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CONTENTS

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ABOUT 23 million acres or nearly 50 percent of the area of Nebraska is in permanent pasture and range land. Pastures normally furnish much of the vitamin A required by the livestock of this state during certain parts of the year, but when grain and hay are scarce, pastures may be depended upon even more as a source of this vitamin. It is generally understood that vitamin A, or its precursors, can be omitted from the rations of farm animals only so long as their body storage of this factor is adequate. In other words, vitamin A, unlike certain fractions of the vitamin B complex, cannot be synthesized, even by ruminants, but must be available to the animal either from the ration or through body storage.

Strictly speaking, vitamin A occurs only in the animal organism; the potential vitamin A production of a plant is dependent on its provitamin A content of which the carotenes are usually the most important part. Therefore, information regarding the carotene content of the grasses grown or native in pastures is of considerable importance to the producer of livestock.

According to Frolik and Keim (*8*) native grasses furnish nearly all the pasturage in the western portion of the state, some pasturage in eastern Nebraska and over 2 million acres of meadows which are harvested annually for their prairie hay. The Nebraska Agricultural Experiment Station at Lincoln, has maintained pure stands of these native grasses for some time. Observation of these stands and of the pasturage in the range area showed that the grasses differed in their growth habits and raised the question of their relative carotene content and feeding value. Since very little if any data were available regarding the vitamin A values of most of these grasses and as no data concerning this question were to be had for these plants when grown under Nebraska conditions, this study was made.

REVIEW OF LITERATURE

Atkeson, Peterson and Aldous (*1*) reported on the carotene content of plants typical of those used for pasture in Kansas. The carotene values which were relatively high in early summer

tended to decrease sharply during the hot months. In some plants the carotene content increased after the fall rains.

Smith and Stanley (*18*), by means of the rat-growth method, tested the vitamin A value of the blue grama grass grown on the range in southern Arizona. While rich in vitamin A in the early stages of growth, the grass was relatively deficient in this vitamin during the greater part of the year.

Watkins (*20*) of the New Mexico Agricultural Experiment Station found that black gama and mesa dropseed grass were moderately high in carotene during the growing season. The mesa dropseed lost all of its carotene at the end of the growing season. Since the black grama remained partially green throughout the winter, it contained enough carotene to meet the vitamin A requirement of range cattle.

Kemmerer, Fudge and Fraps (*12*) determined the carotene content of Texas range forages. The green plants contained from 2 to 495 p.p.m. of carotene on a dry basis.

Langham, McMillen and Walker (*14*) at the Oklahoma Panhandle Agricultural Experiment Station, observed the carotene content of buffalo and blue grama grass. Although the carotene content of both grasses was high during the early stages, it decreased rapidly as the plants approached maturity.

EXPERIMENTAL PROCEDURE

The twenty-four native grasses which were considered by Frolik and Keim (*8*) to be the most important and the most generally distributed in Nebraska were selected for study. These grasses are listed in Table 1. Samples of these grasses were taken from the pure stands maintained by the Department of Agronomy at Lincoln, Nebraska. The plants were cut from 1 to 2 inches above the ground and no attempt was made to obtain only green material. As soon as a sample was cut, it was taken to the laboratory and ground in a motor-driven, water-cooled food chopper. The ground material was then thoroughly mixed and a sample weighed for the carotene determination. The remainder of the ground sample was sealed in a fruit jar and stored in an electrical refrigerator until the moisture determinations were completed.

The method and equipment used in the carotene determinations were similar to those given by Brooke, Tyler and Baker (*3*) except where indicated otherwise. Fifteen milliliters of a freshly-prepared, 10 percent solution of potassium hydroxide in 95 percent ethanol were added to 2 grams of the ground grass in a fat-extraction flask. The sides of the flask were washed down with 5 ml. of 95 percent ethanol and the contents of the flask boiled for 30 minutes under a reflux condenser. The condenser was connected to the flask by a ground glass joint. After the sample had been cooled to room temperature under tap water, the unsaponifi-

able matter was removed from the mixture by shaking with 15 ml. portions of petroleum ether. After three extractions, 10 ml. of 95 percent ethanol were added to break up the residue. The extraction was then continued until the supernatant liquid was colorless. The extracts were filtered through nonabsorbent cotton and combined in a separatory funnel.

