

OSU
Collection

Seasonal Forage Production For Small Grains Species in Oklahoma

**Charles E. Denman
James Arnold**



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that if small grains are planted in early September at the Muskogee Station, one may harvest fairly large amounts of forage in November and December if climatic conditions are favorable. Production at the Muskogee Station is generally limited in January and February and is usually quite good during March and April. Practically the same trends have been recorded at the Perkins Station. Yields of forage have not been good at the Mangum Station in the fall and early winter months due primarily to a lack of moisture for early planting and for plant growth once stands are established.

Small grains forage yields at the Panhandle Station at Goodwell have been very good. These plots have received liberal amounts of irrigation water each year (12 to 24 inches) and 80 to 120 pounds of actual nitrogen fertilizer applied in split applications during the growing season. Small grains grown for forage in the Panhandle area should be planted from mid to late August. Forage has been harvested as early as late September at this station. Forage production at Goodwell, when irrigated, is usually quite good through October and November and becomes very limited through December, January, and February. Production is then very good through March, April, and May and limited production is often obtained during the early part of June.

Available Moisture

Probably first in importance in small grain forage production is available soil moisture. This is generally governed by previous cropping systems, the amount of naturally occurring rainfall or the availability of irrigation water.

Rainfall at the various testing stations can be observed in Table 1 for Perkins, Table 6 for Mangum, Table 14 for Muskogee, and Table 20 for the Panhandle Experiment Station. The irrigation schedule at the Panhandle Station is presented in Table 21.

Temperature

The temperature is also a limiting factor to plant growth at various intervals through the winter season. This is easily observed by low yields of forage obtained over most of the state during January and February. When temperatures drop to 40°F or lower practically all forage growth stops.

Temperature readings for the various Stations may be observed in Table 2 for Perkins, Table 7 for Mangum, Table 15 for Muskogee and Table 22 for the Panhandle Station.

Soil Fertility

If moisture and other factors are not limiting all small grains respond to soil fertility. Under dryland conditions small grains will usually respond favorably to 60 to 100 pounds of actual nitrogen fertilizer and from 100 to 150 pounds when irrigated. Small grains also respond to phosphorus and potash if these elements are deficient in the soil.

Planting Rates

Planting rates of the various small grain species varies somewhat from eastern to western Oklahoma with generally heavier rates planted in the eastern sections because of more rainfall. In general, for grain production, about one bushel of seed of wheat or rye per acre is planted and two bushels per acre for barley or oats. One may plant slightly larger amounts than the rates listed above if the crop is to be used solely for pasture with no plans for harvesting a grain crop.

Seasonal Production

On a seasonal basis rye usually is the top forage producer during the fall and early winter months. It flourishes again in March and declines rapidly during April and May. Barley is generally comparable or slightly superior to wheat in early fall and like rye, is quite productive in early March. Wheat becomes productive in March and remains productive somewhat longer than barley, oats, or rye. Oats are generally productive in fall and early winter but suffer more from low temperatures than the other small grain species. Stands of the various winter oat varieties are often severely depleted because of winter kill.

In general small grain forage production in Oklahoma is fairly good but variable moisture and temperature conditions from year to year makes it quite difficult to predict forage yields for the various species with certainty.

Total Forage Production

It has been found that rye produces the most total forage of the small grain species followed in order by barley, wheat, and oats. Knowledge about time of production during the growing season is often more important to the livestock producer than knowing total production for a forage such as the small grains. The tables that follow present long time averages of forage production of the various species by months and years. Only two years data is presented for the Perkins Station because of highly erratic results that were obtained the past few years.

Seasonal and total forage yields may be observed in tables 3, 4, and 5 for Perkins, tables 8, 9, 10, 11, 12, and 13 for Mangum, tables 16, 17, 18, and 19 for Muskogee, and tables 23, 24, 25, 26, and 27 for the Panhandle Experiment Station.

Implications for Grazing Management

Small grains forage is high-quality forage which produces excellent steer gains or it can be used to provide needed protein supplements for dry cows by rationing the amount of grazing time on small grains.¹

Protein content of small grains forage is high throughout winter and early Spring and a summary of previous research is presented in Table 28.

The seasonal production pattern of small grains presents problems to livestock management. Varieties which produce high yields in fall and winter should be used. Low production in mid-winter may necessitate feeding of supplemental hay and grain. With the flush of spring growth excess forage is often available. For those planning to graze through May, a much smaller acreage will support the Spring grazing than is required to support the cattle until March.

Varietal Descriptions

Many of the small grain varieties tested have been available for quite some time whereas several of the varieties are relatively new. Following are brief descriptions of the various varieties among the 4 species tested.

Wheat

Agent wheat was developed at the Oklahoma Agricultural Experiment Station and released in 1967. It is resistant to all known races of leaf rust in Oklahoma and carries acceptable resistance to all common races of stem rust. Agent is slightly taller than triumph and is mid-season in maturity. It is equal to Triumph in milling and baking qualities, and reaction to smuts and mosaic viruses, but the grain is lower in test weight.

