

Longevity of Crested Wheatgrass in the Sagebrush-grass Type in Southern Idaho¹

A. C. HULL, JR., and G. J. KLOMP

Range Scientists, Crops Research Division, Agricultural Research Service, U.S.D.A., Logan, Utah, and Twin Falls, Idaho.

Highlight

Crested wheatgrass has proved to be well adapted on most sites in the sagebrush zone in southern Idaho. Continued high production as indicated in more than thirty-years records show crested wheatgrass will maintain itself and even spread despite such adverse factors as heavy use, extremes of temperature and moisture, and disease.

Experimental range seedings in southern Idaho commenced on many national forest lands during 1909 and 1910². It was not until the early 1930's when seed of crested wheatgrass became available that sagebrush lands were considered feasible for seeding. Crested wheatgrass, as then used, was a complex of species (Swallen and Rogler, 1950). Most of the early seed was

crested wheatgrass (*Agropyron desertorum* (Fisch.) Schult.) with some fairway wheatgrass (*Agropyron cristatum* (L.) Gaertn.). In this discussion the early seeded stands will be referred to as crested wheatgrass.

The first known range seedings with crested wheatgrass in the sagebrush type in southern Idaho were in 1932 on the Herman Winters farm near American Falls and at the U. S. Sheep Experiment Station³ near Dubois. The Idaho Extension Service made seed available for trial plots at several locations in the spring of 1934 (Wood, 1936). Crested wheatgrass was the most widely used species in early seedings in the sagebrush type. Later other species were seeded. The performance of some of these species is included in this discussion for comparison with crested wheatgrass.

The early seeded areas are representative of the better sagebrush lands in southern Idaho. Seed was scarce, and ranchers and technicians were cautioned to seed shallow on a well-prepared seedbed on the better lands, usually dry-farm areas. Because good planting practices were followed and the species was adapted, most of the seedings were successful. Many of these 30-year old seedings are

still productive. This paper evaluates these seedings and indicates their durability and productivity.

Methods and Results

All of the early crested wheatgrass seedings which could be located were examined from 1941 to 1944 and again in 1963. Some, such as at the U. S. Sheep Experiment Station, have been observed every year. This report evaluates establishment and productivity of the older seeded stands for which records are available.

Locations of seeded areas are shown in Fig. 1. Site characteristics are shown in Table 1 and long-time air-dry yields of some areas in Table 2. Herbage yields were usually taken by clipping current growth 0.5 inch above the ground on several 4.8 or 9.6 ft² samples. Some yields were obtained by a combination of clipping and estimating.

The seedings are treated in two groups: (1) areas shown in Table 2, for which comparative long-time records are available; (2) areas for which only a few yields are available. Seedings are described in the discussion and in the tables, starting with those in the eastern part of the State and progressing westward. All U. S. Sheep Experiment Station seedings are described together.

U. S. Sheep Experiment Station.—This station is 6 miles northeast of Dubois, Idaho. In about 1917 several areas were cleared of native sagebrush-grass vegetation and seeded to sunflowers and sorghum, with poor success. The lands were not cultivated after about 1923. Following abandonment, there was a reinvasion of scattered plants of the original brush species, mainly threetip (*Artemisia tripartita* Rydb.) with some big sagebrush (*A. tridentata* Nutt.). In addition to brush, the seeded areas supported some squirreltail (*Sitanion hystrix* (Nutt.) J. G. Smith)

¹Cooperative investigations of Crops Research Division, Agricultural Research Service, USDA, and the Idaho and Utah Agricultural Experiment Stations at Moscow, Idaho, and Logan, Utah. *Utah Agric. Expt. Sta. Journal Paper 458.*

Most of the early seedings in the sagebrush-grass type were made by ranchers; the Intermountain Forest and Range Experiment Station, U.S. Forest Service (experimental range and seeding phases now Crops Research Division, Agricultural Research Service); Rural Resettlement Administration (land areas now administered by U.S. Forest Service and Bureau of Land Management); Bureau of Animal Industry (now Agricultural Research Service); Soil Conservation Service; Bureau of Land Management; and the University of Idaho. Thanks are extended to personnel of the cooperating agencies, to all who supplied information on seeded areas, and to those who made helpful comments on this paper.

²Unpublished reports and file data.

³The U. S. Sheep Experiment Station is maintained by the Animal Husbandry Research Division of Agricultural Research Service, USDA, in cooperation with the Intermountain Forest and Range Experiment Station, Forest Service, USDA, and with the Agricultural Experiment Station of the University of Idaho.

and a fair cover of annual weeds, mainly Russian thistle (*Salsola kali* var. *tenuifolia* Tausch) and mustards. Seed of crested wheatgrass was drilled with no seed-bed preparation in 1932, 33 and 34. Because of the drought years and the slow establishment of stands, it was assumed that all seedings were failures. With

better moisture in 1936, the seedings began to show and there were full stands of grass on all seeded areas.

