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THE EFFECT OF AGE OF DAM ON WEANING MASS FOR FIVE DAM BREED TYPES IN AN INTENSIVELY MANAGED CROSSBRED HERD

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(Sleutelwoorde: *Voorspeense groei, ouderdom van die moer, beesrasse)*

OPSOMMING: DIE INVLOED VAN OUDERDOM VAN KOEI OP SPEENMASSA BY VYF KOEITIPES IN 'N KRUISGETEELDE KUDDE ONDER INTENSIEWE BESTUUR

Die invloed van ouderdom van die koei op die gekorrigeerde 210 dae massa van die kalf is bepaal m.b.v. die kleinste kwadraat-metode vir 5 koeitipes op 2 plase. Ouderdom van koei het gekorrigeerde speenmassa hoogsbetekenisvol ($P < 0{,}01$) beïnvloed in al 12 die modelle. Verse se kalwers was betekenisvol ligter ($P < 0{,}05$) as dié van koeie. Britse rastipes en *Bos indicus* tipes het hul piekproduksie op 'n vroeër ouderdom as Charolais-, Simmentaler- en dubbeldoeltipes gelewer. Dit weerspieël waarskynlik verskille in ontwikkelingspatroon. Dit volg dat waar die gemiddelde ouderdom van koei in 'n kudde laag is, sal die vroegvolwasse tipes relatief meer produktief wees, as die laat ontwikkelde tipes. Waar slytasie van tande alleen gebruik word as uitskotmaatstaf sal die produktiwiteit van laat ontwikkelende tipes nog verder beïnvloed word aangesien die koeie op 'n fisiologies vroeë ouderdom uitgeskot sal word. Die resultate behoort voorts in oorweging geneem te word in die bepaling van die geskiktheid van rasse vir 'n spesifieke omgewing.

SUMMARY:

The effect of age of dam on adjusted 210 day calf weaning mass was estimated by the Least Squares method for 5 dam types on 2 farms. In the 12 models used the age of dam significantly ($P < 0{,}01$) influenced weaning mass. Heifers produced calves of significantly ($P < 0{,}05$) lower weaning mass than dams of other ages. The British and *Bos indicus* type dams reached peak production in terms of weaning mass at an earlier age than the Charolais, Simmentaler and Dual Purpose types. This was probably due to their rate of maturity. These results indicate that when the average dam-age is low in a herd, the early maturing types can be more productive than later maturing types. Extrapolating this data to extensive conditions, where cows tend to be culled at a younger age due to teeth disfunction, it seems that the later maturing breeds would have a low level of productivity because these cows would be eliminated in their potentially prime productive years. The results should be considered in determining the suitability of breeds to various environments.

When using weaning mass as a selection criterion it is necessary to remove non-genetic sources of variation to improve the accuracy of selection. Literature reviews by Venter (1977) and Paterson (1978) show that the age of the dam influences calf weaning mass considerably and therefore the development of correction factors for this effect is desirable. A knowledge of age-of-dam effects on preweaning growth is also of value in estimating cow efficiency, longevity and overall productivity.

The estimation of different correction factors for the age of dam effect has been discussed (Cartwright, Ellis, Kruse & Crough, 1964; Vernon, Harvey & Warwick, 1964; Cundiff, Willham & Pratt, 1966b); Linton, Brinks, Stonaker, Sutherland & Faulkner, 1968; Cardellino & Frahm, 1971). Indiscriminate use of age of dam correction factors is however not advisable (Koger, Reynolds, Mead, Kirk, Peacock & Kidder, 1962c; Bosman & Harwin, 1967). This warning is appropriate particularly in a mixed breed herd where it has been shown that there are interactions between breed and age of dam for weaning mass (Swiger, Kock, Gregory, Arthaud, Rowden & Ingalls, 1962; Koger *et al.*, 1962c; Cartwright *et al.*, 1964; Sellers, Willham & De Baca, 1970; Hartzenberg, 1971; Cardellino & Frahm, 1971; Venter, 1977). It is thus necessary to estimate the age-of-dam effect within breed type. This investigation was implemented to assess the influence of the age of the dam on weaning mass of her calf for different dam breed-types in an intensively managed crossbred herd where possible, these effects have been related to cow longevity and productivity.

