

### III.—The Carotene Content of Some South African Feeds.

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SINCE the last publication (1940) the writer has collected more veldgrass samples from the areas, Onderstepoort (Pretoria district), the Experimental Farms, Ermelo (Highveld, Transvaal) and Vryburg (Bechuanaland). These samples were also collected monthly from the veld. After the grass had been dried the samples were milled, stored in closed jars and analyzed for Carotene soon afterwards.

The samples were taken from Experimental Plots at Onderstepoort as outlined in a previous publication (1940). The seasons in question were from August, 1936, to August, 1940 (for 4 periods) in the case of veldgrass samples from Vryburg. For Ermelo the periods were from August, 1938, to August, 1940 (for 4 periods). The samples taken at Onderstepoort were for the period August, 1939, to August, 1940.

The methods of extraction and analysis of Carotene were the same as outlined in previous publications (1935, 1940).

The values for Carotene are given in Tables 1, 4, and 7 for the three areas respectively.

The daily intakes of Carotene for a bovine of 800 lbs. live-weight, on a basis of 15 lbs. dry weight consumption, are given in Tables 2, 5 and 8.

The meteorological data for the three areas are given in Tables 3, 6 and 9 respectively.

#### DISCUSSION.

##### (A) *Veldgrass samples from Onderstepoort (Pretoria).*

As previously noted, there is again a rapid decline in Carotene values during the winter months, especially for the months June, July and August [Tables 1 and 1 (a)]. With regard to Carotene intake, there is not only a low intake, but also a deficiency during these months in most of the grasses analyzed. With the incidence of new growth, however, there is a sharp rise in the Carotene values of all grasses, sufficient to supplement any shortage existing and allowing a reserve of Vitamin A to be built up (see Table 2). Although,

generally speaking, the season August, 1939, to August, 1940, was a good one (see Table 2) with fairly good rainfall as well as a good distribution, there was no rain for July and practically none in August. Furthermore, very sharp, frosty nights in July destroyed much of the vegetation, resulting in a more acute shortage. Should copious rains fall during the rainy season following, conditions will improve and serve to enhance the Vitamin A reserve of animals.

(B) *Veldgrass samples from Ermelo.*

The seasons in question were good with abundant rainfall and only for the months June and July, 1939, were low values found for Carotene. Exceptionally high falls of rain with a good distribution during the period 1939-1940, had as a result high values for Carotene in most grass samples (Tables 4 and 5).

(C) *Veldgrass samples from Vryburg.*

Carotene values were determined for four successive seasons (see Table 7). The values representing the season August, 1936-August, 1937, are normal, due to normal rainfall in the season, but the values obtained for August, 1937-August, 1938, were low in comparison with other seasons. During this period 1937-1938, the average rainfall was very low, only about ten inches of rain were recorded altogether (see Table 9). The months May, June, July, August, September, October and November (1937) were all dry months, in all only 0.4 inch rain being recorded.

As a result a serious deficiency of Carotene was expected, although, surprisingly, no actual deficiency in intake could be found on calculation, in spite of the fact that there was a sharp decrease in Carotene values in the grasses analyzed. Low intakes were calculated, but these intakes were still above the minimum requirements according to Guilbert (1937) (see Table 8).

The previous rainy season was exceptionally good and the animals grazing on the veld would have had ample Carotene in reserve to make good any shortage during the following winter.

Another dry winter was experienced in 1938 but this followed on a poor rainy season with low falls. Hence the daily intakes of only 11, 18, 18, 17 mgm. respectively for the months June to September (inclusive) come as no surprise.

Even then there was no actual shortage, although the values are critically near the minimum requirement of 9 mgm. per day. On the whole, the seasons 1938-1939 and 1939-1940 were good, although the values obtained for June and July, 1939, were exceptional when a daily intake per head of 8 and 12 mgm. respectively was noted.

SUMMARY.

1. Carotene values were determined by analysing veldgrass samples, collected monthly in the areas, Onderstepoort (Pretoria district), Ermelo (Transvaal Highlands) and Vryburg (Bechuana-land).

2. From the values for Carotene found, the daily intake was calculated and one can safely conclude that no deficiency of Carotene existed for the season August, 1939, to August, 1940, for all the areas in question.

During 1938, due to low rainfall in the Vryburg area, a low intake of Carotene was registered, which was, however, still above the minimum requirement of 9 mgms. daily. Low intakes for a few months in winter (during dry periods) were found, but these instances were the exception rather than the rule.