C. I. 13874 is an experimental wheat that is being considered for possible future release as a variety.

Danne Wheat is similar to Triumph in maturity, test weight — winter hardiness, straw strength, disease and insect resistance. It is slightly shorter than Triumph, higher yielding and better in baking quality.

¹ Elder, W. C., Oklahoma Agr. Exp. Sta. Bul. 654. Winter grazing small grains in Oklahoma. June, 1967.

Danne 146-4 is an experimental wheat entry from the Joseph Danne collection of breeding material.

Improved Triumph wheat was developed and released by Mr. Joseph Danne in about 1942. It is similar to the Triumph variety in appearance, most disease reactions, and in milling and baking properties.

Triumph 64 wheat was developed and released by Mr. Joseph Danne in 1948 as Rust Resistant Triumph. It is, however, not rust resistant and was re-named Triumph 64 in 1964. Triumph 64 is similar to the original Triumph in maturity, straw strength, insect and disease reaction, and baking properties. It exceeds Triumph in yield, loaf volume, and test weight.

Kaw 61 wheat was released by the Kansas Agricultural Experiment Station in 1961 to replace Kaw. The original Kaw was released jointly by Kansas and Oklahoma Agricultural Experiment Stations in 1960. Kaw 61 is a reselection for purity for resistance to stem rust race 56. It has outstanding test weight and baking qualities. It is resistant to bunt and shows "mature plant" tolerance to leaf rust. Kaw 61 is susceptible to loose smut, soil borne-mosaic, wheat streak mosaic, and Hessian fly. It is lacking in straw strength and often has a high degree of lodging. Kaw 61 is mid-season in maturity.

Parker wheat was developed by the Kansas Agricultural Experiment Station and was released by that station in 1966. It has stiff straw and is resistant to leaf rust and the Hessian fly. It is susceptible to stem rust, soil-borne mosaic, wheat streak mosaic viruses, bunt, and loose smut. Parker has good tillering ability which enhances its use for winter grazing. Parker's maturity is between that of Triumph and Wichita. It has some desirable baking qualities but loaf volume potential is below average.

Scout wheat was developed at the Nebraska Agricultural Experiment Station and was released in 1963. Scout has demonstrated high grain yield potential over a wide range of environmental conditions. It shows resistance to leaf and stem rust, loose smut, and some tolerance to wheat streak mosaic. Scout is susceptible to bunt, Hessian fly, and soil-borne mosaic. Leaf burning, probably from high Spring temperature, has been observed to affect the variety in Oklahoma. In most cases, leaf burning has not reduced grain yields. Scout has better milling and baking qualities than Wichita or the Triumph varieties. Scout is mid-season in maturity.

Sturdy wheat was developed by the Texas Agricultural Experiment Station and the U.S.D.A. Sturdy was released in 1966. The variety is short statured with strong straw and shows strong resistance to lodging. Sturdy was resistant to the leaf rust races in Texas when released but is susceptible to some of the local races. It is also susceptible to powdery mildew.

Maturity of sturdy is about the same as Kaw 61. Sturdy grain has good quality characteristics but has lower test weight than Triumph.

Yukon wheat is a development of the DeKalb Agricultural Research program and is suggested for West-North Central Texas, Oklahoma, and southern Kansas. Its female parental type was a hybrid derivative having Norin 10 as a parent. The male parent is described as an outstanding Texas variety having excellent milling and baking properties. Yukon is 6 inches shorter and 4 days earlier than Tascosa, and has very strong straw. It has been described as a promising forage-grain type because of excellent tillering ability. Yukon is described as having excellent resistance to soil-borne mosaic, but as being susceptible to leaf rust, bunt, and possibly moderately susceptible to loose smut.

Barley

Kerr barley was released by the Oklahoma Agricultural Experiment Station in 1969. It is the result of a cross between Rogers x Omugi. It resembles Rogers in head characteristics and plant type, but tillers more profusely. It, like Will, has resistance to the greenbug and is more winter-hardy than Rogers. One of the more important characteristics of Kerr is its high test weight. Experiment Station tests showed it to exceed Rogers by 0.8 pounds per bushel and Will by 2.6 pounds per bushel.

Rogers barley was developed by the Oklahoma Agricultural Experiment Station and released in 1958. It is a six-row strain with rough-awns, is mid-tall, medium maturing, stiff strawed, mildew resistant, and has good test weight. Rogers is not greenbug tolerant.

Will barley was developed by the Oklahoma Agricultural Experiment Station and released in 1963. It is a six-rowed, rough-awned, mid-tall winter barley that is mid-season in maturity. Will has a very high degree of tolerance to greenbugs and powdery mildew and has shown no loss from smut. It is more winterhardy than Rogers but does not have the good test weight of Rogers.

Oats

The Bronco oat variety was developed at the Texas Agricultural Experiment Substation No. 6, Denton, Texas, in cooperation with the U.S.D.A. and was released in 1956. It is susceptible to stem rust and most races of crown rust. It is resistant to soil-borne winter oat mosaic and has satisfactory resistance to Victoria blight. Bronco is 7-10 days later and 5 to 8 inches taller than Cimarron. It has a prostrate growth habit during early winter and responds slowly to periods of warm weather.

