Mimeographed Circular M-279 May, 1956

FORAGE CROPS EVALUATION AND MANAGEMENT STUDIES

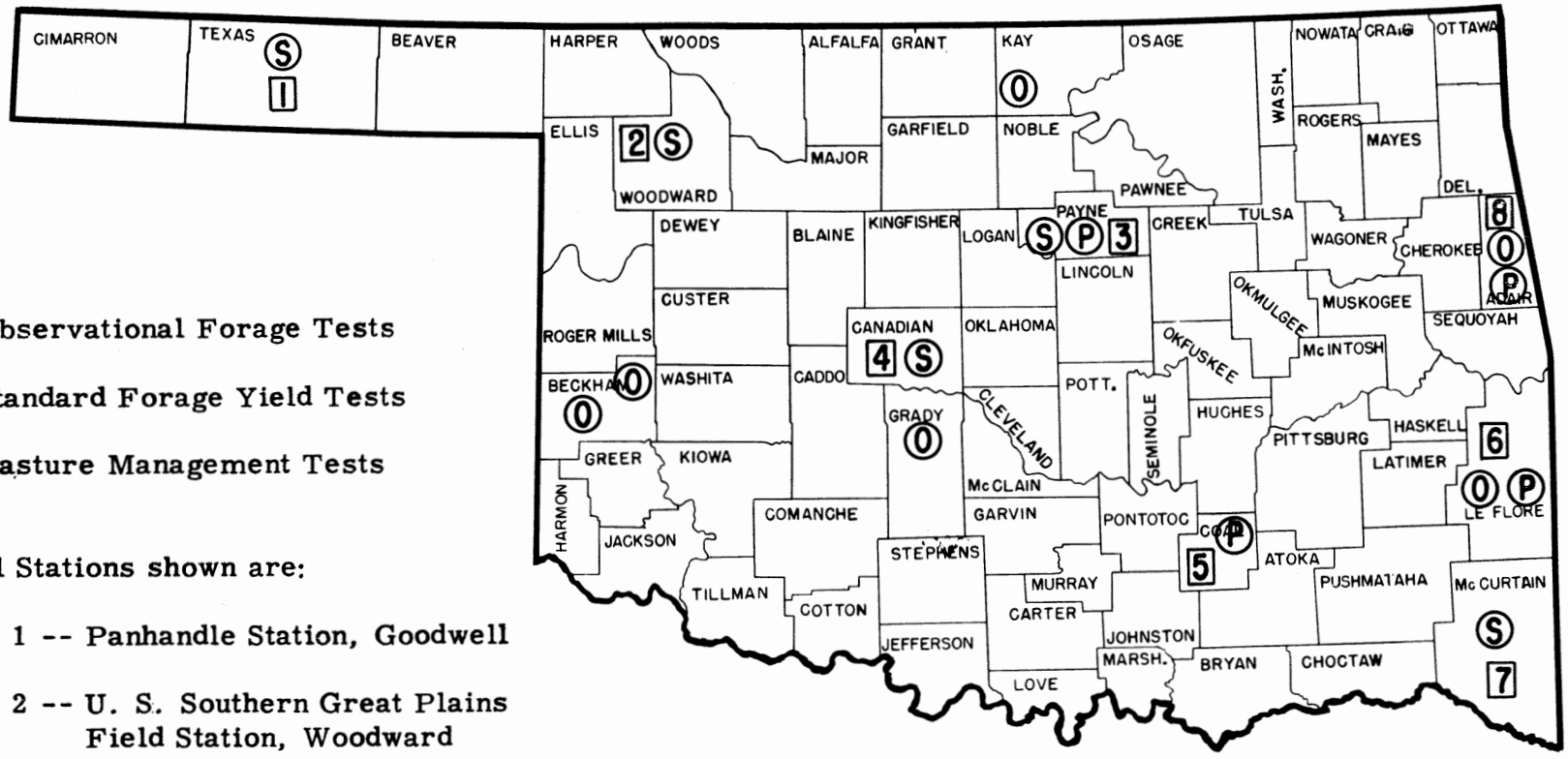
Progress Report, 1955

OKLAHOMA A&M COLLEGE DIVISION OF AGRICULTURE
SCIENCE SERVING AGRICULTURE
EXPERIMENT STATION

DIVISION OF AGRICULTURE
OKLAHOMA A. & M. COLLEGE
Stillwater

AGRICULTURAL EXPERIMENT STATION
Louis E. Hawkins, Director

CONTENTS



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

8 -- Eastern Oklahoma Field Station, Stilwell

(PART I)

PASTURE PLANT ADAPTATION TESTS, 1955

By Wayne W. Huffine

Forage production was curtailed again in 1955 by drought conditions, but to somewhat of a lesser degree than the preceeding year. Rainfall was adequate for spring planting at each test location, but was followed by a prolonged dry period. Late September and early October were periods of excellent precipitation for fall planting; however, no more moisture was received until late December. Low temperatures from about mid-October until the end of the year were not conducive to good fall growth.

The purpose of these tests is to determine the areas of adaptation and relative forage production of the many hay and/or pasture grasses and legumes now available and new ones as they become available. This objective is to be achieved by sampling each of the major soil or natural vegetation regions of the state as shown in Forage Crops Leaflet No. 3.

Test plots previously established are shown in Table I of Mimeographed Circulars M-261 and M-269. In 1955, additional plantings were made of 168 individual strains of forage grasses or legumes at one or more of nine test locations. The locations and strains planted at each in 1953, 1954 and 1955 are shown in this publication. Performance data are given for two or three year periods where available.

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 —

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

Data on forage yields of Blue Panic are from Dr. J. Q. Lynd, Associate Professor of Agronomy, Oklahoma A. and M. College.

Date from Goodwell, Oklahoma on forage yields of alfalfa, brome, wheatgrass, sudan and millet are from Prof. Elden Hood, Associate Professor of Agronomy, Panhandle A. and M. College.

All statistical analyses were made by Dr. F. A. Graybill, Associate Professor of Mathematics, Statistical Laboratory, 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, 1954 and 1955, 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.

1955 Results

Tables II through VII 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 1954 Annual Report of Progress in Forage Crops Evaluation and Management Studies, Mimeographed Circulars M-261 and M-269, Part I, pages 2 through 14.

Data on fertility studies on Iahoma Sweet Sudan are included in Mimeographed Circular M-269, Part I, page 13.

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, 1954 and 1955 at Eleven Forage Crop Testing Locations.

Variety	Elk City	El Reno*	Foraker	Goodwell*	Heavener	Idabel	Perkins	Pocasset	Stilwell	Tonkawa	Woodward
Alfalfa											
Hay Types											
Oklahoma Common	5	3 /1			3	5	5		4		
Socheville		3			3				4		
Ranger	5	3			3	5	5		4		5
Narragansett	5	3			3	5	5		4		5
Sazovakir		3		3	3				4		3
Lahontan	5	3			3	5	5		4		
Vernal	5	3			3	5	5		4		5
Buffalo	5	3			3	5	5		4		5
Talent	5	3			3	5	5		4		
Du Puits	5	3			3	5	5		4		5
Williamsburg	5	3			3	5	5		4		5
Atlantic	5	3			3	5	5		4		5
W-268		3			3				4		
Uruguay #10	5					5	5		4		5
Italian	5					5	5		4		
Caliverde	5					5	5		4		
Flamande	5					5	5				
Adams											5
Joe Hunter Common											5
Cossack											5
Pasture Types											
Stafford		3		3	3				4		
Turkish Wild	5	3	5	3	3	5	5				5
Nomad	5	3		3	3	5	5				5
A-224	5	3			3	5	5				5
Sevelra	5	3		3	3	5	5				5
Ladak	5	3		3	3	5	5		4		
Rhizoma	5	3			3	5	5				5
A-169	5					5	5				5

*Irrigated forage tests.

