Mimeographed Circular M-261 May, 1954

FORAGE CROPS

EVALUATION AND MANAGEMENT STUDIES

Progress Report, 1953

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Agricultural Experiment Station
DIVISION OF AGRICULTURE
Oklahoma A. & M. College
Stillwater

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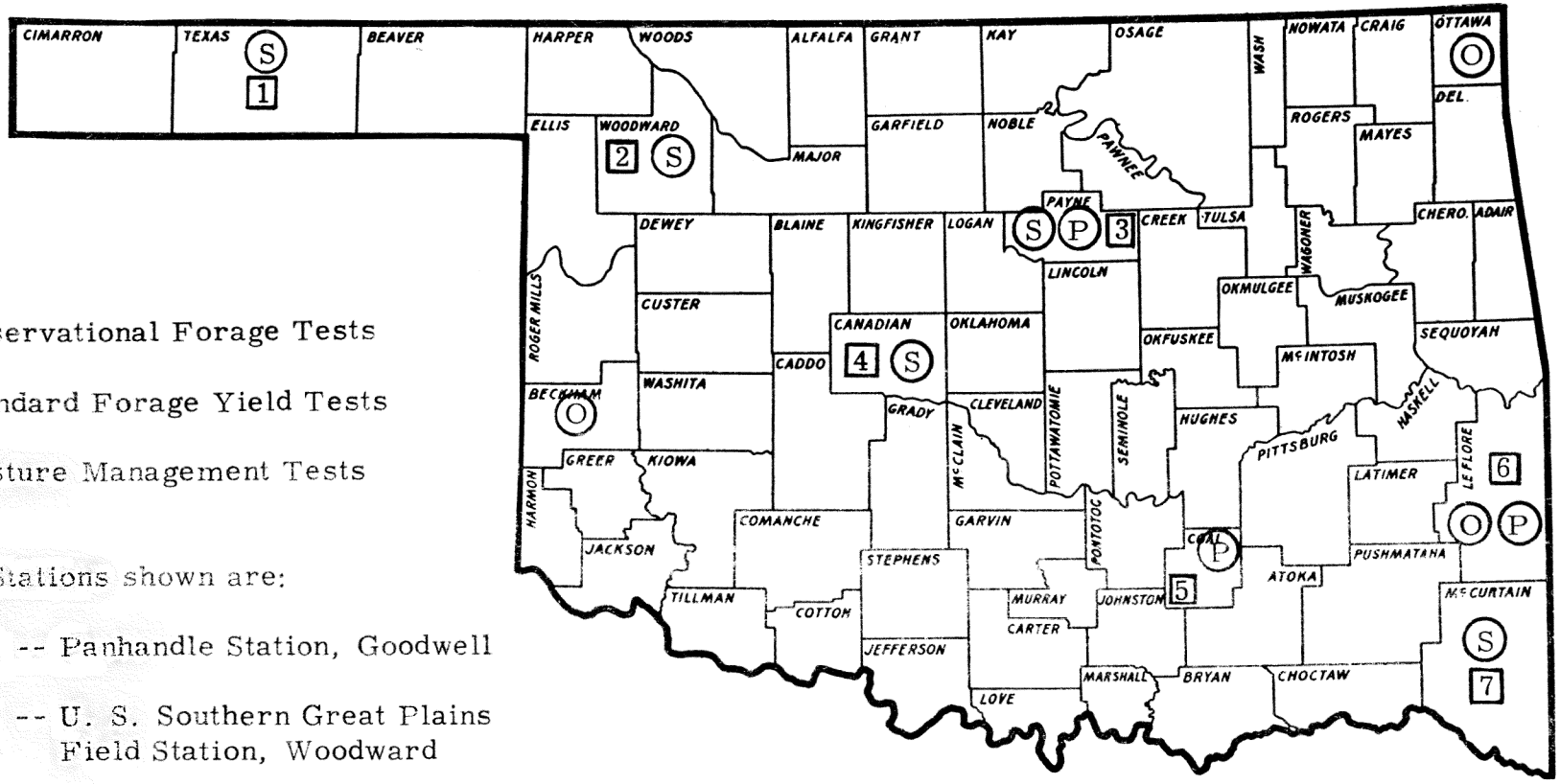

O -- Observational Forage Tests

S -- Standard Forage Yield Tests

P -- Pasture Management Tests

Special Stations shown are:

1 -- Panhandle Station, Goodwell

2 -- U. S. Southern Great Plains Field Station, Woodward

3 -- Main Station, Stillwater (including Perkins Farm 9 miles south)

4 -- Ft. Reno Experiment Station, El Reno

5 -- Pasture Fertility Station, Coalgate

6 -- Soil and Pasture Station, Heavener

7 -- Kiamichi Field Station, Idabel

(PART I)

PASTURE PLANT ADAPTATION TESTS, 1953

By Wayne W. Huffine

Oklahoma has a great diversity of climatic conditions and major soil types. As a result, most of the forage crops grown in other areas can be grown successfully somewhere in the state. But a crop planted in a part of the state where it is not adapted often proves a costly disappointment.

To ascertain the areas of adaptation and relative forage yields of the many forage grasses and legumes, the Experiment Station has established a forage crop testing program to sample each of the major forage crop areas of Oklahoma. These areas correspond, in general, to the present pasture and natural vegetation regions of the state as shown in Forage Crops Leaflet No. 3.

Individual strains of 105 forage grasses and legumes were planted in the fall of 1953 at one or more of seven test locations. This publication shows these locations and the strains planted at each. It also gives 1953 results of forage crop variety trials planted earlier at Perkins and Woodward.

Description of Adaptation Tests

All available strains of forage grasses and legumes, and new ones as they become available, are being evaluated on the basis of forage yield, chemical analysis, seedling vigor, recovery after clipping, cold and heat tolerance, and disease and insect resistance.

Acknowledgments---

Data included from the Woodward Station are from Dr. W. R. Kneebone, Agronomist, U. S. Southern Great Plains Field Station, Woodward.

All chemical analyses were made by Dr. V. G. Heller, Professor of Agricultural Chemistry Research, Oklahoma A. and M. College.

Data on forage and seed yields of Sudan and of Pearl Millet are from Mr. C. E. Denman, Assistant Professor of Agronomy, Oklahoma A. and M. College.

Two types of tests are in use at the present time: (1) Standard Forage Yield Tests; and (2) Observational Tests. The observational tests will be replaced by standard forage yield tests as rapidly as facilities permit.

Data obtained from observational tests include vigor, disease and insect damage, and general adaptation in each region. The tests are usually 3 x 20 foot plots replicated only once.

The standard forage yield test for each strain consists of a minimum of four replications, and usually each plot is 5 x 20 feet.

Locations; and Strains Included

Locations of the tests planted in 1953, and the varieties or strains included in each, are shown in Table I and by the map on the "Contents" pages. The tests at Goodwell and El Reno are irrigated.