#### ACKNOWLEDGEMENTS.

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#### REFERENCES.

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THE CAROTENE CONTENT OF S.A. FEEDS.

TABLE 1.  
*Carotene Content of Grasses cut Monthly from Experimental Plots (Understepoort).  
 Expressed as mgm. per cent. on Natural Basis.*

Type of Grass.	Period.	1940.												
		1939.						1940.						
		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.
1. <i>Chloris gayana</i> (Rhodes Grass)	Carotene...	0.64	1.60	4.73	5.85	4.06	2.10	2.03	2.35	3.00	2.21	0.33	0.21	1.06
	Moisture...	11.6	30.8	42.2	67.1	65.8	63.1	45.0	45.7	59.2	49.2	17.7	20.7	30.7
2. <i>Digitaria eriantha</i> var. <i>stolonifera</i>	Carotene...	0.27	1.31	3.50	5.00	9.60	2.78	2.27	3.88	0.43	0.45	0.06	0.10	1.02
	Moisture...	7.7	26.9	33.3	73.9	60.0	53.2	53.6	53.8	28.6	11.1	6.6	7.4	20.0
3. <i>Oenchrus ciliaris</i> (Buffels Grass)	Carotene...	0.15	0.48	0.67	2.55	8.57	3.20	2.72	4.08	2.28	1.02	0.02	0.07	—
	Moisture...	8.3	12.0	22.0	79.3	74.5	57.6	49.0	32.7	33.3	33.3	31.5	9.6	—
4. <i>Eragrostis plana</i> .....	Carotene...	0.24	1.82	4.75	6.51	10.66	3.00	2.78	4.24	0.65	0.80	0.29	0.14	0.64
	Moisture...	13.8	14.8	15.9	61.0	54.9	43.3	35.1	77.2	50.0	16.1	5.6	8.4	16.6
5. <i>Panicum maximum</i> (Hairy Buffels Grass)	Carotene...	0.06	0.64	3.31	4.71	8.80	2.90	3.07	6.85	1.69	0.77	0.07	0.07	2.61
	Moisture...	7.4	21.4	40.9	79.7	75.4	43.7	41.2	45.1	55.5	45.0	15.0	13.3	26.9
6. <i>Setaria lindenbergiana</i> ...	Carotene...	0.24	1.20	3.20	6.80	11.62	3.42	3.10	6.99	1.33	0.48	0.04	0.05	2.23
	Moisture...	6.1	12.5	23.6	64.0	42.1	44.4	34.5	52.8	22.2	26.3	6.0	7.9	23.3

TABLE 1 (a).  
*Carotene Content of Grasses Cut Monthly from Experimental Plots (Onderstepoort).  
 Expressed as mgm. per cent. on Dry Basis.*

Type of Grass.	Period.	1939.						1940.						
		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.
1. <i>Chloris gayana</i> .....	—	0.72	2.31	8.20	17.80	11.90	5.70	3.70	4.33	7.35	4.35	0.40	0.26	1.53
2. <i>Digitaria eriantha</i> .....	—	0.29	1.79	5.25	19.20	24.00	5.94	4.90	8.41	0.63	0.51	0.06	0.11	1.27
3. <i>Cenchrus ciliaris</i> .....	—	0.16	0.55	0.86	12.30	33.60	7.55	5.33	6.07	3.43	1.53	0.04	0.08	—
4. <i>Eragrostis plana</i> .....	—	0.28	2.14	5.65	16.70	23.70	5.30	4.28	18.60	1.30	0.95	0.31	0.15	0.77
5. <i>Panicum maximum</i> .....	—	0.06	0.81	5.60	23.20	35.80	5.15	5.22	12.50	3.80	1.40	0.08	0.08	3.57
6. <i>Setaria lindenbergiana</i> ...	—	0.25	1.37	4.18	18.80	20.30	6.14	4.74	14.80	1.71	0.65	0.04	0.05	2.91

TABLE 2.  
Daily Intake of Carotene (mgm.) for Cattle (800 lbs. Live weight). Onderstepoort.  
Calculated from Table 1 (a).