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Materials and Methods

The intensive management system on the Johannesburg City Council cattle farms has been described (Paterson, 1978). Records of 8 731 calves born on these farms during the period 1971 to 1974 were included in this investigation. These calves were weaned at 210 days (± 45 days) and a creep feed was supplied from 3 months of age. On these farms 12 breeds have been used in a crossbreeding program and the cows were divided into 5 cow types as follows:

Cow type		Predominant cow breeds
British	–	Hereford, Aberdeen Angus or Shorthorn
Bos indicus	–	Afrikaner, Bonsmara or Brahman
Charolais	–	Charolais
Simmentaler	–	Simmentaler
Dual Purpose	–	Friesland or Brown Swiss

Twelve least squares models (Harvey 1972) as described by Paterson (1978) were used to assess the effect of age of dam on the adjusted 210 day mass of their calves over and within type of dam. These investigations were made on each of the 2 farms.

Cow age groups up to 15 years on farm 1 and 16 years on farm 2 were available. Heifers calved for the first time at 28 (2A) or 31 (2B) months old. These two heifer-groups were assessed separately as at this age the age-effect is most critical (Cundiff *et al.*, 1966b). Significant differences between means were identified using the Method of Least Significant differences (Miller, 1966).

Results and Discussion

The age of dam significantly ($P < 0{,}01$) affected adjusted 210 day weaning mass in all 12 models. The 2 heifer groups consistently produced significantly ($P < 0{,}05$) smaller calves at weaning than the other age of dam groups (Fig. 1a to 1d). Relative to heifer productivity (Tables 1 & 2) cow productivity in terms of mass of calf weaned differed considerably according to cow type. On both farms peak weaning production occurred earlier in the Herefords and *Bos indicus* (3 and 4 years old respectively on farm 1 and at 5 years in both breeds on farm 2) than the Charolais, Simmentaler and Dual Purpose types where peak weaning mass occurred at 10, 6 and 6 years old on farm 1 and 8, 8 and 6 years old on farm 2, respectively. The differences are probably a reflection of the earlier maturity of the different breed types with the larger later maturing breeds producing a smaller calf at weaning while their own demands for growth are still relatively high. This is particularly noticeable in the Charolais breed where the young group of heifers produced the smallest weaners on both farms. Where the Charolais heifers calved 3 months later they produced a more acceptable weaner though this was still small relative to the other dam breed types.

In the later maturing breeds it is difficult to assess longevity critically as there was a shortage of older cows in these groups but it would seem that later maturing breeds attaining maximum weaning production at a later age than the British and *Bos indicus* types would continue to produce at this high level for the same period as the British and *Bos indicus* and then fall off in productivity only at a later age. This is in agreement with results obtained by Venter (1977). Cartwright *et al.* (1964) reported similar results for the younger cow ages, and for crossbreeds, but the production of 8 year old Herefords dropped below that of Brahman cows which continued to show increasing production. This extrapolation may be acceptable under these intensive pasture conditions, but under more adverse conditions it is possible that the period of high productivity in the later maturing breeds would be cut short due particularly to a loss of teeth function.

Assuming these herds consisted entirely of one breed type, then the accumulative productivity for each of these breed types would be as presented in Table 3 where of farm 1 up to 9 years of age, the Simmentaler cows produce more mass of calf weaned than the other 4 types. The Charolais at this stage produce less mass of calf weaned than any of the other types. Even at 11 years of age the Charolais types only equal the Herefords. On farm 2 Charolais types were more productive tham the other breeds at an earlier age. On farm 2 the nutritional level during this period was superior to that on farm 1 and may explain this increased productivity of the Charolais types as also shown by Long, Cartwright & Fitzhugh (1975). As the later maturing breeds are generally heavier their maintenance requirements are greater and their accumulative production values would be less than those shown in Table 3 if corrected for these requirements. In conclusion, later maturing cow types may be more productive if kept on irrigated pastures and at relatively high levels of nutrition.