TABLE 1.—*The Native Nebraska Grasses studied and the years during which their Carotene Concentrations were observed.*

1939	
Side-oats grama	Bouteloua curtipendula
Blue grama	Bouteloua gracilis
Indian grass	Sorghastrum nutans
Big bluestem	Andropogon furcatus
Switchgrass	Panicum virgatum
Western wheatgrass	Agropyron smithii
Buffalo grass	Buchloe dactyloides
Sand dropseed	Sporobolus cryptandrus
1940	
Sandhill bluestem	Andropogon hallii
Sloughgrass	Spartina pectinata
Sand reedgrass	calamovilfa longifolia
Needlegrass	Stipa spartea
Tall dropseed	Sporobolus asper
Hairy grama	Bouteloua hirsuta
Little bluestem	Andropogon scoparius
Western needlegrass	Stipa comata
1941	
Wild rye	Elymus canadensis
Saltgrass	Distichlis stricta
Prairie dropseed	Sporobolus heterolepis
Northern reedgress	Calamagrostis inexpansa
Junegrass	Koeleria cristata
Bluejoint	Calamagrostis canadensis
Alkali dropseed	Sporobolus airoides
Lovegrass	Eragrostis trichodes

When the extraction was completed the separatory funnel was filled with distilled water and allowed to stand for 15 minutes. The water layer was then drawn off and the petroleum ether solution washed once by shaking with 20 ml. of distilled water.

After this single washing with water, the solution was washed with 20 ml. portions of 89 percent aldehyde-free methanol. This washing was continued until the methanol remained water-white and was found to be free of alkali. Phenolphthalein was used as an indicator.

The petroleum ether extract was next filtered into a 100 ml. volumetric flask through Whatman No. 1, 11-cm. paper on which was 1 gram of anhydrous sodium sulfate. The solution was made to volume with petroleum ether and the concentration of carotene determined.

The carotene content of the samples studied during 1939 and 1940 were determined with the aid of a "Buerker" Compensation Colorimeter.[1] The color standard used was made by diluting a solution, composed of 3.06 grams of Naphthol Yellow, 0.45 grams of Orange G Crystals and one liter of distilled water, so that the colorimetric reading was equal to that of a solution of 2.51 milligrams of carotene [2] in a liter of petroleum ether.

The carotene concentrations of the samples studied during 1941 were read in a Coleman Universal Spectrophotometer, Model 11. This instrument was calibrated with crystalline carotene [2] and the readings were made at 450 millimicrons.

The moisture determinations were made according to the method of the Association of Official Agricultural Chemists (*15*).

CLIMATOLOGICAL DATA

As the carotene content of grasses may be influenced by climatic conditions, data regarding temperature, precipitation and sunshine at Lincoln are shown in Table 2. These data were recorded by the United States Department of Agriculture Weather Bureau (*19*).

Considering the state as a whole the year 1939 was warm and dry. In fact, according to the available statewide record, only two years had been warmer and this was the fourth driest year of record. March of this year was somewhat warmer and wetter than normal. April and May were dry with unseasonably high temperatures during May. June was slightly warmer and wetter than normal with frequent well-distributed showers. July was warm and dry and there were hot winds near the middle of the month. While August was slightly drier than normal, moderate temperatures and low winds favored the conservation of soil moisture. September, October, and November were much drier than normal. Severe hot winds during September greatly depleted soil moisture.

The year 1940 was considerably drier than normal with mean temperatures near normal in this area. January was the coldest month in more than 50 years. February was drier than usual with temperatures near normal. March was slightly warmer and considerably wetter than normal which resulted in an improvement in soil moisture. April was slightly cooler and drier than normal. May was the driest since 1894 but temperatures were seasonable. June and July were rather warm and dry. While August was wet, September was warm and dry. October was warm with seasonable rainfall. November was cold and moder-

[1] This colorimeter was distributed by E. Leitz, Inc., New York, New York.
[2] The crystalline carotene was obtained from General Biochemicals, Inc., Cleveland, Ohio.