1953 Results

Tables II through IX show results of previously established forage crop variety trials as well as those annuals established this year.

References

Additional information and data on test locations, forage yields and protein content as obtained at the various locations are given in the 1952 Annual Report of Progress in Forage Crops Research in Oklahoma, Part II, pages 1 through 14.

Data on Sudan grass leaf-stem ratios, and on time-of-clipping studies, forage yield, protein content, and palatability trials of several Sudans, Pearl Millet and Blue Panic are included in the 1952 Annual Report of Progress in Forage Crops Research in Oklahoma, Part II, pages 9, 10, and 11.

This Annual Report of Progress (mimeographed) is available upon request to research workers in forage crops, and others having similar interests, so long as the limited supply lasts.

TABLE I. --Forage Crops Strains and Varieties Planted in the Fall of 1953 at Seven Forage Crop Testing Locations.

Variety	El Reno*	Goodwell*	Heavener	Idabel	Miami	Perkins	Woodward
Alfalfa							
Hay Types							
Oklahoma Common	x		x		x	x	
Socheville	x		x		x	x	
Ranger	x		x		x	x	
Narrogansett	x		x		x	x	
Sazovakir	x	x	x		x	x	x
Nevada Syn. A.	x		x		x	x	
Vernal (Wisc. Syn. G.)	x		x		x	x	
Buffalo	x		x		x	x	
Talent	x		x		x	x	
Du Puits	x		x		x	x	
Williamsburg	x		x		x	x	
Atlantic	x		x		x	x	
W-268	x		x		x	x	
Pasture Types							
Stafford	x	x	x		x	x	x
Turkish Wild	x	x	x		x	x	x
Nomad	x	x	x		x	x	x
A-224	x		x		x	x	
Sevelra	x	x	x		x	x	x
Ladak	x	x	x		x	x	x
Rhizoma	x		x		x	x	
Alsike Clover			x		x		
Astragalus cicer	x		x	x	x	x	
Big Hop Clover			x		x		
Bromegrass							
Martin		x	x		x	x	x
Lincoln	x	x	x	x	x	x	x

* Irrigated forage tests.

TABLE I. --Continued.

Variety	El Reno*	Goodwell*	Heavener	Idabel	Miami	Perkins	Woodward
Elsberry	x	x	x	x	x	x	x
Manchar		x	x	x	x	x	x
Southland (Okla. Syn.)	x	x	x	x	x	x	x
Homesteader		x	x		x	x	x
Mandan 404		x	x		x	x	x
Canadian Commercial		x	x		x	x	x
Fischer	x	x	x	x	x	x	x
Lyon	x	x	x	x	x	x	x
Lancaster	x	x	x	x	x	x	x
Achenbach	x		x	x	x		
Woodward	x						
Crimson Clover							
Auburn Reseeding			x	x	x	x	
Autauga			x	x	x	x	
Talladega			x	x	x	x	
Dixie			x	x	x	x	
Mississippi Selection			x	x	x	x	
Common			x	x	x	x	
Fescue							
Kentucky 31	x		x	x	x	x	
4-36	x		x	x	x	x	
Goar	x		x	x	x	x	
Alta	x		x	x	x	x	
19 G1-25	x		x	x	x	x	
Alta #144	x		x	x	x	x	
Orchardgrass							
Commercial	x		x	x	x	x	
ADEFA	x		x	x	x	x	
Oregon 233	x		x	x	x	x	
M2-11142-50	x		x	x	x	x	
Beltsville Strain	x		x	x	x	x	

* Irrigated forage tests.

TABLE I. --Continued

Variety	El Reno*	Goodwell*	Heavener	Idabel	Miami	Perkins	Woodward
No. 88	x		x	x	x	x	
Palestine	x		x		x	x	
H-2	x		x	x	x	x	
F-52	x		x	x	x	x	
Trogdon	x		x	x	x	x	
Akaroa	x		x	x	x	x	
Reed Canary Grass	x	x	x	x	x	x	x
Red Clover							
No. 1 Mammoth			x		x	x	
Port Gibson			x		x	x	
Louisiana Syn. #1			x		x	x	
Kenland			x		x	x	
Nolin			x		x	x	
Libel			x		x	x	
Certified Midland			x		x	x	
Kentucky 215			x		x	x	
Ryegrass							
Perennial	x		x	x	x	x	
Common	x		x	x	x	x	
No. 12	x		x		x	x	
H-1	x		x	x	x	x	
S. 22 Aberystwyth	x		x		x	x	
S. 23 Aberystwyth	x		x		x	x	
S. 24 Aberystwyth	x		x	x	x	x	
S. 101 Aberystwyth	x		x	x	x	x	
Sanfoin	x		x	x	x	x	
Vetch							
Hairy			x		x	x	
Willamette			x		x	x	
Doark			x		x	x	
Auburn Woolypod			x		x	x	

* Irrigated forage tests.

TABLE I. --Continued

Variety	El Reno*	Goodwell*	Heavener	Idabel	Miami	Perkins	Woodward
Oregon Woolypod			x		x	x	
Madison			x		x	x	
Wheatgrass							
Nebraska 10	x					x	x
42-1	x					x	x
M2-10820	x					x	x
Ree	x					x	x
No. 571	x					x	x
Commercial Crested	x	x				x	x
A-12436	x	x				x	x
No. 50	x					x	x
A-1770	x	x				x	x
M2-10820-49	x					x	x
Turkish Crested	x					x	
White Clover							
Non-Certified Ladino			x	x	x	x	
Certified Blue Tag Ladino			x	x	x	x	
Pilgrim			x	x	x	x	
Louisiana Syn. #1			x	x	x	x	
Louisiana			x	x	x	x	
Winter Pea							
Austrian			x		x	x	
Romack			x		x	x	
Papago			x		x	x	

*Irrigated Forage tests.

TABLE II. --Forage Yields and Protein Content; Perkins Farm, 1952 and 1953.