/1 Figure 3 represents plots which were planted and successfully established in 1953
Figure 4 represents plots which were planted or replanted in 1954.
Figure 5 represents plots which were planted or replanted in 1955.

TABLE I. -- Continued.

Variety	Elk City	El Reno*	Foraker	Goodwell*	Heavener	Idabel	Perkins	Pocasset	Stillwell	Tonkawa	Woodward
Alsike Clover					3		4		4		
Astragalus cicer	5	3	5		3		4		4	5	5
Big Hop Clover							4		4		
Birdsfoot Trefoil											
Iowa Empire 2306			5		4	4	5		4	5	
Cascade			5		4	4	5		4	5	
Italian Broadleaf			5		4	4	5		4	5	
Viking			5		4	4	5		4	5	
Mansfield			5		4	4	5		4	5	
Granger			5		4	4	5		4	5	
Empire			5		4	4	5		4	5	
Imported			5				5			5	
Iowa Empire 2297			5				5			5	
Douglas			5							5	
Blue Panic					4		4		4		
Buffel Grass					4		4		4		
Bromegrass											
Martin				3	3				4		3
Lincoln	5	3		3	3	5	5		4		3
Elsberry	5	3		3	3	5	5		4		3
Manchar	5			3	3		5		4		3
Southland	5	3	5	3	3	5	5	5	4	5	3
Homesteader				3	3				4		3
Mandan 404				3	3				4		3
Canadian Commercial				3	3				4		3
Fischer	5	3		3	3	5	5		4		3
Lyon		3		3	3	5	5		4		3
Lancaster		3		3	3	5	5		4		3
Achenbach	5	3	5		3	5	5	5	4	5	
Woodward	5	3									
No. 63	5						5				
Turkish	5		5			5	5			5	

TABLE I. — Continued.

Variety	Elk City	El Reno*	Foraker	Goodwell*	Heavener	Idabel	Perkins	Pocasset	Stillwell	Tonkawa	Woodward
Crimson Clover											
Auburn Reseeding					3	5	5		4		
Autauga					3	5	5		4		
Talledega					3	5	5		4		
Dixie					3	5	5		4		
Mississippi Selection					3	5	5		4		
Common					3	5	5		4		
Fescue											
Kentucky 31	5	3	5		3	5	5	5	4	5	
A-36	5	3			3	5	5		4		
Goar	5	3	5		3	5	5	5	4	5	
Alta	5	3			3	5	5		4		
19 G1-25	5	3			3	5	5	5	4	5	
Alta #144	5	3			3	5	5		4		
Giant Red Suckling Clover					4	5	4		4		
Lespedeza											
Kobe			5		5	5	5		5	5	
Iowa 6			5		5	5	5		5	5	
Korean			5		5	5	5		5	5	
Climax			5		5	5	5		5	5	
Rowan			5		5	5	5		5	5	
Millet											
Starr				5	5	5					
Common				5	5	5					
Texas 7				5		5					
Native Grasses											
Big Bluestem											
Kaw			5				5	5		5	
Little Bluestem											
A-4741			5				5	5		5	
Sand Bluestem											
Common			5				5	5		5	
W_2			5				5	5		5	
Buffalo											
W_1							5	5		5	
W_2							5	5		5	
Bulk (A-4416)			5				5	5		5	

TABLE I. — Continued.

Variety	Elk City	El Reno*	Foraker	Goodwell*	Heavener	Idabel	Perkins	Pocasset	Stillwell	Tonkawa	Woodward
Indian											
A-4743			5				5	5		5	
Sand Lovegrass											
Common			5				5	5		5	
W5			5				5	5		5	
Sideoats grama											
El Reno							5	5			
A-3603							5	5			
Hopo							5	5			
Coronado (Encinoso)							5	5			
Nebraska 52							5	5			
Tucson							5	5			
Nebraska 37							5	5			
W4							5	5			
Switchgrass											
Common (Ferg. Ranch)			5				5	5		5	
W2			5				5	5		5	
Caddo (4200)			5				5			5	
Blackwell			5				5	5		5	
Orchardgrass											
Commercial	5	3			3	5	5				
ADEFA		3			3						
Oregon 233		3			3						
M2-11142-50		3			3						
Potomac (Beltsville Str.)	5	3			3	5	5				
No. 88		3			3				4		
Palestine		3			3				4		
H-2	5	3			3	5	5		4		
F-52		3			3				4		
Trogdon		3			3	5	5		4		
Akarca	5	3			3	5	5		4		
M2-1142-53	5					5	5				

TABLE I. -- Continued.

Variety	Elk City	El Reno*	Foraker	Goodwell*	Heavener	Libel	Perkins	Pearsall	Stillwell	Tonkawa	Woodward
P-2453	5					5	5				
Danish	5					5	5				
Akaroa (N. Z.)	5					5	5				
Kentucky Sel.	5					5	5				
Caon						5	5				
Persian Clover					4				4		
Reed Canary Grass		3		3	3		3		4		
Red Clover											
No. 1 Mammoth					3	5	5		4		
Port Gibson					3				4		
Louisiana Syn. #1					3	5	5		4		
Kenland					3				4		
Nolin					3	5	5		4		
Libel					3				4		
Certified Midland					3				4		
Kentucky 215					3	5	5		4		
Ryegrass											
Oregon Perennial		3			3						
Common	5	3			3	5	5		4		
No. 12	5	3			3				4		
H-1	5	3			3	5	5		4		
S. 22 Aberystwyth		3			3		5		4		
S. 23 Aberystwyth		3			3				4		
S. 24 Aberystwyth	5	3			3	5	5		4		
S. 101 Aberystwyth	5	3			3				4		
Rust Resistant	5					5	5				
P. I. 211, 828	5					5	5				
La Estanzuela	5					5	5				
P-312	5					5	5				
Sainfoin		3	5		3	5	5		4		
Subterranean Clover											
Bacchus Marsh					4	5	5		4		
Tallarook					4	5	5		4		
Mt. Barker					4	5	5		4		
Nangeela					4	5	5		4		

TABLE I. -- Continued.