However, this superiority tends to occur at more advanced ages and consequently under extensive ranching conditions where the maximum dam age is minimized due to teeth function, these breeds may not show this superiority. A further consideration is that under intensive conditions, if a high heifer replacement rate is maintained, the average cow age in the herd will be low in which case productivity in terms of accumulated weaning mass will again favour the early maturingbreeds which in this case were shown to be British and *Bos indicus* types. The results of this study clearly indicate the need to assess absolute performance levels in practical economic terms when comparing breed types. There is good evidence from this study that higher absolute performance levels are not necessarily associated with an improvement in herd productivity in the practical situation.

Acknowledgements

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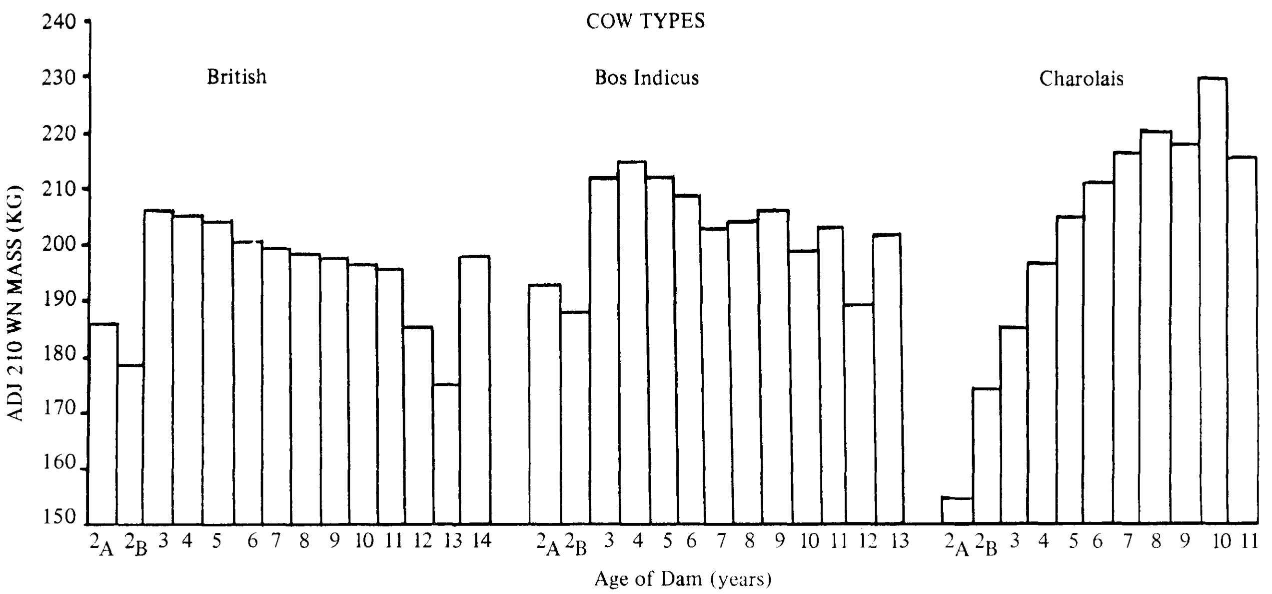
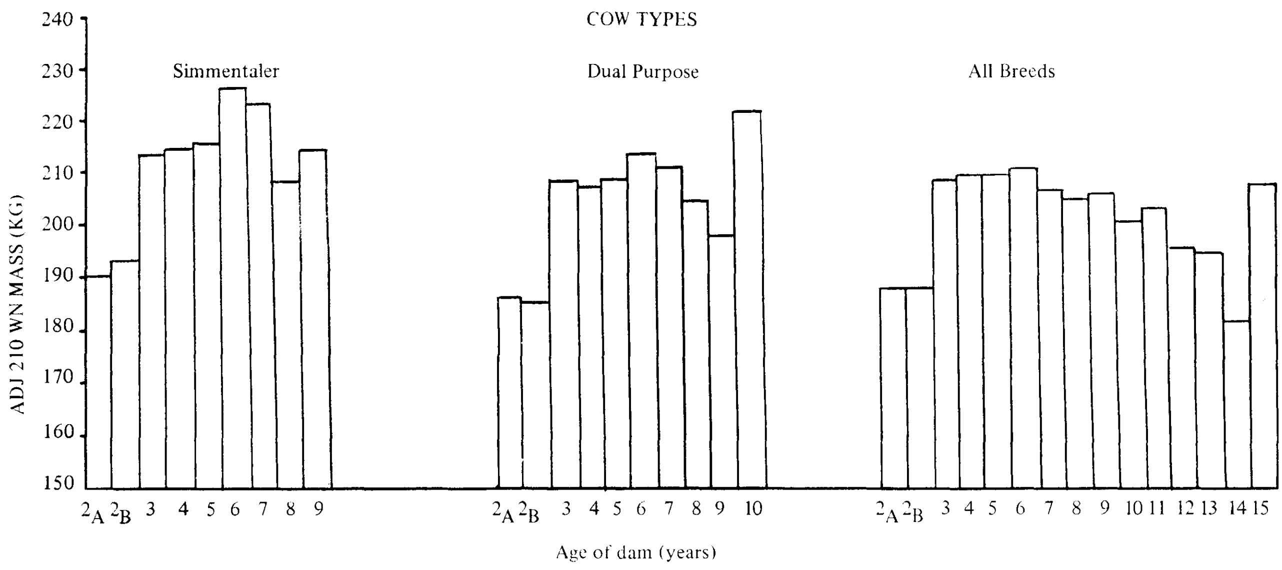