Variety or Strain*	1953			1952		
	Forage Yield		Protein (percent)	Forage Yield		Protein (percent)
	Lbs. per acre	Rank		Lbs. per acre	Rank	
Fescue						
Alta	998	1	9.78	921	2	
Goar	971	2	8.78	1031	1	
144	954	3	10.04	564	6	
19-G1-25	781	4	9.87	672	4	
4-36	771	5	10.32	583	5	
Kentucky 31	744	6	9.48	699	3	
Sideoats Grama						
Hope	3977	1	7.07	2115	5	7.21
Encinoso	3869	2	7.07	2674	1	7.09
A-3603	3830	3	6.44	2026	6	6.42
Tucson	3595	4	7.28	2147	4	6.76
El Reno	3552	5	6.75	2330	2	6.65
Nebraska 52	3430	6	7.06	2172	3	7.12
Commercial	2750	7	6.91	1354	7	6.73
Nebraska 37	2260	8	7.94	1151	8	6.31
Birdsfoot Trefoil						
European Broadleaf	5909	1	12.60			
Granger	5581	2	12.65			
Italian P.I. 188867	5173	3	12.28			
Cascade	4615	4	13.01			
Italian P.I. 187101	4466	5	11.43			
Italian Broadleaf No. 2	4329	6	12.97			
Italian Broadleaf No. 1	4002	7	12.95			
Viking	3621	8	12.07			
Empire	1852	9	15.35			
North Dakota	1288	10	13.97			
Alfalfa						
Oklahoma Common	6292	1	17.04	1959	1	22.90
Stafford	5589	2	17.21	1883	2	24.23
Buffalo	5251	3	17.99	1738	3	23.86
Pilca Butta	5034	4	17.97	1530	4	23.37
Oregon Creeping						
a. Old	2759	5	20.42	628	5	
b. Nomad	4598			1238		
Sweet Clover						
Madrid	2846	1	32.13			
Evergreen	2805	2	32.00			
Bi-White	2524	3	31.59			
Wisconsin A-46	2231	4	32.03			

* See Appendix for Individual Forage Test Information.

TABLE III. --Forage Yields; Perkins Farm, 1951, 1952, and 1953.

(Pounds per Acre)

Variety or Strain	1953				1952		1951	
	40 Lbs. N/Acre		80 Lbs. N/Acre					
	Yield	Rank	Yield	Rank	Yield	Rank	Yield	Rank
Bromegrass								
Southland (Okla. Syn.)	1414	1	2445	1	2384	1	1890	1
Achenbach	1284	2	1852	3	2072	2	1369	5
Oklahoma No. 1	1222	3	2066	2	2036	3	1656	2
Elsberry	1168	4	1558	6	1928	4	1303	6
Nebraska 36	1128	5	1477	7	1672	7	1485	4
Lincoln 23840	997	6	1826	4	1764	6	1505	3
Nebraska 44	911	7	1615	5	1618	8	1228	7
Utah-B-in-12	833	8	935	10	1115	12	541	13
Lincoln 23841	807	9	1019	8	1775	5	1125	8
South Dakota	677	10	997	9	1520	9	727	10
Martin	433	11	509	13	1285	10	850	9
Manchar	413	12	616	12	881	13	558	12
Mandan 404	403	13	744	11	1163	11	494	14
Canadian Commercial	221	14	434	14	671	14	679	11

TABLE IV. --Forage Yields of Pearl Millet at Hay and Pasture Stages; Perkins Farm, 1952 and 1953.

(Pounds per Acre)

Variety or Strain	1953		1952	
	Pasture Stage	Hay Stage	Pasture Stage	Hay Stage
Texas Commercial	5005	5105	2440	3886
Starr	3841	4244	2145	2658
Common	5252	5932	2510	3738
Hybrid A	5127	6212	----	----
Hybrid B	----	----	2626	3947
Hybrid C	4824	5284	2570	4167
Hybrid D	4826	6335	2802	3766
Hybrid E	4980	7070	3026	4118

TABLE V. --Forage Yields and Protein Content of Sudan Grass at Different Stages; Perkins Farm, 1953.

Variety or Strain	Forage Yield (Lbs. per acre)		Protein Content (Percent)	
	Pasture Stage	Hay Stage	Pasture Stage	Hay Stage
Piper	5975	6680	18	14
Wheeler	5780	6569	16	14
Common	5868	5683	15	15
Greenleaf	5467	6003	19	16
S-1	3760	4640	21	18
Commercial Sweet	4711	5117	21	17
337	4671	5503	19	15
USDA #4	5333	6064	17	14
Tift	4670	5664	19	16
Texas 372	4098	4351	19	15
Lahoma	4337	4997	17	17

TABLE VI. --Effect of Plant Spacing on Seed Yield of Greenleaf Vareity of Sudan; Perkins Farm, 1953.

Plant Spacing Within Rows	Pounds Seed per Acre	Bushels per Acr
6 inches	1340	24
12 inches	1137	20
18 inches	936	17
24 inches	844	15

TABLE VII. --Forage Yields and Protein Content; Woodward Station, 1952 and 1953.

Variety or Strain	1953		1952	
	Forage Yield (Lbs. per acre)	Protein (Percent)	Forage Yield (Lbs. per acre)	Protein (Percent) 5/
Bluestem				
King Ranch	1793	9.55	2178 1/	----
Caucasian	1575	7.86	2631 2/	6.22
Weeping Lovegrass	1421	9.65	4084	9.00
Switchgrass				
W2	1261	10.58	2541	9.96
4200	1562	10.55	3902	9.12
Side oats Grama				
Tucson	1127	10.12	1361	9.79
Hope	1012	9.98	1361 3/	9.17
Encinoso	1197	10.06	1634 3/	9.27
El Reno	839	10.10	1089 4/	7.07
Sand Lovegrass				
W2	903	10.16	1724	8.61
W5	730	9.34	2269	7.51

1/ First Cutting only
2/ 3 replications only
3/ 5 replications only
4/ 4 replications only
5/ Analyses from on 8-6-52 cutting

TABLE VIII. --Forage Yields per Cutting Date; Woodward Station, 1951, 1952, and 1953.

(Pounds per Acre)

Variety or Strain	1953	1952	1951				3-year Total Yield
	July 28	June 4	Sept. 10	Aug. 6	July 9	June 5*	
Sand Lovegrass							
W1	463	363	100	85	276	307	1594
W2	285	275	88	81	199	189	1117
W3	433	343	94	79	242	316	1507
W4	369	265	106	84	228	232	1284
W5	403	251	113	94	232	236	1329
Blue Grama							
W1	577	398	200		373	487	2035
W2	698	420	164		328	456	2066
W3	612	468	163		506	541	2290
W4	519	347	134		375	468	1843
Roy	516	410	134		430	500	1990
Pecos	658	411	185		496	534	2284
Hueco 1/	757	492	175		557	673	2654
Marfa-Davis	567	365	111		423	495	1961
Capitan	341	341	162		385	490	1719
Dunlap	509	395	156		471	549	2080
Van Horn 1/	484	317	188		465	363	1817
Caprock	606	407	154		426	526	2119
Ruidoso 1/	404	296	170		359	437	1666
Sideoats Grama 2/							
W1	701	694	166		486	642	2689
W2	591	614	112		372	524	2213
W3	501	502	116		422	404	1945
W4	722	684	161		538	670	2775
El Reno	536	558	112		392	509	2107
McClure	602	496	132		405	509	2144
Vaughn	533	546	213		406	581	2279
Tucson	806	633	255		544	500	2738

*Sand Lovegrass clipped June 4; Blue Grama clipped June 5; and Sideoats Grama clipped June 6.

1/ Two replications only.

2/ Five replications except Vaughn which has three.

TABLE IX. --Crude Protein Content per Cutting Date; Woodward Station, 1951, 1952, and 1953.