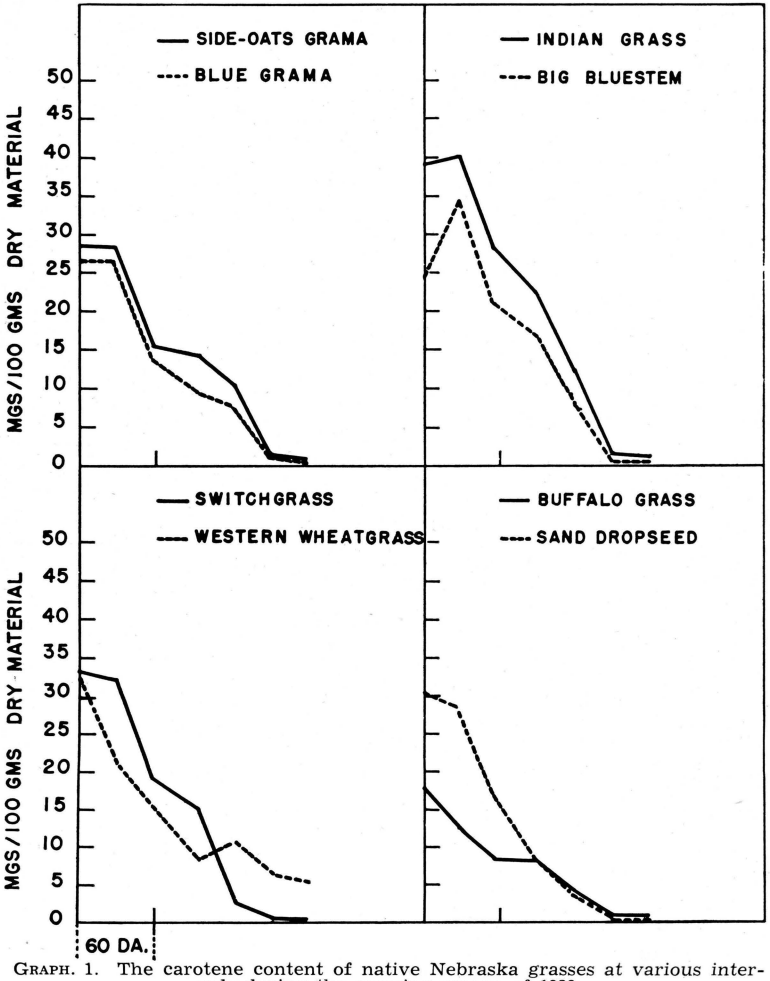
TABLE 2.—*The Mean Temperature, Total Precipitation and Amount of Sunshine observed at monthly intervals during 1939, 1940, and 1941 at Lincoln, Nebraska.*

Month	Temperature °F.		Precipitation in Inches		Number of Days		
	Mean	Departure from Normal	Total	Departure from Normal	Clear	Partly Cloudy	Cloudy
1939							
January	33.6	+ 7.7	0.48	—0.07	8	9	14
February	21.5	— 6.5	1.48	+0.50	15	2	11
March	39.3	— 0.6	2.05	+0.95	13	6	12
April	50.1	— 2.6	1.65	—0.81	9	8	13
May	68.7	+ 6.2	1.62	—1.99	10	11	10
June	73.8	+ 1.7	4.33	—0.08	8	15	7
July	81.7	+ 4.2	2.77	—1.16	14	12	5
August	74.0	— 1.5	2.81	—0.88	12	11	8
September	72.7	+ 4.9	0.29	—3.25	22	4	4
October	55.3	+ 0.1	1.00	—0.94	16	9	6
November	41.5	+ 0.7	Trace	—1.51	17	5	8
December	35.2	+ 6.7	1.37	+0.55	10	13	8
Annual	64.74	+21.0	19.85	—8.69	154	105	106
1940							
January	6.1	—19.8	0.96	+0.41	13	10	8
February	24.5	— 3.5	1.05	+0.07	6	6	17
March	36.8	— 3.1	1.38	+0.28	4	9	18
April	48.9	— 3.8	3.04	+0.58	8	10	12
May	60.1	— 2.4	0.97	—2.64	9	13	9
June	73.6	+ 1.5	1.66	—2.75	9	11	10
July	81.9	+ 4.4	1.54	—2.39	12	13	6
August	73.0	— 2.5	4.86	+1.17	5	14	12
September	69.4	+ 1.6	2.08	—1.46	12	13	5
October	60.4	+ 5.2	2.79	+0.85	15	8	8
November	35.8	— 5.0	2.01	+0.50	13	5	12
December	30.5	+ 2.0	1.27	+0.45	14	3	14
Annual	60.10	—25.4	23.61	—4.93	120	115	131
1941							
January	27.3	+ 2.3	1.80	+1.25	10	10	11
February	27.6	+ 0.4	0.75	—0.23	12	8	8
March	36.4	— 3.5	0.75	—0.35	12	11	8
April	54.7	+ 1.7	3.94	+1.44	11	5	14
May	68.6	+ 5.3	2.39	—1.33	6	24	1
June	73.0	— 0.7	2.95	—1.37	7	16	7
July	79.5	— 1.0	0.72	—3.25	13	17	1
August	79.4	+ 2.2	1.15	—2.55	14	15	2
September	69.6	+ 0.2	4.72	+1.12	7	18	5
October	57.2	+ 0.5	3.03	+1.10	7	15	9
November	43.0	+ 2.3	1.07	—0.25	10	10	10
December	34.4	+ 4.5	2.66	+1.88	10	12	9
Annual	65.07	+14.2	25.93	—2.54	119	161	85