The Cimarron oat variety was developed by the Oklahoma Agricultural Experiment Station and was released in 1954. It is early in maturity and will produce a grain crop from either fall or spring seeding. Cimarron is resistant to Victoria blight and soil-borne mosaic. It is susceptible to the rusts and smuts. The extreme earliness of Cimarron allows it to escape much of the damage from rust in the Spring. Its rapid early fall growth makes Cimarron especially suitable for grazing.

The Nora oat variety was developed by the Arkansas Agricultural Experiment Station and was released in 1966. It is shorter than Cimarron in plant height. Nora is medium maturing and has extra large kernels and high grain yields. However, Nora is less winterhardy than Cimarron and may winter kill in some years in Oklahoma.

Rye

Acco rye is a commercial variety distributed by ACCO Seed Company and is recommended for use as a forage crop.

Bonel Rye was released jointly by the Oklahoma Agricultural Experiment Station and the Agricultural Division of the Noble Foundation of Ardmore, Oklahoma. It is an excellent winter forage producer, equal to or exceeding the Elbon variety in yield. It is cold tolerant and the plants are dark green in color with upright growth habit. It matures later than Elbon, has stiff straw, and produces large high-quality seed.

Elbon rye was released by the Noble Foundation at Ardmore, Oklahoma. It is an excellent forage producer, has erect plant growth, and is winterhardy. Elbon produces fairly large amounts of forage in late fall and early winter if planted in late August or early September.

McNair Vita-Graze is a variety of rye produced as a strains cross involving three foundation lines. The certified generation has extra vigor in initial growth, forage growth, and regrowth. The variety is recommended for fall and winter pasture under good management practices. Unusually good response to nitrogen has been observed. The name McNair Vita-Graze applies only to the certified generation. This variety is produced and distributed by the McNair Seed Company.

Winter Grazer rye is produced and distributed by Pennington Grain and Seed, Inc., Madison, Georgia. The variety is described as excellent for winter pasture in the South.

Table 1. Rainfall distribution by months recorded in inches of precipitation. Perkins.

	1968-69	1969-70
August	0.99	3.11
September	1.88	3.77
October	2.73	2.63
November	4.52	0.08
December	1.71	1.24
January	0.75	0.03
February	2.27	0.13
March	2.60	2.55
April	1.93	6.23
May	3.60	0.60
Total	22.98	20.37

Table 2. Temperatures, mean, low, and high by months, recorded in degrees Fahrenheit. Perkins.

	1968-69			1969-70		
	M	L	H	M	L	H
October	63.1	49.3	76.8	57.3	45.9	68.6
November	47.2	36.4	57.9	46.8	31.2	62.4
December	37.5	25.9	49.0	39.0	27.4	50.5
January	37.9	28.3	47.5	29.3	17.8	40.8
February	40.6	29.8	51.4	40.6	26.5	54.6
March	40.5	29.2	51.7	44.4	33.1	55.7
April	59.3	47.3	71.3	58.8	46.6	70.9

Table 3. Perkins small grains 1968-69. Soil name: Vanoss Fine Sandy Loam. Yields given in pounds per acre of oven dry forage.

VARIETY	Harvest Dates					Total
	11/21	2/28	4/9	4/23	5/9	
Bonel (r) ¹	1611	783	1624	199	257	4474
Elbon (r)	1304	737	1597	246	157	4041
McNair Vita Graze (r)	1410	989	959	246	0	3622
Acco (r)	871	753	904	144	0	2672
Will (b)	1097	129	1531	636	162	3555
Kerr (b)	786	93	1262	756	127	3024
Rogers (b)	775	223	1272	453	300	3023
Improved Triumph (w)	602	259	1860	236	348	3305
Parker (w)	382	219	1886	338	457	3282
Sturdy (w)	802	194	1403	264	316	2979
Agent (w)	628	525	1300	238	242	2933
Danne (w)	580	318	1323	361	331	2913
Kaw 61 (w)	573	130	1437	364	268	2772
Scout (w)	432	127	1271	506	310	2646
Cimarron (o)	378	289	932	685	196	2480
Nora (o)	1092	0	187	661	285	2225
Bronco (o)	12	39	228	1471	145	1895

F = 11.69** LSD .05 = 576, .01 = 766²

¹ (r) is rye, (b) is barley, (w) is wheat, and (o) is oats.

² LSD values in all instances are based on total yields for the season.

Table 4. Perkins small grains 1969-1970. Soil name: Vanoss Fine Sandy Loam. Yields given in pounds per acre of oven dry forage.