(Percent)

Variety or Strain	1953	1952	1951				1950	3-Yr.
	July 28	June 4	Sept. 10	Aug. 6	July 9	June 5	Fall	Avg.
Sand Lovegrass								
W1	8.31	6.31	10.77	8.36	7.69	8.54		8.33
W2	8.24	6.59	10.98	9.24	7.19	9.14		8.56
W3	8.50	6.46	10.12	9.07	7.12	7.99		8.21
W4	8.49	6.43	10.49	8.87	7.53	8.44		8.38
W5	7.40	6.49	10.19	8.13	6.93	8.09		7.87
Blue Grama								
W1	7.77	8.14	10.33		7.03	8.34	5.76	7.90
W2	7.63	7.76	9.96		6.68	8.79	5.87	7.78
W3	8.18	7.75	9.89		7.24	8.84	5.67	7.93
W4	8.00	7.96	10.20		6.51	8.26	5.35	7.71
Roy	8.13	8.22	10.93		7.29	8.48	6.22	8.21
Pecos	8.35	8.88	10.85		7.20	8.75	6.84	8.48
Hueco 1/	8.18	8.48	11.47		7.58	8.40	6.05	8.36
Marfa-Davis	8.38	8.72	11.11		6.77	8.37	5.48	8.14
Capitan	8.37	8.09	10.21		6.43	7.65	5.26	7.67
Dunlap	8.40	9.37	10.68		7.28	8.82	6.42	8.50
Van Horn 1/	8.06	7.74	10.97		7.14	10.02	4.84	8.13
Caprock	7.96	8.34	10.59		7.06	8.23	6.00	8.03
Ruidoso 1/	8.52	8.38	10.60		6.95	8.50	5.00	7.99
Sideoats Grama	3/	3/						
W1	7.49	6.65	10.06		6.12	7.64	4.72	7.11
W2	7.01	6.67	9.31		6.61	7.58	3.74	6.82
W3	7.00	6.91	9.23		6.35	7.83	5.22	7.09
W4	7.29	7.08	9.23		5.59	7.53	4.51	6.87
El Reno	7.49	6.56	8.77		6.02	7.70	5.90 2/	7.07
McClure	7.34	7.19	8.91		6.11	7.85	5.00	7.07
Vaughn	7.58	6.50	8.85		5.70	7.56	4.69	6.81
Tucson	7.38	7.82	8.98		6.96	9.17	5.64	7.66

1/ Two replications only.
2/ One replication only.
3/ Five replications except for Vaughn which has three.

(PART II)

SOUTHEAST OKLAHOMA PASTURE FERTILITY RESEARCH STATION
Coalgate, Oklahoma

Summary Progress Report, 1945-1954*

By J. Q. Lynd

The Station

The Southeast Oklahoma Pasture Fertility Research Station is located approximately 6 miles east of Coalgate in Coal County, Oklahoma. This station has been revised during the past year and now consists of 26 various sized pastures occupying 580 acres and supporting 172 Hereford steers in three experimental herds of uniform age, size and breeding quality.

Grazing Trials, 1945-1953

Results of grazing experiments at the Coalgate station since its establishment in 1945 are reported in Mimeographed Circular M-261 (June 1954). The following is a brief summary of experimental results to date:

Common bermuda grass-legume pastures were established on four land types and received various soil fertility treatments. The pasture on unfertilized upland prairie soil (Dennis loam) produced an eight-year average of 66 lbs. of beef per acre. The same pasture and soil type receiving only lime produced 93 pounds of beef per acre. The bermuda grass-legume pasture on this soil type receiving lime and low rates of superphosphate produced 126 lbs. of beef per acre.

A claypan prairie soil type (Parsons silt loam) supporting a bermuda-legume pasture receiving lime and low rates of phosphate produced 122 lbs. of beef per acre. An alluvial bottomland soil (Verdigris silt loam) receiving only lime produced 159 lbs. of beef, and another pasture on this soil type on which lime and low rates of superphosphate were applied produced 219 pounds of beef per acre.

A bermuda-legume pasture on permeable shallow upland soil (principally Darnell sandy loam) produced an average of 99 lbs. of beef per acre during the period 1947 through 1953.

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*Summarized here from Okla. Agri. Exp. Sta. Mimeographed Circular M-261, same title and author.

Hop clovers have been the dominant legumes in all pastures at this station. White and Ladino clovers are also present in large amounts in the bottomland pastures during most years. More lespedeza has persisted in the pastures on low fertility upland soil than in other pastures with higher fertility levels supporting abundant growth of hop clovers.

Gains per head have not been outstanding for yearling and long two-year-old cattle, ranging from 180 to 198 lbs. per head for the reported grazing seasons. Two-year-old cattle gained an average of 273 lbs. per head during the 1948 grazing season. Three-year-old cattle have made good gains per head in months of April, May and June. All animal gains are highest in late spring and early summer during most years. Daily gain per head is reduced considerably in late summer and fall, with some weight losses usually occuring in October.

Two Weeping lovegrass-legume pastures were established on a shallow upland soil (Darnell sandy loan). One pasture was not fertilized and produced an average of 54 lbs. of beef per acre during the six-year period 1947 through 1952. The fertilized pasture receiving lime and low rates of 0-14-7 fertilizer produced an average of 109 lbs. of beef per acre during this same period.

A 150-acre unimproved native grass pasture produced a four-year average of 14 calves from 16 cows with average weaning weights of 391 lbs. An improved pasture of equal area and similar land types produced an average of 21.8 calves from 26 cows during that period, with the calves averaging 421.5 lbs. at weaning.

Yearling cattle grazed at one animal per 5 acres gained an average of 269 lbs. per head, producing 53.9 lbs. of beef per acre on the unimproved native grass pasture in 1953. The same aged cattle with 3.5 acres per animal gained 257 lbs. per head producing 68.4 pounds of beef per acre on the improved pasture during the same year.

Revised Pasture Experiments

Following the 1953 grazing season this experiment station was revised to determine pasture productivity of various forage combinations on different land types receiving various fertility treatments. The treatments include different kinds and rates of fertilizers with different methods of application.

The established bermuda grass-legume pastures compare rates of phosphate application two and four times previous soil treatments on permeable upland prairie and shallow, upland timbered soil. Rates of phosphate four and eight times the previous low rate (150 lbs. 0-20-0 every third year) are applied to claypan and alluvial bottom land soils. The same fertilizer rates are

applied in duplicate pastures with the fertilizer being applied in each pasture by a different method: Broadcasting; 7-inch rows with a grain drill; and "deep" placed with a narrow-furrow, shoe-type drill.

Rock phosphate with and without low rates of superphosphate are compared on previously unfertilized pastures.

White, Ladino and Crimson clovers and vetch are being introduced into the pasture swards now dominated by the hop clovers.