2A and 2B differ ($P < 0,05$) from 4 to 6

2A differs ($P < 0,05$) from 4 to 6
2B differs ($P < 0,05$) from 3 to 9
4 differs ($P < 0,05$) from 7 to 12
10 differs ($P < 0,05$) from 5

2A differs ($P < 0,05$) from 4 to 10
2B differs ($P < 0,05$) from 4 to 9

Fig. 1a *The effect of age of dam on calf weaning mass by farm and cow type (Farm 1)*

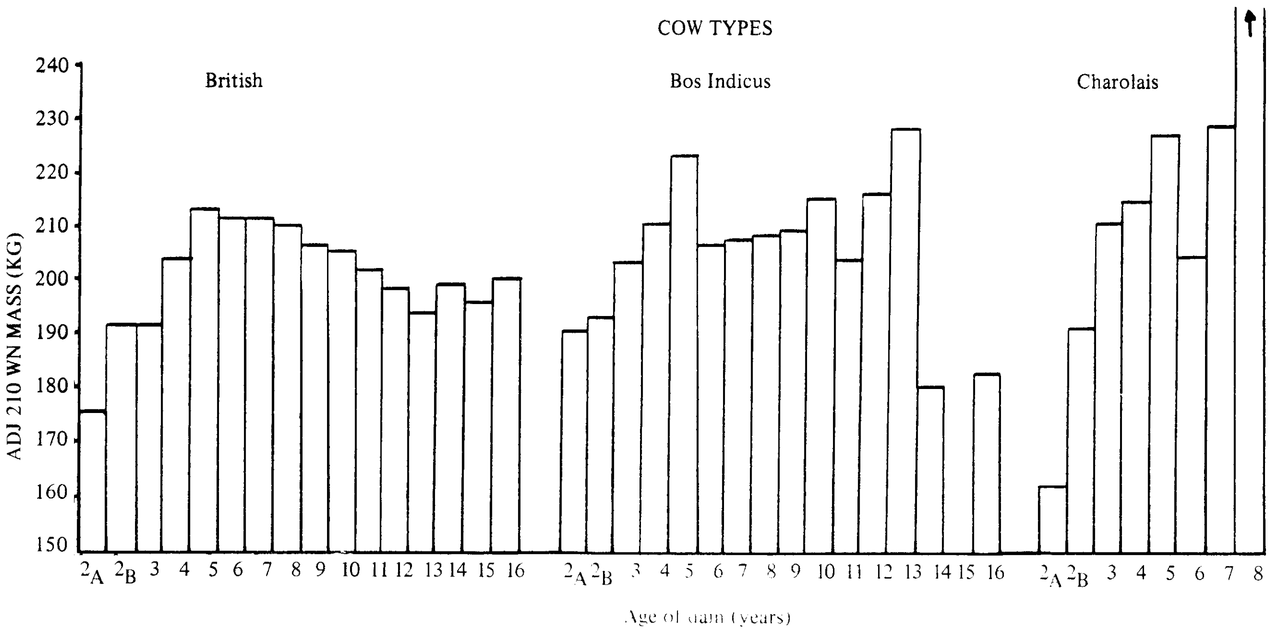


2A and 2B differ ($P < 0,05$) from 3 to 7