Variety	HARVEST DATES				TOTAL
	11/5/69	2/17/70	4/9/70	4/17/70	
McNair Vita Graze (r)	1854	382	489	88	2813
Acco (r)	1775	420	399	97	2691
Bonel (r)	1286	319	570	119	2294
Winter Grazer (r)	1246	461	344	99	2150
Elbon (r)	913	329	629	153	2024
Nora (o)	1647	216	320	210	2393
Cimarron (o)	1063	410	508	224	2205
Kerr (b)	1369	248	425	93	2135
Will (b)	973	234	120	263	1590
Sturdy (w)	977	178	598	112	1865
CI 13874 (w)	773	234	314	167	1488
Kaw 61 (w)	731	83	483	154	1451
Danne 146-4 (w)	498	86	475	209	1268
Agent (w)	497	339	298	158	1292
Danne 146-5 (w)	498	86	475	209	1268
Triumph 64 (w)	589	100	362	201	1252
Yukon (w)	489	190	430	139	1248

F = 5.73** LSD₀₅ = 645, LSD₀₁ = 860

Table 5. Averages by months and years for the various small grains species at Perkins. Yields given in pounds per acre of oven dry forage.

Crops	Year	Averages by Months							Total
		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
Rye	1968-69	1299	0	0	816	1271	213	104	3703
	1969-70	1415	0	0	382	486	111	0	2394
	Average	1357	0	0	599	879	162	52	3049
Barley	1968-69	885	0	0	148	1354	614	196	3197
	1969-70	1171	0	0	241	273	178	0	1863
	Average	1028	0	0	195	814	396	98	2530
Wheat	1968-69	571	0	0	253	1497	330	325	2975
	1969-70	667	0	0	153	448	170	0	1438
	Average	619	0	0	203	973	250	162	2207
Oats	1968-69	494	0	0	109	449	938	208	2198
	1969-70	1355	0	0	313	414	217	0	2299
	Average	925	0	0	261	432	576	104	2249

Table 6. Rainfall distribution by months recorded in inches of precipitation. Mangum.

	1965-66	1966-67	1967-68	1968-69	1969-70
August	1.81	6.62	0.70	3.08	2.02
September	9.99	3.61	2.44	0.85	4.09
October	4.53	0.74	2.06	3.95	1.99
November	0.00	0.15	0.27	2.92	0.22
December	1.32	0.53	0.77	0.86	0.28
January	0.60	0.00	2.03	Trace	0.03
February	0.99	0.08	1.69	1.91	0.01
March	0.81	1.00	1.09	2.11	2.83
April	2.26	1.68	1.27	0.39	1.79
May		2.55	5.69	5.71	
Total		16.96	18.01	21.78	

Table 7. Temperatures, mean, low, and high by months, recorded in degrees Fahrenheit. Mangum.

	1965-66			1966-67			1967-68			1968-69			1969-70		
	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H
Oct.	63.4	50.1	76.6	61.5	46.4	76.6	64.2	48.7	79.7	65.8	49.8	81.7	58.5	47.4	69.5
Nov.	55.9	43.8	68.0	55.2	40.6	69.7	50.2	37.0	63.4	48.1	35.7	60.5	50.1	33.8	66.4
Dec.	47.8	35.9	59.7	39.9	25.4	54.4	40.4	28.1	52.6	39.2	26.2	52.2	43.0	30.4	55.6
Jan.	33.9	22.1	45.7	43.1	24.8	61.3	39.8	29.2	50.3	43.0	29.5	56.4	35.1	22.4	47.7
Feb.	40.1	27.2	52.7	43.6	26.6	60.5	39.2	26.4	52.0	44.1	31.3	56.8	47.0	31.9	62.1
Mar.	55.8	40.4	71.1	58.7	40.9	76.4	52.8	39.6	65.9	44.0	31.8	56.2			
Apr.	60.3	45.5	75.2	67.7	54.6	80.7	60.6	45.1	76.0	63.0	48.4	77.5			

Table 8. Mangum small grains 1965-1966. Soil Name: Meno Sandy Loam. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates				Total
	1/10	3/16	4/6	5/3	
Elbon (r)	540	1571	1398	762	4271
Cimarron (o)	84	409	981	1461	2933
Bronco (o)	116	164	708	116	2602
Rogers (b)	174	345	1253	1079	2852
Will (b)	82	82	1071	880	2405
Improved Triumph (w)	0	0	1270	925	2195
Kaw 61 (w)	0	191	980	989	2160

F = 5.476** LSD .05 = 905, .01 = 1239

Table 9. Mangum small grains. 1966-1967. Soil Name: Meno Sandy Loam. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates				Total
	3/1	3/25	4/15	5/15	
Bonel (r)	926	1271	717	581	3491
Elbon (r)	1225	989	663	510	3387
Will (b)	72	499	1416	500	2487
Kerr (b)	281	427	1225	281	2423
Rogers (b)	91	400	1080	91	2042
Bronco (o)	0	136	998	989	2123
Cimarron (o)	0	227	880	708	1815
Parker (w)	0	490	808	681	1979
Scout (w)	0	418	699	681	1797
Improved Triumph (w)	0	318	808	626	1752
Kaws 61	0	209	735	672	1616
Agent	0	209	472	672	1352