A KR and Caucasian bluestem-legume pasture was established in 1953. A Weeping lovegrass-Sericea lespedeza pasture was renovated and is being used in grazing experiments this year.

Pastures of three improved bermuda grass varieties, Midland, Greenfield and Coastal, have been established and will be available for grazing trials in 1955. Three cool season grass-perennial legume pastures are being established for grazing next season and include K-31 fescue, orchard grass and Southern Bromegrass.

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(PART III)

PROGRESS REPORT OF PASTURE STUDIES, 1953

By W. C. Elder

At the Soil and Pasture Station, Heavener

The soils on the Soil and Pasture Station at Heavener are characteristic of the upland soils of the southern Ozarks. Most of the land once used for cultivated crops in this part of Oklahoma is now being returned to pastures; but this land cannot produce good pastures until some attention is given to soil improvement and establishment of better forage crops.

Results from the Heavener Station indicate that: (1) a large number of good pasture species, both legumes and grass, are adapted in the area; and (2) a good fertilizer program is necessary to secure the best results from these crops.

Grazing studies on this station the past five years have included daily gain per animal and beef gain per acre from several combinations of grasses

and legumes under different fertility levels. The combinations and fertility rates are: (1) Bermuda-grass and winter clovers with 200 lbs. of superphosphate annually vs. no fertilizers; (2) fescue and ladino pasture plus 300 lbs. of superphosphate each year; (3) dallis grass and legumes plus 300 lbs. of superphosphate each year; and (4) common bermuda grass and vetch plus 200 lbs. of superphosphate annually.

Bermuda Grass and Winter Clover (Fertility study).

On a 15-year-old pasture of Bermuda grass, sufficient fertilizer was used prior to 1949 to maintain annual winter legumes and annual lespedeza. In 1949 the area was divided into four pastures. Two pastures have not been fertilized since 1948 and the other two have been fertilized as shown in Table X. The fertilized pastures did not produce outstanding gains over the unfertilized pastures the first two years of grazing (1950-1951). In 1952 and 1953 the spread was much greater, with an increase of 150 pounds of beef per acre in favor of the fertilized pastures in 1953 (Table X). Fertilization has encouraged winter clover growth but hindered annual lespedeza because the rank clover crowded out the lespedeza. White clover has increased in the fertilized pastures.

Fescue-Ladino Pasture and Dallis Grass Pasture.

In the Fescue and Ladino pasture where excellent beef gains were secured in 1950 and 1951, all of the Ladino clover was killed by the drought of 1952. The clover came back from seed in 1953 and made good growth and produced some grazing in May (Table XI); but it was again completely destroyed by dry weather in June, 1953. The fescue survived the drought of 1952-1953 except on poor soil situations.

The dallis grass is handicapped in this test because of poor legume growth. Summer rains encouraged good growth of Dallis grass in August.

Common Bermuda Grass and Vetch Pasture.

Grade Hereford cows, weighing 1000 pounds each, with young calves, started grazing this pasture on March 25. One and a half acres supported each cow and calf for over 200 days of grazing. The cows gained 200 pounds each and the calves 300 pounds each for the season. The cows made gains similar to that of the steers in the fertilized pastures shown in Table X. Good gains were recorded in April, May and June, with some loss of weight in July, and moderate gains in August and September. The calves made uniform gains throughout the season of 1.5 pounds daily.

TABLE X. --Grazing Results on Common Bermuda Grass and Hop, White Clovers and Annual Lespedeza, Fertilized and Unfertilized; Heavener, 1953.

Weighing Dates	Pasture No. 1*			Pasture No. 2			Pasture No. 3*			Pasture No. 4		
	Acres per head	Daily gain (lbs.)	Gain per acre (lbs.)	Acres per head	Daily gain (lbs.)	Gain per acre (lbs.)	Acres per head	Daily gain (lbs.)	Gain per acre (lbs.)	Acres per head	Daily gain (lbs.)	Gain per acre (lbs.)
4/2-5/1	.7**	2.6	107	1.1	2.2	61	.8	2.5	85	1.4	1.5	33
5/2-6/1	.7	2.3	96	1.1	2.1	57	.8	2.4	82	1.4	1.6	37
6/2-7/1	.7	2.1	86	1.1	2.2	61	.7	2.0	80	1.4	1.9	43
7/2-7/30	1.1	.1	5	1.1	-.2	-7	1.2	-.1	-3	1.4	.3	8
7/31-9/1	1.1	1.5	45	1.1	1.1	32	1.2	1.7	50	1.4	1.6	35
9/2-10/1	1.1	1.5	41	1.1	1.0	27	1.2	1.0	28	1.4	.9	19
10/2-10/28	1.1	.2	7	1.1	.2	7	1.2	***	***	1.3	***	***
Total			387			238			322			175

* Pastures 1 and 3 receive an annual application of 200 lbs. superphosphate and 33 lbs. of muriate of potash per acre. Pastures 2 and 4, no fertilizer since 1948.

** Average weight of steers in fertilized pasture 487 lbs. on 4/2 and 778 lbs. on 10/28, or 291 lb. gain for the season. Average weight of steers in non-fertilized pasture 464 lbs. on 4/2 and 712 lbs. on 10/28, or 248 lbs. gain for the season. Grazing period 208 days but 60 days of the period were non-productive. The small gains in July were not due to lack of forage in the pastures. The average 4-year beef gain on fertilized pastures is 275 lbs. per acre. The average 4-year beef gain on non-fertilized pastures is 179 lbs. per acre.

*** No gain or loss.

Vetch makes an ideal legume companion crop with Bermuda grass. If managed properly the vetch will reseed each year and furnish more nitrogen for grass growth than most legumes associated with Bermuda grass pastures.

At the Perkins Farm

The primary purpose of the forage crops work at the Perkins Farm is to observe pasture species and combinations under grazing conditions. Cattle weights are not taken. However, 50 acres of pasture on sandy soil have produced ample grazing for 20 grade Hereford cows and their calves throughout a growing season of approximately 220 days for the past 8 years. The winter pastures greatly reduced the winter feed cost, especially during favorable winter seasons. Grazing weights were recorded on weeping love grass in 1953.

Weeping Lovegrass, With and Without Nitrogen

An old established stand of weeping lovegrass was divided in 1953 into two pastures of four acres each. One pasture received 150 pounds of ammonium nitrate (33% N) in April and 150 pounds in July.

Three cows and their young calves started grazing May 1 on the 4 acres of non-fertilized pasture, and 5 cows and calves on the 4 acres that were fertilized.

Gain or loss of weight on the individual animals was much the same in both pastures. Average calf gain for the 120-day grazing period was 1.5 pounds daily on both pastures. Gains were very uniform throughout the entire period, and the calves gained a total of 180 to 200 pounds per head.

TABLE XI. --Beef per Acre Produced on Fescue-Ladino and Dallis Grass-Legumes; Heavener, 1953.