ately wet. A severe cold wave preceded by freezing rain, swept the state on November 10 and 11.

The year 1941 was somewhat warmer and more moist than usual. Mean temperatures were above normal in practically all

areas of the state but evaporation was considerably less than normal. They were somewhat more than the normal number of cloudy days and the humidity was generally above normal. January was mild and wet. Much of the precipitation fell in the form of rain and on unfrozen ground with the result that soil moisture was considerably increased. The temperature was also moderate during February with somewhat less than normal amount of precipitation. March was cool with little precipitation but as evaporation was low, there was little loss in soil moisture. While April was warm and wet, May was warm and moderately dry. June was wet and native range grass matured a large seed crop.

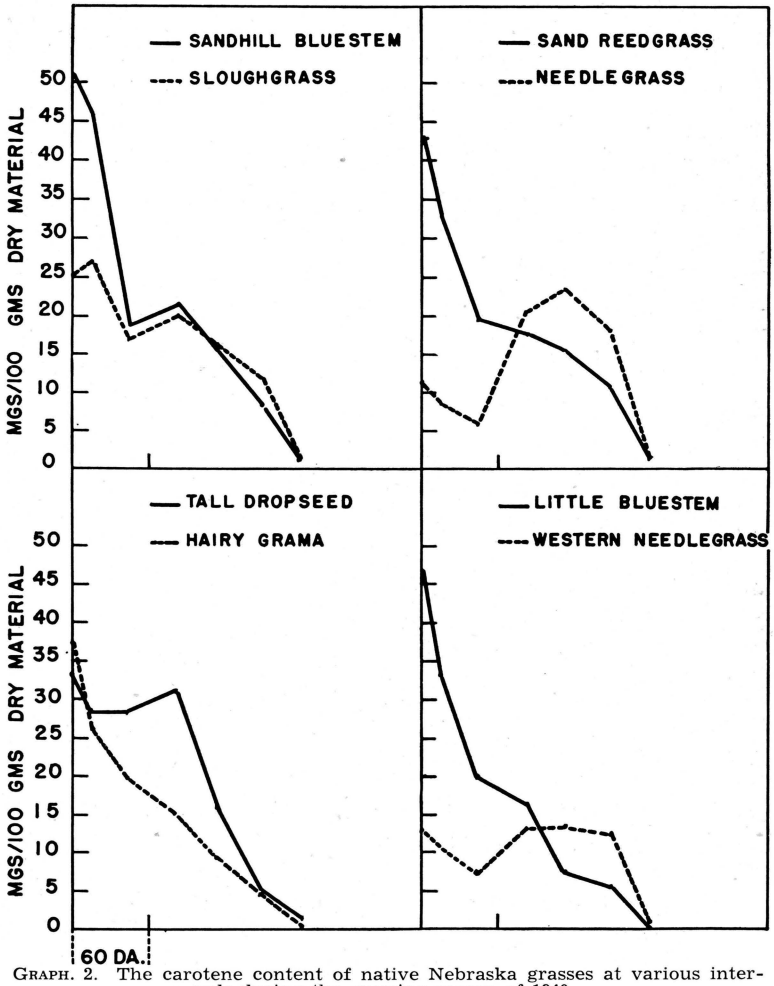


GRAPH. 1. The carotene content of native Nebraska grasses at various intervals during the growing season of 1939.

July was seasonably moist with the temperature near normal. Heavy rains fell during September and the temperature was moderate. October was cloudy, moderately warm and moist while November was fairly warm and dry.