Variety	Elk City	El Reno*	Foraker	Goodwell*	Heavener	Idabel	Perkins	Pocasset	Stilwell	Tonkawa	Woodward
Sudan											
Piper				5	5	5	5		4		
Common				5	5	5	5		4		
Sweet Common				5	5	5	5		4		
Lahoma				5	5	5	5		4		
Sweet 372 (S-1)				5	5	5	5		4		
Greenleaf				5	5	5	5		4		
Wheeler				5	5	5	5		4		
Tift				5	5	5	5		4		
Sweet 372				5	5	5	5		4		
Synthetic #4				5	5	5	5		4		
Piper x S-23				5	5	5	5		4		
Sweet Clover											
Spanish			5		4	4	5		4	5	
Evergreen			5		4	4	5		4	5	
S-65			5		4	4	5		4	5	
A-46			5		4	4	5		4	5	
Madrid			5		4	4	5		4	5	
Tifton			5		4	4	5		4	5	
Vetch											
Hairy	5				5	5	5		5		
Willamette	5				5	5	5		5		
Auburn Woolypod	5				5	5	5		5		
Oregon Woolypod	5				5	5	5		5		
Madison	5				5	5	5		5		
Lana	5				5	5	5		5		
Hungarian	5				5	5	5		5		
Common	5				5	5	5		5		
Wheatgrass											
Nebraska 10	5	5					5	5			3
42-1	5	5					5	5			3
M2-10820		5						5			3
Ree	5	5					5	5			3
Mandan 571	5	5					5	5			3
Commercial Crested		5		3				5			3
A-12496		5		3				5			3

TABLE I. -- Continued.

Variety	Elk City	El Reno*	Foraker	Goodwell*	Heavener	Idabel	Perkins	Pocasset	Stilwell	Tonkawa	Woodward
Nebraska 50	5	5					5	5			3
A-1770	5	5		3			5	5			3
M2-10820-49		5						5			3
Turkish Crested	5	5						5			
Mandan 759	5						5				
Utah 109	5						5				
A-1488	5						5				
M2-10820-52	5						5				
Tall (A-5243)	5						5				
Tall (A-5244)	5						5				
P-27	5						5				
P-41	5						5				
Whitmar beardless	5						5				
Amur	5						5				
Fairway	5						5				
S-64	5						5				
Nordan	5						5				
S-131	5						5				
Smut Tolerant	5						5				
Mandan 2194B	5						5				
White Clover											
Non-Certified Ladino					3	5	4		4		
Certified Blue Tag Ladino					3		4		4		
Pilgrim					3	5	4		4		
Louisiana Syn. #1					3	5	4		4		
Louisiana					3	5	4		4		
Winter Pea											
Austrian	5				5	5	5		4		
Romack							5		4		
Papago							5		4		
Dixie Wonder							5				

TABLE II. -- Forage Yields and Protein Content; El Reno, Oklahoma

Variety or Strain	1955 Forage Yield lbs/A	Rank	1955 Protein (Percent)	1954 Forage Yield lbs/A	Rank	1954 Protein (Percent)
Alfalfa (Hay Types)						
Williamsburg	11507	1	17.78	7223	7	17.16
Ranger	11453	2	18.21	7551	2	18.02
Oklahoma Common	11362	3	17.21	7406	6	18.27
Buffalo	10672	4	18.83	7116	9	17.91
Nevada Syn. A	10509	5	17.35	7134	8	16.97
Atlantic	10291	6	17.83	7496	3	19.16
W-268	9637	7	17.85	7423	5	17.64
Vernal	9384	8	17.09	6916	12	18.73
Du Puits	9202	9	17.02	7787	1	17.34
Narragansett	9020	10	19.11	7478	4	18.38
Talent	8875	11	18.53	6952	11	17.98
Sazovakir	8313	12	18.17	7115	10	16.67
Socheville	7786	13	17.29	6443	13	18.12
Rhizoma	6171	14	19.79	6226	14	19.99
Alfalfa (Pasture Types)						
Stafford	10091	1	18.58	6625	2	18.68
Sazovakir	9565	2	18.60	7079	1	17.18
Turkish Wild	9293	3	18.63	6299	4	18.56
A-224	8640	4	19.91	6570	3	19.09
Rhizoma	6552	5	20.12	5863	5	20.27
Nomad	6189	6	20.56	4374	7	17.39
Sevelra	5863	7	19.16	4120	8	18.76
Ladak	5808	8	17.28	5137	6	18.92
Brome						
Lancaster	9039	1	10.37	3267	3	14.78
Lyon	8894	2	13.07	3412	2	15.72
Achenbach	8658	3	12.31	3939	1	13.84
Woodward	8476	4	12.57	3249	4	15.65
Lincoln	8277	5	12.97	3050	6	12.78
Elsberry	7859	6	12.95	2577	8	14.72
Southland	7423	7	13.87	3104	5	14.97
Fischer	7351	8	13.28	2995	7	15.53
Fescue						
Alta	8930	1	17.97	4538	4	12.32
Alta #144	8676	2	19.32	3703	5	12.89
19-G1-25	8059	3	17.95	6371	1	13.62
4-36	8004	4	17.95	4828	3	14.43
Goar	7787	5	19.78	3104	6	13.84
Kentucky 31	7678	6	17.55	5663	2	12.73
Orchard grass						
F-52	6189	1	8.75	2940	1	13.16
Potomac(Beltsville Str.)	5953	2	8.99	2196	4	12.47
M2-11142-50	5899	3	8.96	2305	2	11.97
Trogdon	5899	4	7.34	2160	6	14.22
Akaroa	5881	5	8.32	1852	8	13.91
Commercial	5844	6	8.99	2160	5	9.97
Oregon 233	4610	7	10.42	2196	3	13.53
ADEFA	4392	8	8.83	2069	7	13.84

TABLE II. -- Continued.

Variety or Strain	1955 Forage Yield lbs/A	1955 Rank	1955 Protein (Percent)	1954 Forage Yield lbs/A	1954 Rank	1954 Protein (Percent)
No.-88	3794	9	10.61	1452	10	14.16
H-2	3721	10	11.0	1525	9	13.97
Palestine	2178	11	9.5	525	11	10.53
Mixtures (Grass & Legume)						
Southland Brome & Okla. Common Alfalfa	12215	1	12.81			
Alta Fescue & Ladino Clover*	11634	2	13.28			
Alta Fescue & Okla. Common Alfalfa	11017	3	14.16			
Southland Brome & Ladino Clover*	10200	4	13.06			
Commercial Orchardgrass & Okla. Common Alfalfa	8967	5	13.93			
Perennial Ryegrass & Okla. Common Alfalfa	8095	6	14.38			
Commercial Orchardgrass & Ladino Clover*	6480	7	12.31			
Perennial Ryegrass & Ladino Clover*	3977	8	13.15			
Ryegrass						
S-24 Aberstwyth	3993	1	10.30			
Perennial	3219	2	9.36			
Common	3098	3	6.86			
S-22 Aberstwyth	3013	4	8.11			
H-1	2323	5	7.55			
No.-12	2057	6	7.89			
S-101 Aberstwyth	1888	7	11.55			
S-23 Aberstwyth	1234	8	11.13			