4 differs ($P < 0,05$) from 6

2A and 2B differ ($P < 0,05$) from 4 to 7

2A differs ($P < 0,05$) from 3 11
2B differs ($P < 0,05$) from 3 to 11
10 and 12 differ ($P < 0,05$) from 4 to 6

Fig. 1b *The effect of age of dam on calf weaning mass by farm and cow type (Farm 1)*

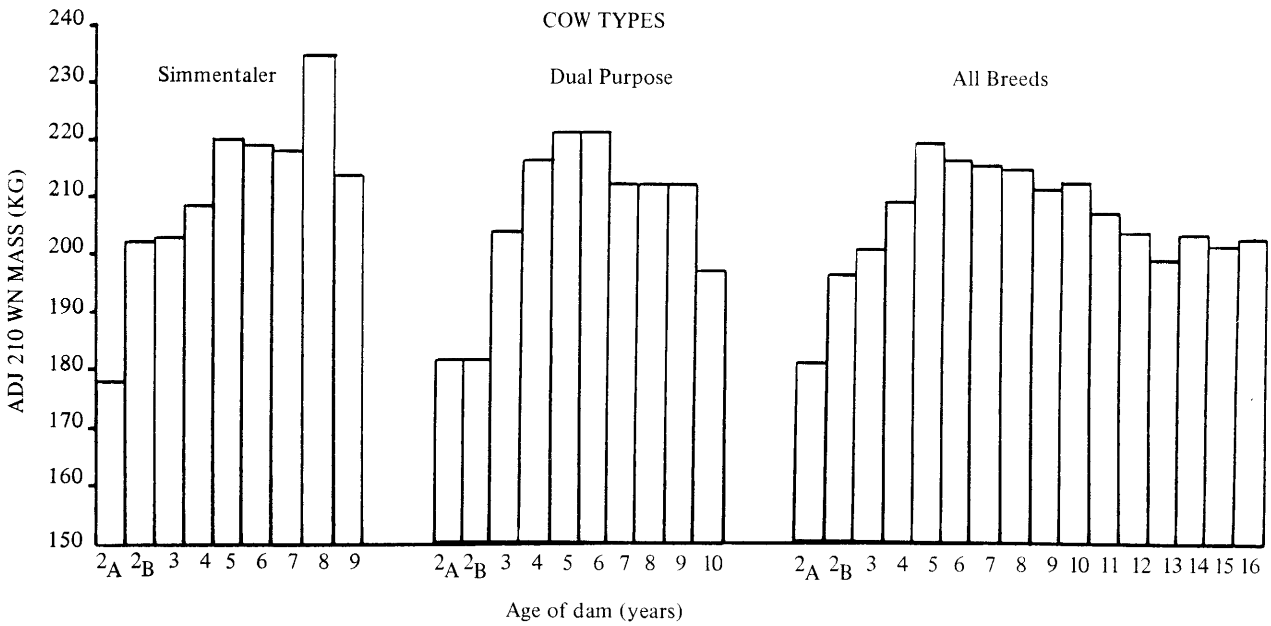


2A differs (P < 0,05) from 4 to 14
2B differs (P < 0,05) from 4 to 11
3 and 4 differ (P < 0,05) from 5 to 8