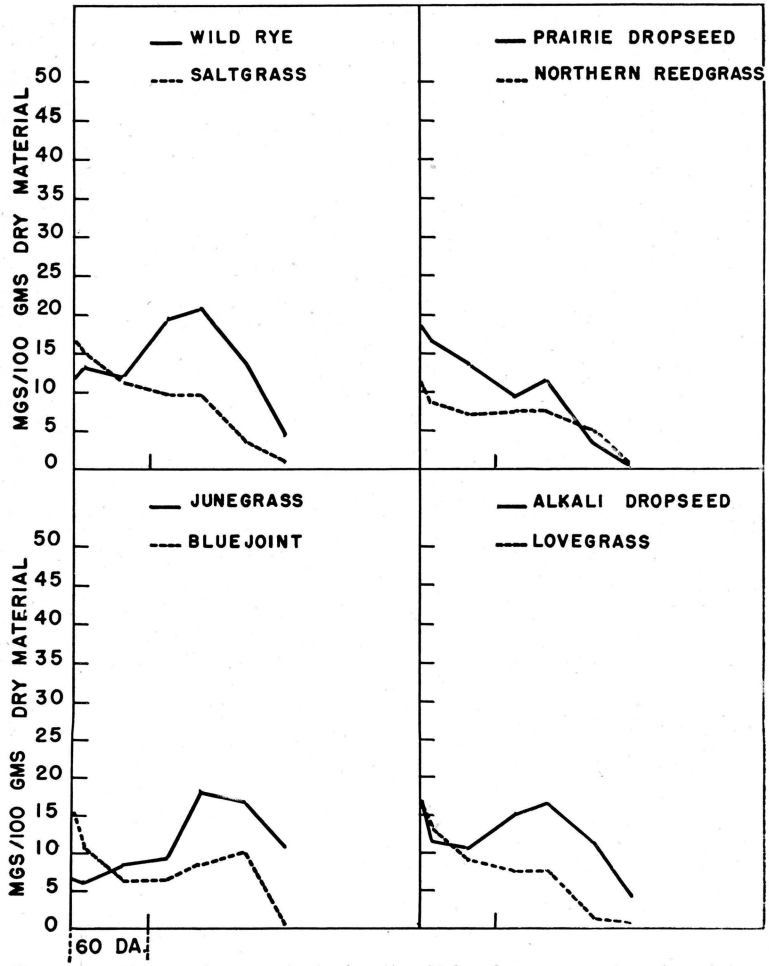
DISCUSSION OF RESULTS

As noted above 1939 was the fourth driest year on record and while June had well distributed showers, the rest of the season was dry and warm. These facts may have contributed to the steady fall in the carotene values of the grasses studied during that year. This reduction in carotene content is apparent from



GRAPH. 2. The carotene content of native Nebraska grasses at various intervals during the growing season of 1940.

Table 3 and also from Graph 1. While 1940 as a whole was drier than normal, the month of August was wet. The carotene values showed a tendency to increase during this month. (Table 3 and Graph 2). 1941 had more precipitation than usual and there were somewhat more than the normal number of cloudy days. The heavy rains of September caused some secondary growth which probably explains the increase in the carotene values found during this period. (Table 3 and Graph 3). However, the grasses studied during 1941 seemed to contain less carotene than those observed during 1939 and 1940.



GRAPH. 3. The carotene content of native Nebraska grasses at various intervals during the growing season of 1941.

From Graphs 1, 2 and 3 it is apparent that the carotene content of the grasses diminished as the plants matured and became dry. Similar conclusions have been drawn by several workers (*2, 16, 17*) regarding the carotene content of other pasture grasses. In Needlegrass, Junegrass, Wild rye, Western Needlegrass and Alkali dropseed there was an increase in the carotene value after the early fall rains. Although the carotene values had in most cases reached a low point by late November, the carotene concentration of Junegrass was still relatively high at that time.