TABLE III. — Forage Yields and Protein Content; Goodwell, Oklahoma

Variety or Strain	1955 Forage Yield lbs/A	1955 Rank	1955 Protein (Percent)	1954 Forage Yield lbs/A	1954 Rank	1954 Protein (Percent)
Alfalfa (Pasture types)						
Stafford	7532	1	19.66	7115	3	20.66
Sevelra	7496	2	19.77	7550	2	21.28
Ladak	7242	3	19.54	8156	1	20.85
Turkish Wild	5935	4	20.79	6317	5	21.42
Nomad	5827	5	20.31	6583	4	22.02
Sazovakir	4319	6	18.58	4030	6	19.83
Brome						
Southland	1416	1	11.5	5107	7	15.59
Lyon	1380	2	11.5	5348	6	14.91
Fischer	1343	3	12.0	5396	4	17.27
Lincoln	1307	4	14.6	6498	1	16.60
Elsberry	1271	5	12.3	2868	11	17.34
Homesteader	1271	6	10.2	4756	8	16.60
Lancaster	1035	7	10.2	3340	10	16.81
Canadian Commercial	672	8	15.6	5372	5	19.60
Martin	635	9	14.2	5628	2	16.78
Mandan 404	617	10	14.1	5409	3	17.20
Manchar	508	11	12.2	4150	9	16.50
Wheatgrass						
A-12496 (Intermediate)	2414	1	9.81			
A-1770 (Crested)	653	2	10.47			
Commercial Crested	545	3	11.31			
Millet						
Starr	6861	1	12.34			
Texas 7	6425	2	11.27			
Sudangrass						
Piper	9111	1	10.0			
Sweet 372	9076	2	11.84			
Sweet Common	8985	3	11.47			
Tift	8603	4	10.52			
Piper S-23	8386	5	10.07			
Wheeler	7895	6	9.21			
Lahoma	7842	7	12.57			
Greenleaf	7714	8	10.3			
Syn. 4	7332	9	10.13			
Common	7097	10	8.14			
Sweet 372 (S-1)	6879	11	10.11			

TABLE IV. -- Forage Yields and Protein Content; Perkins, Oklahoma, 1952 to 1956

Variety or Strain	1955 Forage Yield Lbs/A	1955 Rank	1955 Protein (Percent)	1954 Forage Yield Lbs/A	1954 Rank	1954 Protein (Percent)	1953 Forage Yield Lbs/A	1953 Rank	1953 Protein (Percent)	1952 Forage Yield Lbs/A	1952 Rank	1952 Protein (Percent)
Lespedeza												
Kobe	2051	1	13.68									
Climax	1761	2	13.00	1724	2	14.38						
Iowa 6	1615	3	13.53	1779	1	14.03						
Rowan	890	4	13.31	1307	4	14.22						
Korean	889	5	13.97	1543	3	16.95						
Sideoats grama												
Hope	2441	1	4.19				3977	1	7.07	2115	5	7.21
Tucson	2142	2	4.63				3595	4	7.28	2147	4	6.76
Coronado (Encinoso)	2033	3	4.19				3869	2	7.07	2674	1	7.09
Commercial	1607	4	4.51				2750	7	6.91	1354	7	6.73
El Reno	1597	5	4.31				3552	5	6.75	2330	2	6.65
A-3603	1579	6	4.63				3830	3	6.44	2026	6	6.42
Nebraska 52	1434	7	4.51				3430	6	7.06	2172	3	7.12
Nebraska 37	500	8	5.04				2260	8	7.94	1151	8	6.31
Sudangrass												
Common	4734	1	16.61									
Tift	4610	2	18.13									
Syn. 4	4483	3	17.96									
Sweet 372 (S-1)	3811	4	19.23									
Wheeler	3503	5	15.51									
Piper	3322	6	17.25									
Sweet 372	3249	7	18.76									
Lahoma	2959	8	17.32									
Greenleaf	2887	9	17.20									
Sweetclover												
Evergreen	4066	1	15.31	2196	4	13.97	2805	2	32.00			
A-46	3902	2	16.13	2305	3	13.66	2231	4	32.03			
Spanish	3503	3	15.06	2632	2	15.63						
Madrid	3358	4	15.41	3246	1	14.28	2846	1	32.13			
S-65	3031	5	14.97	1688	5	13.28						
Vetch												
Madison Hairy	5445	1	24.84									
Hungarian	4919	2	19.71									
Hairy	4429	3	24.03									
Williamette	4302	4	23.21									
Auburn Woolypod	2886	5	23.09									
Oregon Woolypod	2414	6	22.90									

TABLE V. -- Forage Yields and Protein Content; Heavener, Oklahoma

Variety or Strain	1955 Forage Yield lbs/A	Rank	Protein (Percent)
Millet			
Starr	817		5.74
Sudangrass			
Piper	2269	1	3.55
Wheeler	2178	2	3.92
Tift	1833	3	4.05
Sweet Common	1761	4	3.92
Sweet 372	1724	5	4.33
Common	1724	6	3.86
Lahoma	1652	7	4.68
Sweet 372 (S-1)	1597	8	4.37
Greenleaf	1579	9	4.68
Syn. 4	1470	10	4.70

TABLE VI. -- Forage Yields and Protein Content; Idabel, Oklahoma

Variety or Strain	1955 Forage Yield lbs/A	Rank	Protein (Percent)
Millet			
Texas 7	4974	1	4.19
Starr	3848	2	5.56
Sudangrass			
Syn. 4	4356	1	4.14
Greenleaf	3794	2	4.89
Piper	3739	3	4.16
Lahoma	3670	4	5.4
Tift	3612	5	3.77
Sweet Common	3340	6	4.37
Wheeler	2977	7	5.05
Sweet 372	2323	8	5.42
Sweet 372 (S-1)	1851	9	5.39
Common	1543	10	3.82

TABLE VII. — Forage Yields of oven-dry hay from fertilized, irrigated Blue Panic El Reno, 1955.

1st Cutting		2nd Cutting		
1st Treatment Applied 4-28-55	Yield per acre	2nd Treatment Applied 6-30-55	Yield per acre	% Nitrogen
0	2105	0	2443	.59
120-0-0	3557	120-0-0	4476	.72
360-0-0	4610	360-0-0	5053	1.22
120-360-0	3521	120-360-0	4396	.69

(PART II)

SOUTHEAST OKLAHOMA PASTURE FERTILITY RESEARCH STATION
Coalgate, Oklahoma

Soil Fertility Studies for Improved Pasture
Production in Southeast Oklahoma
Project 881

By J. G. Lynd

The principal objectives of this research are to determine practical and efficient means of fertilizing improved pastures. Kinds, rates, and methods of fertilizer application are compared on various land types and different grass-legume combinations.

These experiments are mainly located at the Southeast Oklahoma Pasture Fertility Station near Coalgate. This station consists of 26 various sized pastures occupying 580 acres. Three experimental herds consisting of 169 yearling steers are used in the grazing experiments. Six permanent nursery studies with improved forage crops receiving various soil fertility treatments are established for screening promising pasture species.

Particularly outstanding, at present, are the perennial cool season grass-legume pastures. These include tall fescue, orchard grass, brome, alfalfa, white and Ladino clovers. Greenfield, Midland, and Coastal Bermuda grass pastures have been established at the station and offer good possibilities for improving per head gains.

Small grains seeded in dormant Bermuda sod have possibilities for furnishing some high protein winter forage. Experiments on this station have shown the necessity for high fertilizer rates, particularly nitrogen, to obtain success in this program.