2A differs (P < 0,05) from 4, 5 and 8 to 10
2B differs (P < 0,05) from 4, 5 and 8 to 10

2A differs (P < 0,05) from 2B to 8
2B differs (P < 0,05) from 4 to 5 and 7 to 8
3 to 5 differs (P < 0,05) from 8

Fig. 1c *The effect of age of dam on calf weaning mass by farm and cow type (Farm 2)*



2A differs (P < 0,05) from 2B to 8
2B differs (P < 0,05) from 5 to 8
3 differs (P < 0,05) from 5 to 8
4 differs (P < 0,05) from 5

2A differs (P < 0,05) from 4 to 7
2B differs (P < 0,05) from 4 to 7

2A differs (P < 0,05) from 2B to 14
2B differs (P < 0,05) from 4 to 11
3 differs (P < 0,05) from 4 to 10
4 differs (P < 0,05) from 5 to 8
5 differs (P < 0,05) from 9 to 14
6 to 8 differs (P < 0,05) from 12 and 13

Fig. 1d *The effect of age of dam on calf weaning mass by farm and cow type (Farm 2)*

Table 2

Cow productivity as a percentage of heifer productivity as measured by weaning mass by cow breed type and cow age on 2 farms

	Farm 1							Farm 2					
Cow Age	Cow Breed Type						Cow Age	Cow Breed Type					
	British	Bos Indicus	Charolais	Simmentaler	Dual purpose	All breeds		British	Bos Indicus	Charolais	Simmentaler	Dual purpose	All breeds
2A	100,0	100,0	100,0	100,0	100,0	100,0	2A	100,0	100,0	100,0	100,0	100,0	100,0
2B	95,6	97,7	112,8	101,4	99,4	100,0	2B	109,6	100,9	117,9	113,1	100,0	108,3
3	109,6	110,0	119,4	112,0	111,7	110,6	3	109,7	106,1	130,2	112,8	11,8	110,6
4	108,8	111,1	126,6	112,3	111,0	111,2	4	116,3	110,0	131,8	117,0	118,7	115,6
5	108,7	109,8	130,8	113,1	111,8	111,2	5	121,7	116,9	139,7	123,0	121,0	121,1
6	108,5	108,6	135,7	118,9	113,8	111,7	6	120,9	108,2	125,9	121,8	121,2	119,4
7	107,1	105,7	138,8	117,0	112,7	109,6	7	121,0	108,6	140,4	121,8	116,7	118,9
8	106,6	105,9	141,8	109,7	109,3	108,5	8	120,5	109,2	159,2	131,0	116,3	118,9
9	105,8	107,1	140,3	112,5	106,6	109,0	9	118,2	109,7	–	119,7	116,3	116,7
10	105,0	103,2	147,5	–	118,9	106,4	10	117,6	112,6	–	–	108,5	117,2
11	104,7	105,4	138,2	–	–	107,4	11	116,1	106,7	–	–	–	114,4
12	104,1	98,6	–	–	–	103,7	12	113,5	117,2	–	–	–	112,8
13	98,7	104,2	–	–	–	103,2	13	111,0	119,5	–	–	–	110,0
14	93,1	–	–	–	–	96,3	14	114,1	94,7	–	–	–	112,8
15	104,9	–	–	–	–	210,1	15	112,6	–	–	–	–	111,7
16	–	–	–	–	–	–	16	114,9	95,9	–	–	–	112,2

Table 1

Least Squares Means (LSM), Constant Estimates (CE) and Standard Error (SE) for the effect of cow age on calf weaning Mass by cow breed type on 2 farms (kg)