TABLE 3.—*The Carotene and Moisture Content of Native Grasses at various intervals during the growing season.*

Date Sampled	Moisture %	Carotene			Date Sampled	Moisture %	Carotene		
		Per 100 Gms.		Dry p.p.m.			Per 100 Gms.		Dry p.p.m.
		Fresh mg.	Dry mg.				Fresh mg.	Dry mg.	
SIDE-OATS GRAMA									
6–28–39	53.93	13.03	28.29	282.9	10–24–39	6.71	1.23	1.31	13.1
7–25–39	43.14	9.04	15.90	159.0	11–23–39	8.09	0.75	0.80	8.0
8–29–39	38.73	8.89	14.50	145.0					
BLUE GRAMA									
6– 1–39	48.24	13.91	26.88	268.8	9–26–39	21.87	5.79	7.41	74.1
6–28–39	51.61	12.98	26.82	268.2	10–24–39	9.17	1.13	1.24	12.4
7–25–39	45.33	9.01	13.94	139.4	11–23–39	7.85	0.48	0.51	5.1
8–29–39	28.94	6.47	9.11	91.1					
INDIAN GRASS									
6– 2–39	75.95	9.41	39.12	391.2	9–26–39	25.44	9.10	12.21	122.1
6–29–39	66.92	13.27	40.10	401.0	10–24–39	6.32	1.52	1.63	16.3
7–25–39	60.77	11.05	28.15	281.5	11–23–39	8.19	1.00	1.08	10.8
8–29–39	53.55	10.50	22.60	226.0					
BIG BLUESTEM									
6– 2–39	75.05	6.16	24.71	247.1	9–26–39	18.31	6.57	8.04	80.4
6–30–39	69.18	10.70	34.71	347.1	10–24–39	10.40	0.77	0.86	8.6
7–25–39	61.76	8.03	21.01	210.1	11–23–39	5.15	0.54	0.57	5.7
8–29–39	51.81	8.07	16.75	167.5					
SWITCHGRASS									
6– 2–39	72.99	8.98	33.26	332.6	9–28–39	14.07	2.35	2.74	27.4
6–30–39	72.68	8.82	32.28	322.8	10–26–39	15.86	0.46	0.54	5.4
7–26–39	57.30	8.39	19.66	196.6	11–24–39	7.98	0.20	0.21	2.1
8–30–39	48.04	7.84	15.09	150.9					
WESTERN WHEATGRASS									
6– 2–39	70.48	9.61	32.55	325.5	9–28–39	11.26	9.63	10.86	108.6
6–30–39	52.53	10.17	21.42	214.2	10–26–39	35.62	4.31	6.70	67.0
7–26–39	37.40	9.71	15.50	155.0	11–24–39	11.68	4.55	5.15	51.5
8–30–39	34.19	5.76	8.75	87.5					
BUFFALO GRASS									
6– 3–39	56.79	7.79	18.02	180.2	9–28–39	21.68	3.14	4.01	40.1
6–30–39	41.29	7.48	12.74	127.4	10–26–39	43.71	0.56	0.99	9.9
7–26–39	28.29	6.26	8.73	87.3	11–24–39	13.18	0.55	0.63	6.3
8–30–39	36.78	5.33	8.43	84.3					
SAND DROPSEED									
6– 3–39	62.19	11.51	30.45	304.5	9–28–39	12.15	3.38	3.85	38.5
6–29–39	63.65	10.37	28.53	285.3	10–26–39	30.42	0.47	0.59	5.9
7–26–39	49.83	8.55	17.04	170.4	11–24–39	9.58	0.48	0.53	5.3
8–30–39	35.76	5.40	8.41	84.1					

According to Jones and associates (*11*), the minimum carotene requirement for fattening feeder cattle was about 2000 to 2500 micrograms daily per 100 pounds live weight although 1500 micrograms allowed satisfactory fattening of steers in spite of minor symptoms of vitamin A deficiency. The minimum carotene requirement as found by Jones (*11*) is in agreement with earlier work by Guilbert, Howell and Hart (*9*). However, cattle which are being fattened with some growth or which are on a maintenance ration have a lower carotene requirement than cattle which

TABLE 3.—*The Carotene and Moisture Content of Native Nebraska Grasses at various intervals during the growing season (continued)*