The proper time and method of application is as important as the kinds and rates of fertilizer used for efficient and profitable returns. There is no question but that band seeding of grasses and legumes over deeper placed fertilizer bands is the most effective and efficient.

Low level feeding of phenothiazine in the wintering program, combined with periodic drenchings when the steers are on pasture, has been effective for internal parasite control within the experimental herds.

Recent Publications:

Pasture Grazing Trials on Various Land Types. Okla. Agri. Exp. Sta. Bul. B-445. January, 1955.

Effect of Aureomycin on Wintering Steer Calves. 28th Feeders Day Report. April, 1954.

Grass-Legume Band Seeding with a Shoe Type Drill. Agron. Jour. 47:195-196, 1955.

A Scale Rack and Procedure for Rapid, Precise Cattle Weights. Agron. Jour. 47:440, 1955.

PASTURE MANAGEMENT STUDIES, 1955

By W. C. Elder

This is a report of grazing results of cattle on different pastures at the Heavener and Stillwater Experiment Stations. Heavener is located in LeFlore County in extreme southeastern Oklahoma. In general, conditions were good for forage growth at Heavener both for winter and summer growing species. Dry weather in the winter of 1954-1955 prevented grazing of winter pastures until March at Stillwater and dry conditions in the summer of 1955 resulted in gains below expectations.

Grade Hereford cattle were used in evaluation of the forage crops. One-year old heifers were used at Stillwater and one-year old steers and a cow-calf herd at Heavener. All the one-year old animals were wintered alike. The steers gained 64 pounds each in 124 days before grazing started at Heavener, and the heifers gained 62 pounds each for the same period for the Stillwater pastures. All ancestry records are kept of each animal to be used on the pastures. In many tests it was possible to use off-spring from one sire in comparative pasture studies.

HEAVENER STATION

Effect of Fertilizers on Bermuda grass - Winter Clover Pastures.

High rainfall and low soil fertility in this section of Oklahoma makes commercial fertilizer use important in all improved pasture programs. In this test, an area of land long established to common Bermuda, Black Medic, Hop and White clover was divided into four small pastures in 1949. Two of these pastures received 200 lb. 0-20-0 superphosphate and 33 lb. muriate of potash per acre annually. Two tons of agricultural lime per acre was applied on the fertilized pastures in 1949. In the other two pastures no fertilizer nor lime has been used since 1948. One-year old steers in these pastures have been weighed every month during the grazing season for the last six years. Table I gives the daily animal gain, carrying capacity of pastures and beef production per acre for the 1955 grazing season.

The beef gain per acre was much higher in 1955 than the last five-year average. Beef gains per acre for the last five years have averaged 265 pounds per acre for the fertilized, and 174 pounds per acre for the unfertilized pastures. In 1955 fertilized pastures averaged 332 pounds and unfertilized pastures 237 pounds per acre. The long grazing season contributed some to the high production in 1955, but the greatest factor was high gains in October. In only two years of the last six, has this month contributed to the total beef production. The results of 1955 grazing were similar to past years except for October. High daily gain and acre production occurred in April and May, with some reduction in June. Little gain was made in July, 1955 but this is true also for many of the years in the past at this station. Low production in July is probably due to several factors. High humidity, hot and calm weather may reduce grazing time. Also, cattle are in good condition because of the 2 pounds per day average gain for the early months of grazing. Cattle may have some difficulty changing from a grass legume nation to Bermuda grass alone. Preventing the summer slump of production on Bermuda-legume pastures in eastern Oklahoma would be a worthy project.

The fertilizer program in this test has increased beef production for an average of 92 pounds per acre annually for six years over non-fertilized pastures. It has not increased gain of the individual animals for the entire year. Steers

in the fertilized pastures make more gain early, due to clover production, but usually gain less in the summer months. The high production obtained on the unfertilized pastures is due to treatments made before the experiment was started. This area had been in pasture for 12 years and sufficient phosphorus had been used to obtain good growth of annual clovers. In 1955, seven years after fertilizers were discontinued, there was still a good stand and growth of annual winter legumes (Hop and Medic).

Bermuda Grass and Vetch Pastures

Vetch planted in Bermuda grass in 1950 has been one of the most productive pastures on the Heavener station. The vetch has reseeded in the Bermuda grass each year with good management. Vetch has produced more nitrogen for use of the grass in summer months than the quick maturing annual clovers. Table II gives results of the 1955 grazing. One animal in this pasture gained less than 100 pounds for the season, which altered the final result appreciably. A post morten examination after the grazing season did not give any clue as to why this animal did not gain weight as did the other steers.

Ladino-Fescue Pasture

This combination during favorable seasons has produced more beef per acre than any other pasture. Unfortunately, the dry seasons of 1952, 1953, 1954 and 1955 destroyed all ladino clover in the summer months. Much of the gain in 1955 was from volunteer annual clovers. Fescue survived the drouth in good shape. Cattle had to be removed from the pasture in July because all young ladino clover was killed and the fescue became dormant. Grazing results for this pasture combination are given in Table II.

Dallis Grass - Legume Pasture

Legumes in this pasture vary each year. Usually Hop Clover and Black Medic are dominant in the spring months. Ladino and small white clovers will show up well in some years. Common lespedeza may make up a large percent of the sward in summer months. Dallis grass has withstood the drouth years in good shape. It does not have the summer carrying capacity of common Bermuda grass. During the wet season of 1950-1951 Dallis grass invaded Bermuda on the Heavener station. During the dry years the reverse has been true. Cattle preferred the Dallis grass over the Bermuda grass if they had a choice. Table II gives grazing results for 1955 on Dallis grass.

Fescue-Alfalfa Pasture

Alfalfa fertility studies for several years on the Heavener station has made it possible to grow this fine forage crop on the well drained, but low fertility soils. Fescue and alfalfa were planted in 7 inch alternate rows on a small pasture in the fall of 1954. Good beef gains were secured from this pasture in May and June, but cattle were removed on July 1st to allow good alfalfa establishment. If this combination can be grown successfully it will be a great aid for the pasture program in eastern Oklahoma.

TABLE I -- 1955 Grazing Results on Fertilized and Unfertilized Common Bermuda Grass, Hays, White Clover pastures - Heavener

Weighing Dates	Pasture No. 1 /1			Pasture No. 2			Pasture No. 3 /1			Pasture No. 4		
	Acres Per head	Daily gain (lbs.)	Gain P/A (lbs.)	Acres per head	Daily gain (lbs.)	Gain P/A (lbs.)	Acres per head	Daily gain (lbs.)	Gain P/A (lbs.)	Acres per head	Daily gain (lbs.)	Gain P/A (lbs.)
3/23-4/22	.7	2.2	89	1.1	2.3	63	.8	1.9	66	1.4	2.1	43
4/23-5/27	.7	2.3	109	1.1	2.0	60	.8	1.8	70	1.4	2.2	52
5/28-6/29	.7	1.5	63	1.1	1.6	45	.8	1.6	58	1.4	2.0	42
6/30-7/29	.7	.3	13	1.1	.2	4	.8	.3	9	1.4	.4	9
7/30-8/31	.7	.5	23	1.1	.4	9	.8	1.1	40	1.4	1.5	33
9/1 -9/27	.7	.6	25	1.1	.6	16	.8	.6	20	1.4	1.1	20
9/28-11/4	.7	.9	45	1.1	1.6	52	.8	1.2	52	1.4	1.3	33

Average gain per acre 1955 -- fertilized 332 lbs. and unfertilized 237 lbs.
Average gain for steers on pastures for 224 day grazing season was 288 lbs. each.