(Pounds per Acre)

Weighing dates	Fescue-Ladino	Dallis grass-legumes
April 17 to May 1	51	14
May 1 to June 1	43	40
June 1 to July 1	61	43
July 1 to July 3	9	-7
July 30 to September 1	33	90
September 1 to October 1	16	20
Total	213	200

The cows in both pastures gained a little less than 2 pounds daily during the month of May, then lost 1.5 pounds daily from June 1 to July 15 and gained 0.9 pounds daily from July 15 to September 1. Cows were 30 to 40 pounds heavier at the end of the grazing period.

The fertilized pasture was better than the non-treated on the basis of carrying capacity, but the increase did not pay for the cost of fertilizer. Taking the net gains of cows and calves, the fertilized pasture produced 243 pounds of beef per acre while the non-fertilized pasture produced 178 pounds. Value of the 65-pound increase in gain did not pay the cost of the 300 pounds of commercial nitrogen used.

Loss in weight of cows in June and July is explained by the dry weather in June. Good moisture in July and August encouraged new growth. However, there was ample forage for good grazing in both pastures at all times.

Similar cows and calves were grazed nearby on (1) KR and Caucasian bluestem, and on (2) Bermuda grass with access to sudan grass. The calf weights were practically the same as on the lovegrass pastures; but the cows on the lovegrass gained only 30 to 40 pounds, while the cows on the other pastures gained 150 to 175 pounds during the same period.

Bermuda-grass and Vetch Pasture

The best summer pasture on the Perkins Experiment Station has been Bermuda grass and vetch. Vetch is protected at time of seed production (June) either by removal of cattle or by light grazing. This pasture has not been replanted to vetch in the last nine years, nor has the grass been renovated. Because of late rains in the fall of 1952, vetch was able to volunteer only in heavy turfs of Bermuda grass. Young vetch plants thrive in a dense mat of grass and are protected in the winter from freezing and from the soil drying out.

Caucasian and KR Bluestem

Caucasian and KR bluestem pastures were grazed in preference to Bermuda grass in the summer of 1953. In previous years, the Caucasian headed out earlier than the KR; but in 1953 the early summer seed heads appeared first on KR. Rains in July stimulated seed production again in September and October, and in this second seed crop the Caucasian was much earlier in maturing than was the KR.

At the Agronomy Farm, Stillwater

Several pastures of 3 to 4 acres each have been established during the past three years on the A & M Agronomy Farm just west of Stillwater, for making comparisons among different species and combinations of grasses and legumes. Cattle weights in each pasture are recorded monthly during the grazing season. The various pastures involve a wide range of soils. In some of the pastures, phosphorus is applied to promote legume growth, and in others nitrogen is used to stimulate grass growth.

Commercial Nitrogen on Common Bermuda Grass.

For good pastures, it is usually desirable to have legumes growing with grasses. However, in many years it is impossible to secure good stands of legumes in Bermuda grass in Oklahoma because of dry fall and winter months. Previous clipping tests at this Station show that Bermuda grass responds well to commercial nitrogen fertilization. Therefore a grazing trial was set up in 1952 on common Bermuda grass located on a high fertility soil receiving 300 pounds of ammonium nitrate per acre annually. The nitrogen is applied in split applications of 150 pounds in April and 150 pounds in July.

In 1952, the months of April, May and June produced high gains for the fertilized pasture; but, because of a dry summer, nitrogen did not encourage grass growth in July, August and September.

In 1953, the gains were somewhat the same throughout the growing season, since good rains came in July, August and September (Table XII).

Midland Bermuda-grass Pastures.

Midland Bermuda grass is a new hybrid, combining winter hardiness and increased productivity, which was released by the Oklahoma Station in 1953. Roots of the new strain were planted in two pastures in 1951. One pasture receives 300 pounds of ammonium nitrate each year (150 pounds in April and 150 pounds in July). The other pasture was over-seeded to vetch, white colver and annual lespedeza, and 200 pounds per acre of superphosphate applied in October each year.

In 1952, good growth of legumes, principally vetch, produced more beef gains than the nitrogen fertilized pasture.

In 1953, the legumes were handicapped by dry weather in the winter, and the gains for the two pastures were not too far apart. Late frosts delayed grazing until April 25 (Table XIII). A large quantity of forage remained in both pastures at the end of the grazing season because the late season had favorable moisture conditions.

TABLE XII. --Beef Cattle Gains on Common Bermuda-grass; Unfertilized, and with Ammonium Nitrate; Agronomy Farm, Stillwater, 1953.

	Nitrogen Fertilizer*			No Treatment		
	Acres per head**	Gain per acre (Pounds)	Daily gain per head (Pounds)	Acres per head**	Gain per acre (Pounds)	Daily gain per head (Pounds)
April 16-May 9	.9	44	1.7	1.4	29	1.5
May 9-June 4	.9	54	2.1	.9	24	1.3
June 4-July 3	.8	55	1.7	.9	20	.9
July 3-August 5	.8	41	.9	1.4	37	1.5
August 5-September 10	.8	71	1.4	1.4	37	1.5
September 10-October 9	.8	62	1.4	1.4	22	1.0
Total 1953		327			169	
Total 1952		316			133	

* Ammonium nitrate; 150 pounds per acre in April and 150 pounds per acre in July.

** Grade Hereford heifers weighing 450 to 500 pounds per head at start of grazing season.

TABLE XIII. --Beef Cattle Gains on Midland Bermuda-grass; with Legumes, and with Ammonium Nitrate; Agronomy Farm, Stillwater, 1953.

	With Legumes			With Ammonium Nitrate*		
	Acres per head**	Gain per acre (Pounds)	Daily gain per head (Pounds)	Acres per head**	Gain per acre (Pounds)	Daily gain per head (Pounds)
April 25-June 4	1.0	37	1.4	1.0	41	1.7
June 4-July 3	1.0	43	1.4	1.0	34	1.1
July 3-August 5	1.0	44	1.2	1.0	32	1.0
August 5-September 10	.75	55	1.1	1.0	45	1.3
September 10-October 10	.75	52	1.3	1.0	30	1.0
Total 1953		231			182	
Total 1952		313			180	

* Ammonium nitrate; 150 pounds per acre in April and 150 pounds per acre in July.

** Grade Hereford heifers weighing 450 to 500 pounds per head at start of grazing season.

The legume pasture is managed to permit reseeding of vetch each year and to return some of the legume growth to the soil to furnish nitrogen for the summer-growing Bermuda grass. The stocking rate does not have to be lowered in the legume pasture to secure this extra growth because the vetch has a rank growth when Bermuda grass is ready to graze in the spring.

The tall, upright-growing Midland Bermuda grass in these pastures is grazed readily by the livestock. However, the individual gains have not been greater than similar animals grazing on Common Bermuda grass and vetch.