F = 6.655** LSD .05 727, .01 = 976

Table 10. Mangum small grains 1967-1968. Soil Name: Meno Sandy Loam. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates				Total
	2/27	3/25	4/15	5/20	
Rogers (b)	0	436	2069	517	3022
Will (b)	0	254	1997	644	2895
Kerr (b)	0	209	1860	581	2650
Cimarron (o)	0	372	1380	1225	2977
Bronco (o)	0	64	608	2087	2759
Bonel (r)	535	1026	1089	327	2977
Elbon (r)	590	890	753	300	2533
Danne (w)	0	200	1488	744	2432
Scout (w)	0	209	1225	826	2260
Agent (w)	0	282	1298	635	2215
Improved Triumph (w)	0	291	1343	563	2197
Parker (w)	0	64	1352	763	2178
Kaw 61 (w)	0	272	1071	835	2178

F = 1.451 (NS)

Table 11. Mangum small grains 1968-1969. Soil Name: Meno Sandy Loam. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates					Total
	2/28	3/19	4/15	5/10	5/30	
Acco (r)	2215	463	1116	563	472	4819
Eibon (r)	1595	472	1688	463	454	4746
Bonel (r)	1153	427	1743	654	481	4457
Rogers (b)	0	1625	545	744	672	3585
Will (b)	0	1425	390	872	563	3249
Kerr (b)	0	1107	245	1017	581	2950
Bronco (o)	0	101	0	971	2097	3169
Cimarron (o)	0	644	91	1017	1225	2977
Nora (o)	0	645	36	853	1434	2913
Scout (w)	0	944	436	617	717	2713
Parker (w)	0	1025	508	490	508	2532
Danne (w)	0	790	499	599	518	2405
Kaw 61	0	808	318	554	663	2341
Sturdy (w)	0	817	309	481	436	2069
Improved Triumph (w)	0	753	563	300	281	1896

F = 10.61 LSD .05 = 767, .01 = 1023

Table 12. Mangum small grains 1969-1970. Soil Name: Meno Sandy Loam. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates				Total
	2/10	3/23	4/23	5/25	
Bonel (r)	899	2514	853	898	5164
McNair Vita Graze (r)	908	2587	699	679	4872
Elbon (r)	390	2759	949	733	4831
Acco (r)	980	2033	750	319	4082
Kerr (b)	0	263	2210	827	3300
Will (b)	0	245	2106	700	3051
Checoita (o)	0	13	1181	1799	2993
Cimarron (o)	0	67	1812	907	2786
Nora (o)	0	118	1373	1124	2614
Agent (w)	0	309	1328	886	2523
Yukon (w)	0	236	1336	930	2502
Parker (w)	0	236	1632	615	2483
Duanne (w)	0	73	1116	759	1948
Kaw 61 (w)	0	73	1098	731	1902
Sturdy (w)	0	118	1144	591	1853
Triumph 64 (w)	0	127	1114	531	1772
Danne 146-4 (w)	0	80	1136	530	1746
Cl 13874 (w)	0	127	1153	376	1656

F = 11.568** LSD .05 = 951, 1.0 = 1268

Table 13. Averages by months and years for the various small grains species at Mangum. Yields given in pounds per acre of oven dry forage.

CROP	YEAR	OCT.	FEB.	MAR.	APR.	MAY	TOTAL
Wheat	1965-66	0	0	96	1125	957	2178
	1966-67	0	0	329	704	666	1699
	1967-68	0	0	220	1296	728	2243
	1968-69	0	0	856	439	1028	2323
	1969-70	0	0	153	1229	661	2043
	Average	0	0	331	959	808	2097
Oats	1965-66	100	0	287	845	1289	2768
	1966-67	0	0	182	939	849	1970
	1967-68	0	0	218	994	1656	2868
	1968-69	0	0	463	42	2542	3020
	1969-70	0	0	66	1455	1277	2798
	Average	20	0	243	855	1523	2685
Rye	1965-66	540	0	1571	1398	762	4271
	1966-67	0	1076	1130	690	546	3439
	1967-68	0	563	958	921	341	2755
	1968-69	0	1654	454	1516	996	4674
	1969-70	0	794	2473	813	657	4737
	Average	0	817	1317	1068	660	3971
Barley	1965-66	128	0	214	1162	980	2629
	1966-67	0	148	442	1240	291	2317
	1967-68	0	0	300	1975	581	2856
	1968-69	0	0	1386	393	1483	3261
	1969-70	0	0	254	2158	764	3176
	Average	26	30	519	1386	820	2848

Table 14. Rainfall distribution by months recorded in inches of precipitation. Muskogee.

August	6.62	1.43	6.49
September	1.86	4.48	4.63
October	0.55	6.62	2.50
November	1.84	0.95	7.77
December	2.09	2.84	2.84
January	1.36	3.28	3.91
February	0.67	2.94	3.43
March	1.86	4.50	3.76
April	4.92	5.37	3.45
May	7.08	6.58	4.40
Total	28.85	39.04	43.18

Table 15. Temperatures, mean, low, and high by months, recorded in degrees Fahrenheit. Muskogee.