/1 Pastures 1 and 3 receive an annual application of 200 pounds of 0-20-0 superphosphate and 33 pounds of muriate per acre. Pastures 2 and 4 have not received any fertilizer since 1948.

TABLE II. — Beef production on Bermuda Grass-Vetch, Fescue-Ladino and Dallis Grass-Legume Pastures; Heavener, 1955

Weighing Dates	Pounds of Beef per acre Gain				
	Bermuda Grass-Vetch			Fescue-Ladino	Dallis Grass-Legume
	Acres per head	Daily gain lbs.	lbs. P/A		
3/23-4/22	1.0	1.9	57	27	34
4/23-5/27	1.0	1.7	57	108	81
5/28-6/29	1.0	1.4	42	61	55
6/30-7/29	1.0	- .3	- 8	19	14
7/30-8/31	1.0	.8	25		40
9/1- 9/27	1.0	.7	18		18
9/28-11/4	1.0	1.1	38		35
Total lbs. Beef P/A			228	215	277

STILLWATER (AGRONOMY FARM)

Several small pastures have been established on the Experiment Station in the last five years. Different forage species and combinations are evaluated with grazing animals. Included in the studies are management practices and effect of commercial fertilizers on the crops.

Common Bermuda Grass with Nitrogen Fertilizer.

One pasture has 150 pounds of 33 per cent ammonium nitrate applied in April and repeated in July; the other pasture is not fertilized. These pastures have a good cover of common Bermuda grass and are located on high fertility soils. Table III gives results of the 1955 grazing season. In this study one pound of nitrogen has produced one and one-half pounds of beef. This increase is lower than that reported by many of the southern states. Dry weather has complicated management in the fertilized pasture. Animals are added or removed from the pastures to maintain ample forage for grazing. Where nitrogen is used the animals must be changed often, depending on the moisture conditions.

Midland Bermuda Grass Pastures.

Midland Bermuda grass, a new hybrid released from the Oklahoma Experiment Station in 1953, was planted in two 3 acre pastures in the summer of 1951. One pasture was planted to legumes, with hairy vetch dominating, and fertilized annually with 200 pounds of 0-20-0 superphosphate per acre. The other pasture was fertilized with 50 pounds per acre of nitrogen in April and again in July. Table IV gives grazing results for 1955. Irrigation was started on the legume pasture July 1, 1955. Previous grazing records in these pastures show legumes to be more productive than commercial nitrogen fertilizer. Usually the legume pasture can be grazed one month earlier than the nitrogen fertilized Bermuda grass. The Midland Bermuda grass pasture, fertilized with nitrogen has a lower production record than the common Bermuda grass treated similarly in Table III. This is due to the poor soil situation for the Midland pasture. This pasture is producing only one pound of beef for each pound of nitrogen used.

Fescue-Alfalfa and Brome-Alfalfa Pastures.

Two pastures were planted in October, 1951. Kentucky #31 fescue was drilled in 14 inch rows and the alfalfa (Buffalo) planted between each grass row. The second pasture was planted the same way with Southland brome and alfalfa. Two hundred pounds of 0-20-0 superphosphate per acre has been applied on the pasture in October each year. Soils for this study are classified as IV, or very low fertility, for alfalfa and brome grass production. Carrying capacity of these pastures has been lower than the Bermuda grass on similar soils. Bermuda grass will produce more beef per acre, but the alfalfa and grass pastures have a longer grazing period and the animals will make greater daily gain. The severe drouth of 1954 destroyed all the fescue except in some favorable moisture areas. Brome withstood the dry conditions equally as well on the poor sites and much better on the better soils. Observation made on several plantings of fescue on the different Experiment Stations over the state indicates that the loss of stand was due to dry weather in the fall months, and not during the dry hot summer months.

Alfalfa withstood the long dry weather in good shape in 1954. Grazing was delayed in 1955 until alfalfa was in the bloom stage of growth to prevent bloat. Bloat has not been a problem in these pastures when fescue and brome were a part of the sward. 1955 grazing results in Table V are not impressive if beef per acre is the criteria. The daily gain of 1.3 pounds per animal is important during July, August, and September.

Rye, Barley and Vetch Winter Pastures.

Moisture conditions were sufficient to permit establishment of winter pastures in the fall of 1954, but insufficient to produce grazing forage until March, 1955. Dry weather in May limited the spring grazing time. Table VI gives grazing results for three winter pastures. The No. 1 pasture on upland soil was equal to No. 3 continuously grazed on bottom soil. Fertility has been built up in No. 1 by manure from animals for 4 previous years and some of the vetch has been turned under near the end of each grazing season. Pasture No. 2 and Pasture No. 3 have been cropped to wheat in the past and summer fallowed.

Pastures No. 2 and 3 were treated the same in every respect except in grazing management. No. 2 was divided into four parts and animals moved from one area to another in an effort to maintain forage crops in an optimum stage of growth for best grazing. Animals made about the same gain daily on these pastures, but more forage was built up in the rotated pasture at the end of the season, making it necessary to increase the stocking rate, and increased our yields 15%. Five hundred pound animals gained 1.5 pounds daily on these pastures in 1955. This high gain has been maintained in the past on similar pastures for a longer grazing season.

Pastures No. 2 and 3 irrigated and planted to rye, barley and vetch in September, 1955 produced approximately 200 pounds of beef per acre by January 1, 1956.

TABLE III. -- Beef Cattle Gains on Common Bermuda-grass Pastures; Fertilized with Ammonium Nitrate and Unfertilized, Stillwater, 1955.

Weighing Dates	Nitrogen Fertilizer /1			Non-fertilized		
	Acres per head	Gain per acre (lbs.)	Daily gain per head (lbs.)	Acres per head	Gain per acre (lbs.)	Daily gain per head (lbs.)
4/5-5/7	.9	78	2.3	1.4	40	1.7
5/8-6/3	1.4	20	1.2	1.4	31	1.6
6/4-7/6	.9	45	1.3	1.4	33	1.4
7/7-8/4	.9	45	1.5	1.4	24	1.2
8/5-9/6	.9	30	.9	1.4	27	1.0
9/7-10/6	.9	3	.1	1.4	7	.3
10/7-10/25	.7	- 6	- .3	.9	- 7	- .4
Total Gain		235			155	

/1 50 lbs. of nitrogen applied in April and again in July.

TABLE IV. — Beef Cattle Gains on Midland Bermuda-grass Pastures with legumes vs. Fertilization with Ammonium Nitrate, Agronomy Farm, Stillwater, 1955.