Tall Fescue, Smooth Brome and Alfalfa Pastures

Recent plantings of fescue in Oklahoma look promising. Recent brome plantings also show promise where put on soils of good fertility. Although Oklahoma has considerable acreage in alfalfa, little of it is used for grazing.

Good perennial species that are adapted to Oklahoma growing conditions are desirable in a pasture program. Unfortunately, most of the land now being planted to pastures is low in fertility and is usually considered unsuited for crops that have high fertility requirements such as alfalfa and brome grass.

To check the possiblity of using commercial fertilizer to encourage plantings of these crops on land that must be used for pastures in the future, two pastures were planted in 1951 on areas classified as IV and VI land. Lime requirements were fulfilled before planting time. On a well prepared seedbed, smooth brome was planted in 14-inch rows in one pasture and Kentucky 31 fescue in the second pasture. Alfalfa was seeded between the grass rows at the same time, and 200 pounds of superphosphate per acre was drilled with the seed. Additional applications of 200 pounds of superphosphate per acre were made in October, 1952, and October, 1953.

These pastures were ready for grazing in April, 1952. Stocking rates were not too heavy in 1952, to permit good establishment of the perennial plants.

In 1953, grazing started in these pastures in March, and cattle have been grazing on them for the entire year (to March, 1954) without supplementary feeding. Gains by weigh periods are shown in Table XIV. Hay was supplied twice when snow covered the forage. Stocking rates were high in spring months to use the surplus growth. From July, 1953, until March, 1954, the rate was approximately one animal unit per 2 acres.

The good winter growth in these pastures resulted from 6 inches of rain that came in September and October. The alfalfa made good growth until December and the surplus growth of brome and fescue carried the animals through the winter months. There was sufficient new growth of grasses to furnish protein

TABLE XIV. --Grazing Results on Alfalfa and Perennial Grass Pastures; Agronomy Farm, Stillwater, 1953-54.

	Fescue + Alfalfa			Brome + Alfalfa		
	Acres per head	Gain per acre (Pounds)	Daily gain per head (Pounds)	Acres per head	Gain per acre (Pounds)	Daily gain per head (Pounds)
1953						
March 21-April 15	1.3*	9	0.5	1.3	11	0.6
April 15-May 9	.8	43	1.9	.8	26	1.5
May 9-June 4	.7	41	1.3	.8	60	1.6
June 4-July 3	1.0	46	1.6	1.0	54	1.9
July 3-August 5	2.0	22	1.3	2.0	18	1.2
August 5-September 10	2.0	28	1.5	2.0	28	1.5
September 10-October 9	2.0	23	1.5	2.0	28	1.8
October 9-November 11	2.0	9	.6	2.0	4	.3
November 23-December 29	1.0	25	.7	1.3	9	.3
1954						
December 29-February 2	1.3	8	.3	2.0	5	.2
February 2-March 4**	1.3	16	.6	2.0	-4	loss .2
Total 1953-54		270			239	
Total 1952		126			164	

* One-year-old Hereford heifers weighing 450 lbs.

** Nine-month-old Hereford calves.

for good winter maintenance. Grade Hereford calves gained .3 to .6 pounds daily on these pastures from November, 1953 to March, 1954. Fescue is making a better growth than brome in these pastures on these types of soils. No bloat problem occurred on the fescue-alfalfa pasture; and bloat showed up only twice in the brome-alfalfa pasture, immediately after freeze damage to the alflafa.

These pastures look encouraging. The stands are being maintained under long continuous grazing. Acre gains are not outstanding, but good for these soils; and the gain per animal is above other pastures on the Station. For the 1953 grazing season, animal gains were approximately 250 pounds each on Bermuda grass while the alflafa-grass produced 310 pounds gain per animal.

Kentucky Fescue 31 Grazed in Pure Stands.

One pasture planted to a pure stand of Kentucky 31 fescue has been grazed for the past two years. Beef yields per acre were good in April, May and June, with little or no grazing in July, August and September. Fall and winter grazing depends primarily on rains in September and October. For the winter 1953-1954, fescue has provided good carrying capacity for animals where only maintenance rations are desired. Daily gains per animal have been low in this pasture despite the fact the soil is high in fertility.

Temporary Winter Pastures.

Rye, barley and vetch used for pasture in the winter months have produced animal gains that corresponded closely with spring pasture gains, and above summer pastures. Nine-month-old grade Hereford calves gained 1.7 pounds daily from November, 1953 to March, 1954. Two to three hundred pounds of beef per acre can be expected from winter pastures, depending upon rainfall and soil conditions. Barley makes more pasture in fall months; rye makes more pasture in December, January and February; and winter oats make a longer grazing period in the spring. Vetch improves grazing, especially in late spring, and can be used to improve soil fertility if some of the growth is returned to the soil. One pasture on the Station, located on Class IV and VI land that previously had two years of rye and vetch harvested for seed, then grazed one year with some of the vetch plowed under, produced more winter pasture the fourth year (1953-1954) than good bottom land (Class I) formerly in wheat and summer fallowed, than seeded to the same mixture.

Sudan Pastures.

Sudan pastures are making less beef per acre than winter cereals and vetch. Sudan produced 120 pounds beef per acre in 1952 and 150 pounds per acre in 1953. Good gains per animal are secured in June, July and August.

Palatability Comparisons.

One area of land is used to check the palatability of forage species that look promising in the forage breeding and testing program. Several small plantings of grasses and/or legumes are made. Sufficient livestock are used to graze the entire area in four to six days. It is recognized that a large number of factors are involved in palatability trials, but it is interesting to know that cattle do have a preference between species and many times between different strains of the same species.

In the Sudan strain tests of 1952 and 1953, cattle preferred sweet varieties to common Sudan, without exception. Common pearl millet was not grazed as well as Sudan for the first grazing period in 1953. However, it was grazed equally as well as sweet sudan in the other three grazing periods. All the forage is clipped to equal height after each grazing period.

Blackstrap molasses, sugar, salt and urea in different concentrations were sprayed on several grasses during the hot, dry summer months in an effort to encourage animal intake. These tests in 1953 on Bermuda grass, weeping lovegrass and sudan did not give encouraging results.

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APPENDIX A: WEATHER RECORD FOR 1953.

Excerpts from "Preliminary Weather Summary for Oklahoma, 1953," Weather Bureau, U. S. Department of Commerce.*

Recurring drought or incipient drought conditions, and recovery from drought, featured Oklahoma's weather for 1953. Drought conditions prevailed somewhere in the State throughout the year, although areas suffering for lack of moisture were small and of limited extent following good rains in most areas in July and October. For the State as a whole, accumulated precipitation amounts since the beginning of the year failed to reach normal accumulated totals despite marked surges of recovery in July and October.

At the beginning of 1953, the State, especially in western sections, was suffering from drought conditions which started in April, 1952. Although surface moisture supplies were generally adequate as a result of good rains and snows around Thanksgiving Day in 1952, subsoil moisture deficiencies were serious, and in some western sections critical. January and February were dry and mild.