	1966-67			1967-68			1968-69		
	M	L	H	M	L	H	M	L	H
Oct.	60.0	44.7	75.2	61.3	47.7	74.9	61.6	48.1	75.1
Nov.	55.1	42.4	67.7	48.8	36.4	61.1	47.1	37.3	56.9
Dec.	40.1	28.7	51.5	40.8	30.5	51.1	38.6	27.4	49.7
Jan.	41.6	27.6	55.5	37.8	28.0	47.5	38.9	29.3	48.5
Feb.	41.3	28.4	54.1	37.6	25.8	49.3	42.8	32.5	53.1
Mar.	57.8	44.5	71.0	51.3	39.2	63.3	44.4	33.1	55.7
Apr.	65.3	55.1	75.4	60.2	46.7	73.7	62.5	50.7	74.2

Table 16. Muskogee small grains 1966-1967. Soil Name: Taloka. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates						Total
	11/29	1/30	3/21	4/4	4/26	5/16	
Elbon (r)	1822	604	2803	553	73	113	5968
Bonel (r)	1207	545	3153	543	95	159	5702
Kerr (b)	801	261	2085	1290	660	83	1580
Rogers (b)	323	200	1699	1112	327	0	3661
Will (b)	328	134	1705	1125	305	0	3597
Parker (w)	232	116	2927	1062	402	89	4828
Agent (w)	1315	491	1350	653	411	214	4484
Scout (w)	460	177	2029	1259	414	123	4462
Improved Triumph (w)	570	258	2316	1013	0	0	4157
Kaw 61 (w)	507	191	1714	1158	393	93	4056
Bronco (o)	272	207	610	652	2147	254	4142
Cimarron (o)	196	256	2547	417	249	41	4106

F = 16.589**

LSD .05 = 744, .01 = 998

Table 17. Muskogee small grains 1967-1968. Soil Name: Taloka. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates					Total
	12/4	2/20	3/28	4/20	5/20	
Bonel (r)	1586	712	1165	2115	0	5578
Elbon (r)	1670	747	702	1718	0	4907
Kerr (b)	286	242	877	4018	0	5423
Rogers (b)	270	222	1024	3353	0	4869
Will (b)	52	81	581	3707	0	4421
Agent (w)	286	847	849	2232	0	4214
Parker (w)	0	209	1131	2800	0	4140
Scout (w)	0	63	800	3152	0	4015
Danne (w)	0	196	976	2814	0	3986
Kaw 61 (w)	0	257	980	2579	0	3816
Improved Triumph (w)	0	338	1124	1992	0	3455
Bronco (o)	0	35	37	3419	242	3733
Cimarron (o)	0	74	85	2624	0	2783

F = 4.719**

LSD .05 = 996, .01 = 1333

Table 18. Muskogee small grains 1968-1969. Soil Name: Taloka. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates					Total
	10/23	12/14	3/27	4/15	5/13	
Cimarron (o)	606	230	211	559	894	2500
Nora (o)	432	148	0	939	670	2189
Bronco (o)	148	0	0	444	1553	2145
Elbon (r)	763	177	709	476	320	2445
Bonel (r)	449	189	601	336	205	1780
Agent (w)	396	0	440	663	662	2161
Kaw 61 (w)	370	0	252	788	651	2061
Danne (w)	240	0	314	864	559	1977
Parker (w)	217	0	365	913	453	1948
Improved Triumph (w)	354	0	392	717	398	1861
Scout (w)	270	0	225	663	583	1741
Sturdy (w)	289	0	320	618	372	1599
Kerr (b)	264	0	348	900	587	2099
Will (b)	450	0	408	821	363	2042
Rogers (b)	402	0	374	752	369	1897

F = 1.011 (NS)

Table 19. Averages by months and years for the various small grains species at Muskogee. Yields given in pounds per acre of oven dry forage.

Crop	Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total
Wheat	1966-67	0	771	0	308	0	2584	1691	130	4397
	1967-68	0	0	48	0	318	977	2594	0	3938
	1968-69	305	0	0	0	0	330	747	525	1907
	Average	102	205	16	83	106	1124	1563	209	3411
Oats	1966-67	0	234	0	232	0	1579	1932	148	4124
	1967-68	0	0	0	0	55	61	3022	121	3258
	1968-69	395	0	126	0	0	70	647	1039	2278
	Average	132	78	42	77	18	596	1865	436	3217
Rye	1966-67	0	1515	0	575	0	2978	632	136	5835
	1967-68	0	0	1628	0	730	934	1952	0	5243
	1968-69	606	0	183	0	0	655	406	263	2113
	Average	202	504	603	191	243	1521	996	133	4393
Barley	1966-67	0	484	0	198	0	1830	1605	28	4146
	1967-68	0	0	203	0	182	827	2693	0	4904
	1968-69	372	0	0	0	0	376	824	440	2013
	Average	124	161	68	66	61	1010	2039	156	3684

Table 20. Rainfall distribution by months recorded in inches by precipitation. Goodwell.