Weighing Dates	With Legumes /1 Acres per head	Gain per acre (lbs.)	Daily gain per head (lbs.)	With Ammonium Nitrate /2 Acres per head	Gain per acre (lbs.)	Daily gain per head (lbs.)
3/30-5/3	.75	78	1.7			
5/4-6/3	1.0	27	.9			
4/23-6/3				1.5	42	1.5
6/4-7/6	1.0	35	1.1	1.0	38	1.2
7/7-8/4		130		1.5	20	1.1
8/5-9/6	Started irrigation and			1.5	18	.9
9/7-10/6	fertilization study.			1.5	12	.6
10/7-10/25				1.0	20	1.2
			Total lbs. P/A		150	

Beef gain per acre with legumes (1952-313 lbs.) ('53-231 lbs.) ('54-215 lbs.)
Beef gain per acre with nitrogen (1952-180 lbs.) ('53-182 lbs.) ('54-161 lbs.)
/1 More than 90% of the legumes is Vetch.
/2 50 lbs. N. was applied in April and again in July.

TABLE V. — Beef Gains from Alfalfa - Fescue & Alfalfa - Brome Pastures. Oklahoma Experiment Station, Stillwater, 1955.

Weighing Dates	Fescue - Alfalfa Acres per head	Gain per acre (lbs.)	Daily gain per head (lbs.)	Brome - Alfalfa Acres per head	Gain per acre (lbs.)	Daily gain per head (lbs.)
5/18-7/6	2.0	36	.9	2.0	31	.8
7/7-8/4	1.3	26	1.3	1.3	29	1.4
8/5-9/6	1.3	39	1.6	1.3	36	1.5
9/6-10/20	2.0	26	1.2	2.0	26	1.2
Total Gain		127			122	

TABLE VI. -- Beef Gains from Winter Pastures of Rye, Barley and Vetch, Oklahoma Experiment Station, 1954-1955.

Weighing Dates	Pasture No. 1 /1 Continuous Grazed			Pasture No. 2 Rotation Grazed			Pasture No. 3 Continuous Grazed		
	Acres per head	Gain per acre (lbs.)	Daily gain per head (lbs.)	Acres per head	Gain per acre (lbs.)	Daily gain per head (lbs.)	Acres per head	Gain per acre (lbs.)	Daily gain per head (lbs.)
3/9-4/19	.5	115	1.5	.5	115	1.5	.5	103	1.4
4/20-5/17	.6	61	1.5	.4	93	1.4	.3	69	1.5
Total Gain		176			208			172	

/1 Pasture No. 1 soil is upland Class IV and No. 2 and No. 3 are bottom soils Class II.

Irrigation and Fertilization of Midland Bermuda Grass, Stillwater, 1955

This experiment was started July 1, 1955 in part of a Midland Bermuda grass pasture overseeded with legumes. Some vetch growth was present in the pasture during April and May but in July no legumes were growing. One hundred pounds of nitrogen per acre was applied, broadcast, on July 1 and repeated August 1. A sprinkler irrigation system was used that applied 1/3 inch of water per hour. Frequency of watering depended on several factors. During the high production months of July and August it was necessary to use 0.3 inch of water daily. If no rain fell during the period, the irrigation system was run 8 to 9 hours at night every 10 days. Three inches of water could be applied at one time without appreciable run-off. Soils in this pasture are Port loamy and Renfrow complex. Port soil is alluvial, permeable stratified clay and sandy layers. Renfrow is loam to light clay loam on surface and blocky clay subsoil. The heavy turf of Bermuda grass was a great aid in holding this large quantity of moisture. Soil moisture and available nitrogen were very low when the test started.

The pasture was divided into 4 equal parts to facilitate rotation grazing. Animals were grazed on each area for 5 days making 15 day intervals between grazing periods.

Table VII gives results of the animal gains for 90 days of grazing. Gains were low in September, primarily because of nitrogen shortage. In this test it appears that Midland Bermuda grass with good moisture conditions can use 100 pounds of nitrogen every 30 days. Clippings were made before and after grazing of each area for total dry weight and protein content of the forage.

During the high production months of July and August, the forage analyzed an average of 14.4 per cent protein for all clippings made before grazing started in each area. Clippings made five days later, or when cattle were removed from the pasture, averaged only 10.9 per cent protein. In September protein content of forage dropped to 11 per cent at the start of the grazing period and 9 per cent after grazing was completed. Moisture content of forage was 66.5 per cent before grazing in July and August, and 58.6 per cent after grazing. In September, moisture before grazing was 58.8 per cent and 52.9 per cent after the grazing period.

These facts may explain why the cattle were always anxious to move into another pasture after the second or third day of grazing. Not only was the moisture and protein lower at the end of the grazing period, but the tall growing Midland variety becomes more stemmy and less leafy with short grazing. The cattle were most dissatisfied in this pasture in September. Three months of constant grazing of Bermuda grass alone seemed to cause a desire for other forage plants. When the cattle were moved to and from weighing scales, many weeds were consumed that were not grazed by cattle from other pastures.

Daily gain per animal was disappointing in this pasture. One pound per day from animals weighing 600 to 700 pounds on forage testing 12 to 14 per cent protein is low and should be a lead to further investigations.

One of the major grazing problems was the large number of droppings caused by the high carrying capacity. The tall vegetation around each dropping was not grazed unless forage became low in other parts of the pasture.

A small area in the irrigated fertilized pasture was fenced for clipping studies. Fertilizer treatments were 0-50, 100 and 200 pounds nitrogen per acre, applied July 1 and repeated again August 1. One set of plots was clipped every 20 days or the same time as required for cattle to complete the rotation grazed pasture. The other group of plots was clipped as for hay or 30 to 40 days apart.

Tables VIII and IX give results of the clipping tests. More forage was produced by less frequent clipping but more nitrogen was recovered in the fertilized plots if clipped often. Plots treated with 50, 100 and 200 pounds of nitrogen per acre and cut for hay recovered 37 per cent, 42 per cent and 38 per cent of the nitrogen applied respectively. When the Bermuda grass was cut every 20 days, as for pasture, the nitrogen recovery in forage was 68 per cent for 50 pounds of nitrogen per acre applied, 59 per cent for 100 pounds nitrogen and 45 per cent for 200 pounds nitrogen applied.

TABLE VII. — Grazing Results of Midland Bermuda grass under Irrigation and Fertilized with Ammonium Nitrate, Stillwater, 1955. /1

Grazing Dates	Head per acre /2	Daily Gain	Pounds Beef per acre
7/6-8/3	4.5	1.06	137
8/4-9/5	5.0	.9	157
9/6-10/3	5.0	.4	55
Total			349

/1 300 lbs. of Ammonium Nitrate applied July 1st and repeated again August 1st.
/2 Animals used in the pasture were Hereford heifers weighing 600 to 700 lbs. each.

TABLE VIII. -- Results of Clipping Midland Bermuda Grass under Irrigation and with Different Amounts of Nitrogen Fertilizer.