Type of Grass.	Period.	1939.						1940.						
		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.
1. <i>Chloris gayana</i> .....	—	49	156	554	1,200	804	385	250	292	496	294	27	17	103
2. <i>Digitaria eriantha</i> var. <i>stolonifera</i>	—	20	121	354	1,296	1,620	401	331	568	42	34	4	7	86
3. <i>Cenchrus ciliaris</i> .....	—	11	37	58	830	2,270	510	360	410	231	103	3	5	—
4. <i>Eragrostis plana</i> .....	—	19	144	382	1,130	1,600	358	289	1,255	88	64	21	10	52
5. <i>Panicum maximum</i> .....	—	4	55	378	1,565	2,415	348	353	844	256	95	5	5	241
6. <i>Setaria lindenbergiana</i> ..	—	17	92	282	1,270	1,370	415	320	1,000	115	44	3	3	197
Average for 6 grasses.....	—	20	101	335	1,215	1,680	403	317	728	205	105	10	8	135
Minimum requirement ac- cording to Gilbert	—	9	9	9	9	9	9	9	9	9	9	9	9	9

TABLE 3.

*Meteorological Data.—Onderstepoort.*

Date.	Average Rainfall.	Average Maximum Tempe- rature.	Average Minimum Tempe- rature.	Difference between Maximum and Minimum Tempe- rature.
	(Inches.)	°F.	°F.	°F.
1939—				
January.....	5.24	84.8	57.4	27.4
February.....	8.82	84.0	58.2	25.8
March.....	2.75	75.7	48.6	27.1
April.....	0.07	74.2	44.2	30.0
May.....	2.54	74.0	39.9	34.1
June.....	0	68.5	32.8	35.7
July.....	2.44	65.4	33.8	31.6
August.....	0.40	70.2	37.5	32.7
September.....	0.93	75.8	41.2	34.6
October.....	3.40	82.6	51.2	31.4
November.....	7.35	78.8	53.0	25.8
December.....	3.41	84.0	57.1	26.9
1940—				
January.....	1.79	82.5	57.4	25.1
February.....	1.30	86.2	57.3	28.9
March.....	3.70	82.6	55.0	27.6
April.....	1.26	77.7	46.7	31.0
May.....	1.21	73.1	38.0	35.1
June.....	2.31	67.0	33.1	33.9
July.....	0	68.0	32.0	36.0
August.....	0.14	75.9	37.5	38.4

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TABLE 4.  
Carotene Content of Mixed Veldgrasses cut Monthly on the Experimental Farm, Ermelo, Tvl.  
Expressed as mgm. per cent. Carotene on Dry Basis.

	1939.												
	1938.			1939.									1940.
	August.	September.	October.	Nov.	December.	January.	February.	March.	April.	May.	June.	July.	August.
0.06	0.19	0.71	0.99	1.01	1.42	2.13	1.60	1.40	0.48	0.25	0.22	0.57	
0.57	1.14	3.03	2.53	3.51	0.77	1.96	3.70	2.18	1.37	1.00	0.33	0.68	

TABLE 5.  
Daily Intake of Carotene (mgm.) for Cattle (800 lbs. live weight). Ermelo. Calculated from Table 4.

	1938.												1939.														
	1938.			1939.									1940.			1939.			1940.								
	August.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	August.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	
—	4	14	48	67	68	96	144	108	95	32	17	15	39														
—	39	77	205	171	237	52	132	250	147	92	67	22	46														
Average (2 years).....	21	45	126	119	152	74	138	179	121	62	42	18	42														
Minimum requirement...	9	9	9	9	9	9	9	9	9	9	9	9	9														



TABLE 6.

*Meteorological Data.—Ermelo, Transvaal.*

Date.	Average Rainfall.	Average Maximum Tempe- rature.	Average Minimum Tempe- rature.	Difference between Maximum and Minimum Tempe- rature.
	(Inches.)	°F.	°F.	°F.
1938—				
August.....	1.72	66.0	37.7	28.3
September.....	0.77	74.0	43.7	30.3
October.....	4.04	74.6	50.0	24.6
November.....	4.32	78.1	49.2	28.9
December.....	5.46	75.6	53.6	22.0
1939—				
January.....	8.42	75.5	52.3	23.2
February.....	6.00	75.5	56.1	19.4
March.....	2.73	73.3	50.3	23.0
April.....	0.49	73.6	42.5	31.1
May.....	1.50	68.7	40.6	28.1
June.....	0.11	62.3	33.8	28.5
July.....	2.38	59.4	34.7	24.7
August.....	0.34	65.7	37.9	27.8
September.....	1.14	69.2	40.8	28.4
October.....	1.97	77.4	49.4	28.0
November.....	7.84	71.7	47.9	23.8
December.....	7.63	76.6	52.7	23.9
1940—				
January.....	4.73	78.2	52.7	25.5
February.....	3.54	77.4	52.7	24.7
March.....	1.31	76.4	52.6	23.8
April.....	1.72	74.1	45.4	28.7
May.....	2.02	66.4	39.6	26.8
June.....	3.39	61.3	35.8	25.5
July.....	0.03	62.6	32.9	29.7
August.....	0.17	69.3	39.6	28.7