August	1.30	4.68	3.04	2.18
September	0.68	1.93	1.58	0.54
October	1.45	0.23	0.04	2.34
November	Trace	0.00	0.09	1.54
December	0.65	0.30	0.05	0.08
January	0.14	0.02	0.71	0.20
February	0.58	0.02	0.13	0.88
March	Trace	0.01	0.18	1.69
April	0.04	1.04	1.37	1.09
May	0.13	1.87	4.07	2.74
Total	4.97	10.10	11.26	13.28

Table 21. Supplemental irrigation reported in inches applied by dates. Goodwell.

1965-66.	Sept. 4, 2.50, Oct. 5, 2.50, Dec. 22, 2.50, March 21, 2.50, and April 12, 2.50 inches.
1966-67.	Sept. 13, 2.50, Oct. 15, 2.50, Nov. 19, 2.50, Mar. 4, 2.50, Apr. 10, 2.50, May 12, 2.50, and May 27, 2.50 inches
1967-68.	Sept. 5, 4.0, Oct. 21, 4.0, Jan. 5, 4.0, Mar. 23, 4.0, Apr. 6, 4.0, and Apr. 19, 4.0 inches.
1968-69.	Sept. 12, 4.0, Oct. 1, 4.0, Dec. 10, 4.0, Feb. 7, 4.0, and Apr. 29, 4.0 inches.

Table 22. Temperatures, mean, low, and high by months, recorded in degrees Fahrenheit. Goodwell.

	1965-66			1966-67			1967-68			1968-69		
	M	L	H	M	L	H	M	L	H	M	L	H
Oct.	59.0	42.8	75.1	57.6	38.5	76.7	61.9	42.6	81.2	61.5	44.5	78.5
Nov.	51.0	35.3	66.6	47.4	29.7	65.0	44.2	27.4	61.0	44.0	31.7	56.2
Dec.	40.9	27.8	54.0	32.8	16.5	49.0	35.2	21.0	49.3	34.2	18.1	50.2
Jan.	38.9	14.7	43.0	39.1	22.1	56.1	36.6	19.7	53.5	33.9	21.5	46.3
Feb.	33.7	20.0	47.3	40.9	22.5	59.3	38.9	22.8	54.9	40.2	23.1	57.2
Mar.	48.4	28.6	68.2	53.6	35.3	71.8	48.0	31.0	64.8	40.4	25.0	55.7
Apr.	55.4	37.2	73.6	61.6	45.5	77.7	55.0	38.8	71.1	57.7	41.9	73.5

Table 23. Goodwell small grains 1965-1966. Soil Name: Richfield Silty Clay Loam. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates					Total
	10/15	11/13	3/29	4/19	5/10	
Kaw 61 (w)	1988	1539	3236	2995	454	10,211
Improved Triumph (w)	2026	1641	2066	3258	339	9,330
Elbon (r)	2432	2421	2917	951	621	9,341
Will (b)	2389	2372	726	1153	704	7,344

F = 25.293** LSD .05 = 772, .01 = 1110

Table 24. Goodwell small grains 1966-67. Soil Name: Richfield Silty Clay Loam. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates						Total
	9/24	10/29	3/18	4/5	5/8	6/12	
Elbon (r)	1836	1002	2801	1419	961	1378	9396
Bonel (r)	1293	1043	2766	983	999	1051	8135
Kerr (b)	1362	844	1430	1084	1930	507	7157
Will (b)	1386	967	455	534	831	1065	5238
Agent (w)	1546	1027	1952	572	547	1065	6709
Improved Triumph (w)	1242	1043	1296	1868	670	455	6574
Kaw 61 (w)	1263	583	972	844	877	1138	5677

Table 25. Goodwell small grains 1967-1968. Soil Name. Richfield Silty Clay Loam. Yields given in pounds per acre of dry forage.

Variety	Harvest Dates							Total
	10/20	12/19	3/22	4/2	4/16	5/3	5/28	
Scout (w)	349	174	1625	998	617	370	354	4487
Agent (w)	398	784	1559	481	599	160	363	4343
Danne (w)	247	111	1182	1009	653	331	303	3834
Kaw 61 (w)	292	94	1314	710	714	334	369	3826
Parker (w)	138	111	1104	953	704	352	331	3692
Imp. Triumph (w)	430	80	1238	693	518	329	0	3287
Bonel (r)	603	303	1695	485	636	352	305	4371
Elbon (r)	556	567	1741	407	343	392	249	4253
Kerr (b)	254	131	833	552	908	458	365	3499
Rogers (b)	334	213	1082	663	488	354	272	3405
Will (b)	280	160	1013	534	545	481	300	3310

F = 4.79** LSD .05 = 643, .01 = 865

Table 26. Goodwell small grains 1968-1969. Soil Name: Richfield Silty Loam. Yields given in pounds per acre of oven dry forage.