* Press release for December 31, 1953.

The most severe and widespread drought condition during the year occurred from May 20th to July 7th, when extremely hot and dry weather prevailed. It was the hottest June of record for Oklahoma. Every station in the State recorded a maximum of 100° or higher in June. The last ten days of May were also extremely hot. Practically no rain fell the last 12 days of May; rainfall in June was only 55% of normal; and little or no rain fell in July before the 7th. This dry period was especially hard on the corn crop, and the 1953 corn crop as a result was the poorest in the history of the State. Early broomcorn and sorghum crops were hurt badly. Pastures and hay crops were generally very poor, especially in western sections. Forced by short feed and water supplies, marketing of livestock was unusually heavy.

Most of the State recovered from the drought with good rains in July and August. The mid-summer recovery from the drought lasted only through the first three or four days of September, after which hot, dry weather again prevailed. By the close of September the State again faced a serious drought situation. In October, however, most sections of Oklahoma received heavy rains, and by the close of the month the drought appeared for the most part to be effectively broken.

Oklahoma's precipitation for the year 1953 amounted to about 31.39 inches or about 2 inches less than that normally received. Except for 1952 when the annual average was 23.62 inches, it was the driest year for the State as a whole since 1943. July with 5.72 inches was the wettest month, while January with 0.63 inches was the driest.

Although much of the State suffered for lack of rainfall most of the year, limited areas at times received excessive amounts in heavy local downpours, followed by moderate to severe local flooding. Heavy rains in parts of southeastern Oklahoma dumped as much as 9.54 inches at Coalgate on July 20th. Between 8:30 p.m., November 18th and noon of the 19th, a downpour of 6.54 inches was reported at El Reno.

The year was warm. The annual average temperature for the State was 62° or about 1.5° above normal. No long periods of cold weather were experienced during the year as January, February, and March had well above normal temperatures. The only below zero temperature in 1953 was a -6° reading at Kenton on February 11.

April was cool during the first three weeks, and killing frosts and freezes as late as April 20th were among the latest ever recorded at many of the stations. The last week of April was extremely hot, and record high temperatures were registered on the 22nd.

The latter part of May, the month of June, and the first week in July were exceptionally hot. The early summer was one of the hottest ever experienced in Oklahoma. The extreme heat was broken the latter part of the summer as July and August temperatures averaged below normal.

It was warm in September and October and near normal temperature in November. The last few days in September were exceptionally hot with record high temperatures for so late in the season reported at many stations. The first State-wide freeze of the fall fell on the night of November 8-9 was near the normal date of occurrence.

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APPENDIX B

Table II--Standard Fescue Test. --Oven-dry hay; Average of 8 replications in 1953. (Planted October 13, 1951; cut May 29, 1952, and May 6, 1953). Perkins, Oklahoma. Soil type and texture -- Norge, fine sandy loam.
L.S.D. 5% = 176 lbs.

Table II--Standard Side-oats Grama Test. --Oven-dry hay; Average of 8 replications. (Planted May 29, 1952; cut September 25, 1952, and June 17, August 5, and October 5, 1953). Perkins, Oklahoma. Soil type and texture -- Norge, fine sandy loam.
L.S.D. 5% = 456 lbs.

Table II--Standard Birdsfoot Trefoil Test. --Oven-dry hay; Average of 4 replications. (Planted March 30, 1951; cut May 2, June 23, and August 7, 1953). Perkins, Oklahoma. Soil type and texture -- Norge, fine sandy loam.
L.S.D. 5% = 1187 lbs.

Table II--Dry Land Alfalfa Test. --Oven-dry hay; Average of 6 replications. (Planted September 21, 1951; cut May 6, June 18, and July 30, 1953). Perkins, Oklahoma. Soil type and texture -- Teller, very fine sandy loam.
L.S.D. 5% = 1535 lbs.

Table II--Standard Sweet Clover Test. --Oven-dry hay; Average of 4 replications. (Planted April 5, 1952; cut May 6, 1953). Perkins, Oklahoma. Soil type and texture -- Norge, fine sandy loam.
L.S.D. 5% = 720 lbs.

Table III--Standard Brome Grass Test. --Oven-dry hay; Average of 5 replications. (Planted September 20, 1950; cut June 27, 1951; May 19, 1952; and April 29, and June 18, 1953). Perkins, Oklahoma. Soil type and texture -- Norge, fine sandy loam.
L.S.D. 5% (40 lbs. N/Acre) = 275 lbs.
L.S.D. 5% (80 lbs. N/Acre) = 652 lbs.

Table IV--Pearl Millet Test. --12% moisture hay; Average of 4 replications. Perkins, Oklahoma. (Planted May 1, 1953; cut for pasture July 13, August 4, September 10, and October 22, 1953; cut for hay July 25, September 22, and October 13, 1953). (Planted May 28, 1952; cut for pasture July 19, August 1, 15, and 29, September 12, and 26, 1952; cut for hay July 25, August 22, and September 19, 1952). Soil type and texture -- Norge, fine sandy loam.
L.S.D. 5% (Hay 1953) = 1918 lbs.
Differences in pasture yields = N.S.

Table V--Sudan Grass Test. --12% moisture hay; Average of 4 replications. (Planted May 1, 1953; cut for pasture July 13, August 4, September 10, andOctober 22, 1953; cut for hay July 25, September 22, and October 13, 1953). Perkins, Oklahoma. Soil type and texture -- Norge, fine sandy loam.
L.S.D. 5% (pasture) = 1097 lbs.
L.S.D. 5% (hay) = 1212 lbs.

Table VI--Sudan Seed Yield Test. --Average of 4 replications; rows 36 inches wide. (Planted May 7, 1953; harvested for seed October 3, 1953). Perkins, Oklahoma. Soil type and texture -- Norge, fine sandy loam.
L.S.D. 5% = 284 lbs.

Table VII--Grass Strain Test. --Air-dry weight; Average of 6 replications. (Planted May 1951; cut June 17, and August 6, 1952; and June 1, and July 27, 1953). Plots 5 x 20 feet. Woodward, Oklahoma.

Table VIII--Forage Yields per Cutting Date. --Air-dry weight; Average of 3 replications, with exceptions noted. Plots 10 x 10 feet. Woodward, Oklahoma.
L.S.D. 5% (Sand Lovegrass) = 95 lbs.
L.S.D. 5% (Blue Grama) = 157 lbs.
L.S.D. 5% (Side-oats Grama) = 153 lbs.

Table IX--Percent Crude Protein per Cutting Date. --Grass Strain Tests. --Average of 3 replications, with exceptions noted. Plots 10 x 10 feet. Woodward, Oklahoma.
L.S.D. 5% (Sand Lovegrass) = 0.38%
L.S.D. 5% (Blue Grama) = 0.46%
L.S.D. 5% (Side-oats Grama) = N.S.