FARM 1

Age on Dam	British				Bos Indicus				Charolais				Simmentaler				Dual Purpose				All Types			
	N	CE	LSM	SE	N	CE	LSM	SE	N	CE	LSM	SE	N	CE	LSM	SE	N	CE	LSM	SE	N	CE	LSM	SE
Mean	1 088	–	194,7	±2,4	1 400	–	200,7	±1,4	158	–	200,5	±5,1	557	–	210,0	±2,8	565	–	203,7	±3,3	3768	–	200,5	±2,1
2A	48	– 8,3	186,5	4,2	34	9,9	190,8	4,4	9	–46,5	154,0	11,8	58	–20,4	189,6	4,3	27	–17,7	186,1	6,2	176	–12,3	188,2	2,1
2B	69	– 7,5	187,3	3,4	92	–14,3	186,4	2,9	40	–26,8	173,7	7,8	136	–17,7	192,3	3,0	58	–18,9	184,7	4,2	395	–12,3	188,2	1,5
3	26	9,7	204,4	5,3	15	9,2	209,9	6,4	4	–16,6	183,9	14,1	25	2,3	212,3	5,3	11	4,0	207,8	8,1	81	7,2	207,7	2,9
4	125	8,1	202,9	2,7	132	11,2	211,9	2,4	27	– 5,6	194,9	7,2	164	3,0	213,0	2,5	153	2,8	206,6	2,7	601	8,3	208,8	1,2
5	108	8,02	202,7	2,8	107	8,8	209,5	2,5	20	1,0	201,5	7,5	99	4,5	214,5	3,0	127	4,3	208,0	2,8	461	8,2	208,7	1,3
6	155	7,6	202,3	2,4	208	6,6	207,3	2,1	19	8,5	209,0	7,0	47	15,5	225,5	4,0	103	8,0	211,8	3,1	532	9,4	209,9	1,3
7	143	5,1	199,8	2,5	208	0,9	201,6	2,0	15	13,1	213,7	9,0	22	11,8	221,8	5,6	59	5,9	209,7	3,9	447	5,2	205,7	1,4
8	129	4,1	198,9	2,6	215	1,5	202,1	2,0	13	17,9	218,4	8,8	3	– 2,2	207,9	14,0	17	– 0,4	203,4	6,6	337	4,02	204,5	1,5
9	103	2,7	197,4	2,9	187	3,7	204,4	2,0	7	15,9	216,1	11,1	3	3,3	213,3	13,9	9	– 5,5	198,3	8,9	309	4,7	205,2	1,7
10	68	1,2	195,9	3,3	115	– 3,7	197,0	2,4	2	26,7	227,2	21,1					1	17,4	221,2	25,6	186	– 0,2	200,3	2,0
11	61	0,5	195,2	3,5	56	0,4	210,1	3,4	2	12,4	212,9	21,6									119	1,9	202,4	2,4
12	37	– 0,5	194,2	4,4	22	–12,5	188,2	5,2													59	– 5,1	195,4	3,3
13	12	–10,7	184,0	7,6	9	– 1,9	198,8	8,0													21	– 6,2	194,3	5,5
14	3	21,1	173,6	15,1																	3	–19,9	180,6	1,4
15	1	1,0	195,7	25,8																	1	7,0	207,5	2,5