Variety	Harvest Dates						Total
	10/10	11/26	4/8	4/25	5/23	6/12	
Kaw 61 (w)	345	381	1139	830	980	890	4565
Agent (w)	340	590	1461	635	1066	241	4333
Scout (w)	350	163	1307	944	1044	345	4202
Sturdy (w)	345	599	1157	989	894	104	4089
Parker (w)	204	114	1534	1035	1194	0	4080
Danne (w)	250	386	1361	935	1076	0	4007
Improved Triumph (w)	391	254	1189	867	726	0	3427
Bonel (r)	0	713	1470	563	1493	0	4238
Elbon (r)	404	640	1411	594	1094	0	4143
Rogers (b)	309	372	1416	944	1035	0	4075
Kaw	155	159	1126	953	1370	0	3762
Will (b)	254	77	1035	949	1312	0	3626

F = 2.551** LSD .05 = 903, .01 = 1074

Table 27. Averages by months and years for the various small grain species at Goodwell. Yields given in pounds per acre of oven dry forage.

CROPS	Year	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
Wheat	1965-66	----	2007	1590	----	----	----	2651	3127	397	----	9771
	1966-67	1350	884	----	----	----	----	1407	1095	698	886	6320
	1967-68	----	285	----	225	----	----	1245	1487	653	----	4036
	1968-69	----	318	355	----	----	----	1307	891	997	226	4100
	Average	338	874	486	64	----	----	1653	1650	686	278	6057
Rye	1965-66	----	2432	2421	----	----	----	2917	951	621	----	9341
	1966-67	1564	1023	----	----	----	----	2784	1201	980	1215	8766
	1967-68	----	580	----	435	----	----	1718	934	649	----	4312
	1968-69	----	202	677	----	----	----	1441	579	1249	----	4191
	Average	391	1059	775	109	----	----	2215	916	886	304	6653
Barley	1965-66	----	2389	2372	----	----	----	726	1153	704	----	7344
	1966-67	1374	906	----	----	----	----	943	809	1381	786	6198
	1967-68	----	289	----	168	----	----	976	1263	734	----	3405
	1968-69	----	239	203	----	----	----	1192	949	1239	----	3821
	Average	344	956	644	42	----	----	959	1044	1017	197	5192

Table 28. Crude Protein (%) of small grains as influenced by nitrogen rates plowed down before seeding. Agronomy Research Station, Stillwater. (From Okla. Agr. Res. Sta. Proc. Series P-563 by J. M. Baker and B. B. Tucker).

Sampling Date	Rates of nitrogen applied (Pounds per acre)				
	0	40	80	160	320
WHEAT					
Dec. 3, 1965	22.5	24.4	25.0	25.6	25.6
Jan. 15, 1966	23.8	21.3	21.3	23.1	23.8
Feb. 4, 1966	19.4	20.6	21.9	23.8	23.8
Mar. 18, 1966	27.5	29.4	31.3	28.9	30.6
Mar. 24, 1966	25.6	24.4	26.9	26.3	26.9
Apr. 7, 1966	17.5	18.8	19.4	19.4	18.1
Apr. 13, 1966	18.8	19.4	20.0	19.4	19.4
Apr. 21, 1966	13.1	14.4	14.4	14.4	15.6
May 13, 1966	10.0	10.0	8.8	11.3	10.6
OATS					
Dec. 3, 1965	26.9	26.3	28.1	29.4	28.1
Jan. 15, 1966	25.0	23.8	24.4	23.8	25.0
Feb. 4, 1966	25.6	25.0	28.8	28.1	29.4
Mar. 18, 1966	23.8	28.8	26.3	28.8	27.5
Mar. 24, 1966	22.5	26.3	26.9	26.3	27.5
Apr. 7, 1966	18.8	21.3	21.9	20.0	22.5
Apr. 12, 1966	20.6	20.6	21.3	20.6	22.5
Apr. 21, 1966	12.5	13.8	13.1	15.6	14.4
May 13, 1966	11.3	13.1	12.5	15.0	14.4
BARLEY					
Dec. 3, 1965	25.6	25.0	26.9	28.8	26.9
Jan. 15, 1969	25.6	20.0	26.3	21.9	26.3
Feb. 4, 1966	26.9	26.9	26.3	25.6	28.8
Nov. 18, 1966	30.0	26.9	27.5	31.3	32.5
Mar. 24, 1966	20.6	21.3	23.8	30.6	30.6
Apr. 7, 1966	15.6	15.6	21.3	22.5	16.9
Apr. 13, 1966	18.1	20.6	21.3	26.9	24.4
Apr. 21, 1966	13.1	12.5	12.5	16.3	16.9
May 13, 1966	9.4	10.0	10.3	12.5	13.8
RYE					
Dec. 3, 1965	27.5	25.6	27.5	28.8	28.1
Jan. 15, 1966	25.0	24.4	26.3	26.9	28.1
Feb. 4, 1966	27.5	23.8	28.1	27.5	30.0
Mar. 18, 1966	26.9	29.4	26.9	26.3	28.8
Mar. 24, 1966	20.6	20.0	20.6	26.9	27.5
Apr. 7, 1966	13.1	13.1	16.9	17.5	20.0
Apr. 13, 1966	16.3	14.4	18.1	19.4	20.0
Apr. 21, 1966	11.3	13.8	10.6	14.4	15.0
May 13, 1966	7.5	8.1	8.8	12.5	11.3