Date Sampled	Moisture %	Carotene			Date Sampled	Moisture %	Carotene		
		Per 100 Gms.		Dry p.p.m.			Per 100 Gms.		Dry p.p.m.
		Fresh mg.	Dry mg.				Fresh mg.	Dry mg.	
SANDHILL BLUESTEM									
6–10–40	73.70	13.44	51.16	511.6	9–28–40	57.61	6.68	15.77	157.7
6–26–40	74.40	11.72	45.82	458.2	10–31–40	31.82	5.60	8.21	82.1
7–24–40	68.58	5.99	19.08	190.8	11–30–40	14.51	1.09	1.28	12.8
8–30–40	65.13	7.52	21.58	215.8					
SLOUGHGRASS									
6–10–40	62.93	9.37	25.28	252.8	9–28–40	58.50	6.72	16.22	162.2
6–26–40	64.73	9.55	27.10	271.0	10–31–40	48.86	6.05	11.83	118.3
7–24–40	50.77	8.37	17.01	170.1	11–30–40	20.28	1.33	1.67	16.7
8–30–40	58.97	8.20	20.00	200.0					
SAND REEDGRASS									
6–10–40	67.40	14.09	43.26	432.6	9–28–40	47.27	8.19	15.55	155.5
6–26–40	63.73	12.06	33.26	332.6	10–31–40	36.57	6.86	10.82	108.2
7–24–40	53.67	9.09	19.62	196.2	11–30–40	17.82	0.93	1.14	11.4
8–30–40	48.29	9.23	17.86	178.6					
NEEDLEGRASS									
6–10–40	54.33	5.15	11.28	112.8	9–28–40	53.01	11.10	23.62	236.2
6–26–40	50.54	4.34	8.78	87.8	10–31–40	34.90	11.04	18.20	182.0
7–24–40	30.35	4.10	5.88	58.8	11–30–40	22.58	1.20	1.55	15.5
8–30–40	51.04	9.96	20.33	203.3					
TALL DROPSEED									
6–11–40	63.31	12.36	33.71	337.1	9–28–40	58.27	6.70	16.07	160.7
6–27–40	61.43	10.96	28.43	284.3	10–31–40	37.72	3.29	5.28	52.8
7–25–40	53.95	13.14	28.54	285.4	11–30–40	22.83	0.85	1.10	11.0
8–30–40	63.05	11.50	31.14	311.4					
HAIRY GRAMA									
6–11–40	60.33	14.88	37.52	375.2	9–28–40	46.24	5.11	9.52	95.2
6–27–40	58.16	10.92	26.11	261.1	10–31–40	32.30	3.37	4.98	49.8
7–25–40	57.40	8.49	19.94	199.4	11–30–40	22.19	0.20	0.26	2.6
8–30–40	56.84	6.54	15.17	151.7					
LITTLE BLUESTEM									
6–11–40	68.83	14.50	46.55	465.5	9–28–40	50.04	3.81	7.63	76.3
6–27–40	70.03	9.99	33.35	333.5	10–31–40	26.19	4.34	5.88	58.8
7–25–40	64.86	7.04	20.05	200.5	11–30–40	17.00	0.13	0.16	1.6
8–30–40	63.43	5.88	16.10	161.0					
WESTERN NEEDLEGRASS									
6–11–40	54.60	6.01	13.25	132.5	9–28–40	41.90	8.06	13.88	138.8
6–27–40	49.24	5.44	10.72	107.2	10–31–40	28.81	9.12	12.63	126.3
7–25–40	20.31	5.84	7.33	73.3	11–30–40	20.89	0.74	0.94	9.4
8–30–40	47.09	6.88	13.01	130.1					

are gestating and lactating (*4, 5, 6, 10*). As range cattle produce only a small amount of milk, their carotene requirement for milk production is considerably less than that of dairy cattle. Fraps and coworkers (*7, 12*) calculated that from 535,000 to 1,000,000 micrograms of carotene are required daily by the dairy cow to produce butterfat high in vitamin A. On the basis of these requirements it has been estimated (*12*) that range forage should contain at least 4 p.p.m. of carotene in order to meet the needs of

TABLE 3.—*The Carotene and Moisture Content of Native Nebraska Grasses at various intervals during the growing season (continued)*