FARM 2

Age on Dam	British				Bos Indicus				Charolais				Simmentaler				Dual Purpose				All Types			
	N	CE	LSM	SE	N	CE	LSM	SE	N	CE	LSM	SE	N	CE	LSM	SE	N	CE	LSM	SE	N	CE	LSM	SE
Mean	2 585	–	199,3	±1,3	983	–	204,7	±3,5	141	–	212,0	±5,1	1 031	–	209,8	±3,5	223	–	204,6	±5,6	4 963	–	204,9	±1,4
2A	77	–25,7	173,5	3,0	30	–14,2	190,4	5,1	29	–49,7	162,3	7,5	164	31,7	178,1	3,0	28	–23,6	181,0	9,8	328	–24,9	180,0	1,8
2B	130	– 9,1	190,2	2,4	34	–12,5	192,1	4,6	14	–20,7	191,4	8,8	145	– 8,4	201,4	3,0	25	–23,6	181,0	7,1	348	–9,4	195,5	1,7
3	33	– 8,9	190,3	4,4	14	– 2,6	202,1	6,9	13	– 0,7	211,3	9,7	85	– 8,9	200,9	3,4	10	– 2,3	202,3	9,3	155	– 5,9	199,0	2,3
4	253	2,4	201,7	1,7	95	4,7	209,4	3,0	44	1,9	213,9	7,7	274	– 1,5	208,3	2,2	77	10,3	214,9	6,0	743	3,4	208,3	1,3
5	355	11,9	211,2	1,5	79	17,8	222,5	3,1	21	14,7	226,7	9,0	201	9,2	219,0	2,5	53	14,5	219,1	6,1	709	12,9	217,8	1,3
6	316	10,5	209,8	1,7	51	1,4	206,0	3,7	4	– 7,7	204,4	17,4	114	7,4	217,2	3,1	9	14,82	219,4	10,2	494	9,8	214,7	1,5
7	361	10,8	210,0	1,5	197	2,2	206,8	2,6	9	15,8	227,8	10,0	40	7,1	216,9	4,6	7	6,7	211,3	10,9	614	9,2	214,1	1,5
8	361	9,8	209,1	1,6	203	3,2	207,9	2,5	7	46,4	258,4	12,1	7	23,5	233,4	10,0	6	5,9	210,5	10,5	584	9,02	213,9	1,5
9	247	5,7	205,0	1,8	154	4,2	208,8	2,7									5	5,9	210,5	11,1	406	5,3	210,2	1,7
10	161	4,8	204,1	2,2	102	9,8	214,4	3,1					1	3,4	213,2	25,4	3	– 8,4	196,3	13,7	267	6,4	210,4	1,9
11	113	2,22	201,5	2,5	19	– 1,5	203,2	6,1													132	1,5	205,5	2,5
12	67	– 2,4	196,9	3,2	1	11,0	2,15,6	24,5													68	– 2,3	202,6	3,2
13	54	– 6,8	192,5	3,5	1	22,9	227,6	24,6													55	– 6,6	198,3	3,5
14	39	– 1,3	198,0	4,1	2	–24,2	180,4	17,6													41	– 2,0	203,0	4,1
15	13	– 3,9	195,4	7,0																	13	– 3,5	201,4	7,0
16	5	0,1	199,3	11,2	1	–22,0	182,6	24,7													6	– 2,9	202,0	1,0

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Table 3

Accumulated weaning production (1 000 kg) by cow age and breed type on 2 farms

Cow Age	Farm 1						Cow Age	Farm 2					
	Cow Breed Type							Cow Breed Type					
	British	Bos Indicus	Charolais	Simmen-taler	Dual purpose	All breeds		British	Bos Indicus	Charolais	Simmen-taler	Dual purpose	All breeds
2A	33	34	27	33	33	33	2A	57	62	53	58	59	59
2B	107	107	69	109	106	107	2B	123	129	120	128	122	127
3	123	124	110	126	123	124	3	153	160	152	159	154	158
4	245	252	228	254	247	250	4	303	316	311	314	313	312
5	339	348	321	354	343	346	5	452	473	472	469	469	467
6	446	458	432	474	456	458	6	556	575	573	577	577	573
7	536	549	528	573	550	550	7	685	702	713	710	708	704
8	611	625	610	651	626	627	8	807	823	864	845	831	829
9	671	688	677	717	687	690	9	890	908	–	936	916	915
10	708	725	719	–	728	727	10	944	965	–	993	968	971
11	731	748	744	–	–	751	11	971	992	–	–	–	998
12	743	748	744	–	–	763	12	985	1 007	–	–	–	1 012
13	746	764	–	–	–	767	13	995	1 019	–	–	–	1 023
14	747	–	–	–	–	768	14	1 003	1 027	–	–	–	1 031
15	747	–	–	–	–	768	15	1 006	1 029	–	–	–	1 034
16	–	–	–	–	–	–	16	1 007	1 030	–	–	–	1 035