggested that these 2 factors are probably inter-related. Should undernutrition by so severe as to result in the cessation of cyclic activity, sexual activity is likely to recommence only at a mass significantly greater than that at which it ceased (Hale, 1975).

Table 8

The calving rate of cows with different condition scores at mating

Condition score at mating	n	No. of calves born per 100 cows mated
1,5	12	8
2,0	72	43
2,5	124	64
3,0	211	78
3,5	31	77

A survey of breeding records in this study has shown that an improvement in cow condition during the mating season is concommittant with an increase in calving rate up to a CS of 3,5. This study has shown further that a target CS of 2,5 at mating is possibly too low and that a CS of 3,0 appears to be optimum. It is also apparent that those cows that do conceive at a lower CS (CS 1,5, CS 2,0), do so later in the mating season. This is likely to have a detrimental affect on the cows calving interval and reduce the number of calves weaned per 100 cows bulled over a period of years (Kilkenny, 1978).

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