Date Sampled	Moisture %	Carotene			Date Sampled	Moisture %	Carotene		
		Per 100 Gms.		Dry p.p.m.			Per 100 Gms.		Dry p.p.m.
		Fresh mg.	Dry mg.				Fresh mg.	Dry mg.	
WILD RYE									
6–20–41	61.72	4.56	11.93	119.3	9–25–41	70.35	6.21	20.95	209.5
6–30–41	57.75	5.67	13.42	134.2	10–30–41	65.29	4.81	13.85	138.5
7–29–41	53.50	5.59	12.01	120.1	11–28–41	64.51	1.50	4.68	46.8
9– 2–41	75.37	4.85	19.70	197.0					
SALTGRASS									
6–20–41	59.46	6.96	17.17	171.7	9–25–41	38.75	5.85	9.55	95.5
6–30–41	55.18	6.83	15.25	152.5	10–30–41	35.91	2.44	3.80	38.0
7–29–41	48.62	5.76	11.21	112.1	11–28–41	30.22	0.75	1.07	10.7
9– 2–41	58.48	4.04	9.73	97.3					
PRAIRIE DROPSEED									
6–20–41	57.49	8.19	19.26	192.6	9–25–41	54.41	5.21	11.43	114.3
6–30–41	54.36	7.63	16.72	167.2	10–30–41	36.10	2.38	3.72	37.2
7–29–41	51.31	6.79	13.94	139.4	11–28–41	20.45	0.26	0.33	3.3
9– 2–41	58.66	4.06	9.83	98.3					
NORTHERN REEDGRASS									
6–20–41	60.58	4.83	12.26	122.6	9–25–41	46.02	4.19	7.76	77.6
6–30–41	55.98	3.93	8.93	89.3	10–30–41	45.88	2.82	5.21	52.1
7–29–41	49.40	3.64	7.20	72.0	11–28–41	27.16	0.57	0.79	7.9
9– 2–41	66.13	2.62	7.75	77.5					
JUNEGRASS									
6–20–41	50.73	3.54	6.78	67.8	9–25–41	53.44	8.53	18.31	183.1
6–30–41	45.75	3.30	6.07	60.7	10–30–41	65.94	5.81	17.07	170.7
7–29–41	44.24	4.86	8.71	87.1	11–28–41	66.64	3.70	11.09	110.9
9– 2–41	48.83	4.77	9.32	93.2					
BLUEJOINT									
6–20–41	69.21	5.27	16.12	161.2	9–25–41	47.59	4.70	8.70	87.0
6–30–41	62.50	4.03	10.77	107.7	10–30–41	49.06	5.11	10.04	100.4
7–29–41	47.85	3.43	6.57	65.7	11–28–41	19.42	0.44	0.54	5.4
9– 2–41	62.48	2.47	6.59	65.9					
ALKALI DROPSEED									
6–20–41	71.64	5.53	18.90	189.0	9–25–41	55.42	7.49	16.81	168.1
6–30–41	65.85	4.02	11.78	117.8	10–30–41	46.57	6.14	11.49	114.9
7–29–41	56.03	4.79	10.90	109.0	11–28–41	33.91	2.71	4.11	41.1
9– 2–41	67.39	4.98	15.26	152.6					
LOVEGRASS									
6–20–41	67.24	5.75	17.56	175.6	9–25–41	54.30	3.55	7.76	77.6
6–30–41	61.22	5.30	13.66	136.6	10–30–41	33.96	0.81	1.23	12.3
7–29–41	59.45	3.68	9.08	90.8	11–28–41	48.19	0.44	0.84	8.4
9– 2–41	68.91	2.41	7.74	77.4					

range cattle and 100 p.p.m. if the dairy cow is to produce butterfat quite high in vitamin A.

From the data shown in Table 3, it is evident that all of the grasses were able to supply the carotene required by range cattle at least until late in November with the exception of Switchgrass, Hairy Grama, Little Bluestem and Prairie Dropseed. By the last of November these grasses contained less than the estimated requirement of 4 p.p.m. Eighteen of the grasses still contained enough carotene by the latter part of September to furnish the estimated requirement of 100 p.p.m. for dairy cattle. As early as June 30 the Northern reedgress contained too little carotene to satisfy the requirement of lactating dairy cattle. A similar condition was true by the last week in July in the case of Buffalo grass, Bluejoint and Lovegrass.

SUMMARY

The carotene content of twenty-four grasses native to Nebraska were determined at approximately monthly intervals from June to November. While the carotene concentration of most of the grasses was moderately high during the growing season, it declined to a rather low point by late November.

With the exception of Switchgrass, Hairy Grama, Little Bluestem and Prairie Dropseed, all of the grasses contained enough carotene to supply the needs of range cattle until late November. However, only eighteen of the grasses still contained enough carotene by the latter part of September to furnish the carotene required by dairy cows. Even as early as July the Northern reedgrass, Buffalo grass, Bluejoint and Lovegrass were unsatisfactory as a source of carotene for dairy cows. While the carotene values observed during the periods of greatest concentration varied from 511.6 p.p.m. (Sandhill bluestem) to 122.6 p.p.m. (Northern reedgrass), these values ranged from 60.7p.p.m. (June grass) to 1.6 p.p.m. (Little bluestem) during the periods of lowest concentration.

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