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TABLE 7.  
*Carotene Content of Mixed Veld-grasses cut monthly on Experimental Farm, Armoedsvlakte, Vryburg, Bechuanaland. Expressed as mgm. per cent. Carotene on dry basis.*

August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.
1936.												
0.12	0.39	0.98	0.33	0.52	1.32	3.17	4.05	2.05	1.75	1.07	0.34	0.50
1937.												
0.50	0.81	0.64	1.03	0.55	0.81	0.91	0.67	0.65	0.38	0.16	0.26	0.27
1938.												
0.27	0.25	2.29	1.10	1.54	1.16	3.12	1.30	1.49	1.53	0.12	0.19	0.90
1939.												
0.90	1.03	3.16	1.54	3.24	2.23	2.58	6.58	9.14	3.20	3.39	1.71	1.09

TABLE 8.  
*Daily Intake of Carotene (mgm.) for Cattle (800 lbs. Live-weight.)—Vryburg. Calculated from Table 7.*

	August.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.
	1936.												
	8	26	61	35	35	89	214	273	138	118	72	23	34
	1937.												
	34	55	43	70	37	55	61	45	44	26	11	18	18
	1938.												
	18	17	154	74	104	78	211	87	100	103	8	13	61
	1939.												
	61	70	214	104	219	151	173	440	614	215	227	115	73
Average (4 years).....	30	42	118	42	96	93	165	211	223	115	79	42	46
Minimum requirement....	9	9	9	9	9	9	9	9	9	9	9	9	9

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TABLE 9.

*Meteorological Data.—Armoedsvlakte (Bechuanaland).*

Date.	Average Rainfall.	Average Maximum Temperature.	Average Minimum Temperature.	Difference between Maximum and Minimum Temperature.
1936—	(Inches).	°F.	°F.	°F.
August.....	0	74.5	34.7	39.8
September.....	.79	76.5	41.5	35.0
October.....	.71	82.2	49.6	32.6
November.....	4.07	83.0	55.6	27.4
December.....	.50	91.5	57.8	33.7
1937—				
January.....	6.45	86.9	61.7	25.2
February.....	7.32	84.2	61.2	23.0
March.....	2.27	85.5	53.7	31.8
April.....	1.09	81.3	44.6	36.7
May.....	.16	75.7	44.6	31.1
June.....	0	68.7	26.9	41.8
July.....	0	65.1	27.2	37.9
August.....	0	77.0	36.0	41.0
September.....	.15	84.4	41.2	43.2
October.....	0	87.8	53.8	34.0
November.....	.13	93.4	56.4	37.0
December.....	3.13	88.9	57.7	31.2
1938—				
January.....	2.19	88.6	60.8	27.8
February.....	2.98	84.6	58.2	26.4
March.....	.49	88.8	54.6	34.2
April.....	.83	81.3	47.8	33.5
May.....	.29	75.1	39.2	35.9
June.....	.05	68.3	35.5	32.8
July.....	.16	66.9	33.3	33.6
August.....	.07	72.6	35.7	36.9
September.....	0	78.3	41.7	36.6
October.....	1.35	86.3	55.4	30.9
November.....	.76	85.1	53.9	31.2
December.....	2.68	88.7	61.5	27.2
1939—				
January.....	1.54	90.5	58.7	31.8
February.....	3.07	84.0	63.1	21.1
March.....	2.78	80.1	59.3	20.8
April.....	.09	74.3	44.2	30.1
May.....	.42	73.4	38.8	34.6
June.....	0.02	67.8	33.3	34.5
July.....	1.54	63.2	36.8	26.4
August.....	.67	69.7	37.8	31.9
September.....	.06	76.0	41.6	34.4
October.....	1.06	83.0	52.2	30.8
November.....	.97	85.3	55.9	29.4
December.....	1.49	91.9	59.9	32.0
1940—				
January.....	2.52	89.8	60.6	29.2
February.....	1.55	89.4	61.8	27.6
March.....	4.25	81.8	57.6	24.2
April.....	2.27	76.1	48.2	27.9
May.....	.36	72.0	39.3	32.7
June.....	.04	67.7	34.1	33.6
July.....	0	68.7	30.9	37.8
August.....	.01	75.8	39.9	35.9