Date	Treatment /1	# Forage per acre /2	Protein per cent	# Protein per acre
7/11	Ck	1540	11.31	174.2
7/11	50# N/A	1845	13.52	249.4
7/11	100# N/A	1700	15.72	267.2
7/11	200# N/A	1707	18.00	307.3
7/30	Ck	618	12.00	111.2
7/30	50# N/A	1642	14.19	232.9
7/30	100# N/A	2365	16.25	384.3
7/30	200# N/A	3355	18.19	610.3
8/23	Ck	1072	13.31	142.7
8/23	50# N/A	2495	15.25	380.5
8/23	100# N/A	2791	18.44	514.7
8/23	200# N/A	2528	21.63	546.8
9/16	Ck	529	13.25	70.1
9/16	50# N/A	466	14.38	67.0
9/16	100# N/A	500	14.84	74.2
9/16	200# N/A	990	17.56	173.8

Four cuttings	Total Protein	Total Yield
Ck	498.2 lbs. P/A	3759 lbs. P/A
50# N/A	929.8 " "	6448 " "
100# N/A	1240.4 " "	7356 " "
200# N/A	1638.2 " "	8580 " "

/1 Nitrogen was applied broadcast as Ammonium Nitrate July 1st and repeated August 1st.

/2 Average of four replications.

TABLE IX. -- Midland Bermuda Grass Hay Production under Irrigation and Fertilized with Ammonium Nitrate.

Date Cut	Treatment	# Forage per acre	Protein per cent	# Protein per acre
8/2	Ck	3291	10.25	337.3
8/2	200# N/A	6525	15.03	980.7
8/2	100# N/A	6091	10.94	666.4
8/2	50# N/A	4622	10.19	470.9
9/13	Ck	2234	11.40	254.7
9/13	200# N/A	3771	15.03	566.8
9/13	100# N/A	3814	11.65	444.3
9/13	50# N/A	3180	10.47	332.9

Total	Two cuttings	Total Forage	Total Protein
	Ck	5525 lbs. P/A	592.0 lbs. P/A
	50# N/A	7802 " "	803.8 " "
	100# N/A	9905 " "	1110.7 " "
	200# N/A	10296 " "	1547.5 " "

APPENDIX A

Table II — Standard Alfalfa Test — Oven dry hay; Average of 4 replications (planted Oct. 1, 1953; cut June 1, July 6, August 8, and September 15, 1955) El Reno, Oklahoma. Soil type and texture — Brewer, clay loam.
L. S. D. 5% = 2238 lbs.

Table II — Standard Brome Test — Oven dry hay; Average of 4 replications (planted Sept. 29, 1953; cut June 2 and November 10, 1955) El Reno, Okla. Soil type and texture — Brewer, clay loam.
L. S. D. 5% = 1483 lbs.

Table II — Standard Fescue Test — Oven dry hay; Average of 4 replications (planted Sept. 29, 1953; cut June 1 and November 10, 1955) El Reno, Okla. Soil type and texture — Brewer, clay loam.
L. S. D. 5% = 2032 lbs.

Table II — Standard Orchard grass Test — Oven dry hay; Average of 4 replications (planted October 1, 1953; cut June 2, 1955) El Reno, Oklahoma. Soil type and texture — Brewer, clay loam.
L. S. D. 5% = 838 lbs.

Table II — Grass-Legume Mixture Test — Oven dry hay; Average of 4 replications (planted October 20, 1953; cut May 6, August 9, and Nov. 10, 1955) El Reno, Oklahoma. Soil type and texture — Brewer, clay loam.
L. S. D. 5% = 2345 lbs.

Table III— Standard Alfalfa Test — Oven dry hay; average of 3 replications (planted Sept. 11, 1953; cut June 11, July 13, and August 11, 1955) Goodwell, Oklahoma. Soil type and texture — Zita, clay loam*.
L. S. D. 5% = 1503 lbs.

Table III— Standard Brome Test — Oven dry hay; average of 2 replications (planted Sept. 11, 1953; cut June 11, 1955) Goodwell, Oklahoma. Soil type and texture — Zita, clay loam*.
L. S. D. 5% = 543 lbs.

Table III— Standard Wheatgrass Test — Oven dry hay; Average of 4 replications (planted Sept. 11, 1953; cut June 11, 1955) Goodwell, Oklahoma. Soil type and texture — Zita, clay loam*.
L. S. D. 5% = 687 lbs.

Table III— Standard Sudangrass Test — Oven dry hay; Average of 4 replications (planted June 4, 1955; cut July 27, Sept. 1, Oct. 20, 1955) Goodwell, Oklahoma. Soil type and texture — Richfield, clay loam.
L. S. D. 5% = 1690 lbs.

Table III— Standard Millet Test — Oven dry hay; Average of 4 replications (planted June 4, 1955; cut July 27, Sept. 1, Oct. 20, 1955) Goodwell, Oklahoma. Soil type and texture — Richfield, clay loam.
L. S. D. 5% = 1389 lbs.

Table IV -- Standard Lespedeza Test -- Oven dry hay; Average of 4 replications.
(planted March 31, 1955; cut September 17, 1955) Perkins, Oklahoma.
Soil type and texture -- Norge, fine sandy loam.
L. S. D. 5% = 381 lbs.

Table IV -- Standard Sweet Clover Test -- Oven dry hay; Average of 4 replications.
(planted May 14, 1954; cut June 3, 1955) Perkins, Oklahoma.
Soil type and texture -- Norge, fine sandy loam.
L. S. D. 5% = 1452 lbs.

Table IV -- Standard Sideoats Grama Test -- Oven dry hay; Average of 8 replications
(planted May 29, 1952; cut June 30, Sept. 20, 1955) Perkins, Oklahoma.
Soil type and texture -- Norge, fine sandy loam.
L. S. D. 5% = 358 lbs.

Table IV -- Standard Sudangrass Test -- Oven dry hay; Average of 4 replications
(planted May 16, 1955; cut June 24, July 18, 1955) Perkins, Oklahoma.
Soil type and texture -- Teller, very fine sandy loam.
L. S. D. 5% = 594 lbs.

Table IV -- Standard Vetch Test -- Oven dry hay; Average of 4 replications
(planted Oct. 26, 1954; cut June 10, 1955) Perkins, Oklahoma.
Soil type and texture -- Norge, fine sandy loam.
L. S. D. 5% = 1524 lbs.

Table V -- Standard Sudangrass Test -- Oven dry hay; Average of 4 replications
(planted May 13, 1955; cut July 17, 1955) Heavener, Oklahoma.
Soil type and texture -- Waynesboro loam.
L. S. D. 5% = 545 lbs.

Table V -- Standard Millet Test -- Oven dry hay; Average of 4 replications
(planted May 13, 1955; cut July 17, 1955) Heavener, Oklahoma.
Soil type and texture -- Waynesboro loam.
L. S. D. 5% = 560 lbs.

Table VI -- Standard Sudangrass Test -- Oven dry hay; Average of 4 replications
(planted May 12, 1955; cut July 14, Sept. 8, 1955) Idabel, Oklahoma.
Soil type and texture -- Kirvin, very fine sandy loam.
L. S. D. 5% = 1559 lbs.

Table VI -- Standard Millet Test -- Oven dry hay; Average of 4 replications
(planted May 12, 1955; cut July 14, Sept. 8, 1955) Idabel, Oklahoma.
Soil type and texture -- Kirvin, very fine sandy loam.
L. S. D. 5% = 1030 lbs.