Half of a 3-acre area was drilled in the early spring of 1932 and half in 1933. The seeded area has been grazed light to heavy each year. To date there is little sagebrush invasion. In 1963, one

of the most favorable years on record, this 31-year-old stand produced 2,384 lb/acre of herbage (Table 2). As seed was produced, some of it was blown over the snow from the original stand toward a snow fence 120 feet south of the seeding. The entire area between the snow fence and the seeding now supports a good stand of volunteer crested wheatgrass.

In 1933, a 5-acre area was seeded. In 1941, part of the seeded area was fenced to test early and late spring grazing. At the initiation of this study, the area was mowed and raked to remove brush and old grass. Each year from 1941 to 1952 the area produced 120 sheep days/acre of early spring and late fall grazing. Although there is considerable reinvasion of threetip sagebrush, the grass is still productive and produced 2,016 lb/acre of air-dry grass in 1963, the best yield on record (Fig. 2). Crested wheatgrass has gradually spread into poor native range and forms a full stand for 100 to 400 feet on all sides of the seeding.

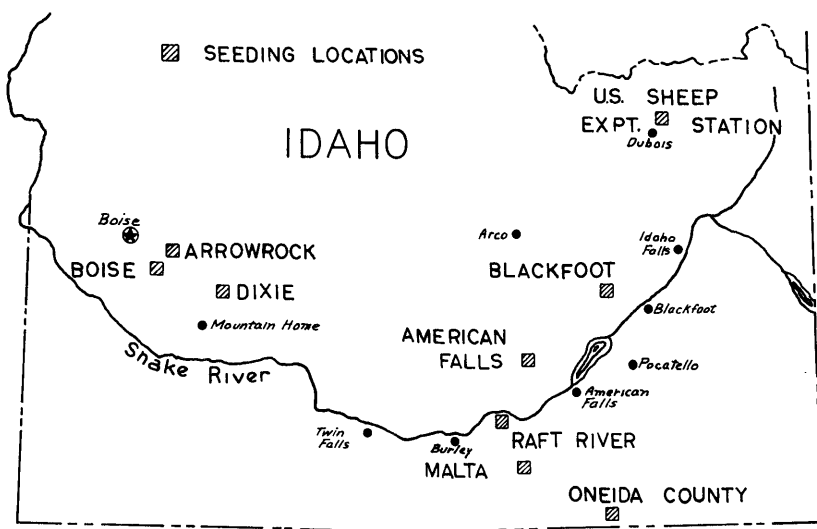


Fig. 1. Location of nine early seedings in southern Idaho is shown by the squares.

Table 1. Location, site characteristics, and seeding method for early Idaho seedings.

Location and years seeded	Elevation Feet	Precipitation Inches	Soil Characteristics	Seeding Method
U. S. Sheep Expt. Station				
1932, 33, 34, 46	5500	11	Silt loam 12 to 36" deep	Drilled $\frac{3}{4}$ " deep, 6" rows, 15 lb/A ^a
Blackfoot				
1933-39, 46	4600	8	Silt loam	Broadcast and harrowed 10 lb/A ^b
Oneida County				
1936 to present	4600 to 5800	9 to 14	Silt loam Some sandy loam	Mostly drilled $\frac{3}{4}$ " deep, 12" rows, 6 lbs/A. Some in alternate strips
Malta				
1943	4800	11	Silt loam	Drilled 1" deep, 12" rows, 6 lb/A
Raft River				
1944	4300	10	Silt loam	Drilled 1" deep, 12" rows, 7 lb/A
Boise				
1943	3500	11	Silt loam	Drilled $\frac{3}{4}$ " deep, 12" rows, 7 lb/A
Arrowrock				
1936	4600	18	Coarse sandy loam	Broadcast and raked, 15 lb/A
American Falls				
1932	4800	9	Silt loam	Drilled $\frac{3}{4}$ " deep, 6" rows, 8 lb/A
Dixie				
1934	4500	16	Sandy loam	Drilled $\frac{3}{4}$ " deep, 12" rows, 5 lb/A

^a 1946 seeding was at 6 lb/acre in 12" rows.

^b 1946 seeding was at 6 lb/acre, $\frac{3}{4}$ " deep in 12" rows.

Table 2. Area, year seeded, and air-dry crested wheatgrass^a herbage yield in lb/acre for several locations in southern Idaho and U. S. Sheep Experiment Station.

Year of Yield	U. S. Sheep Station		Oneida		Raft		Arrow-rock	
	1932	1933	Blackfoot 1934	Co. * 1937	Malta 1943	River 1944	Boise 1943	1936
1940	—	—	—	943	—	—	—	1603
1941	—	729	—	1533	—	—	—	2207
1942	1200	665	—	751	—	—	—	2427
1945	—	—	—	—	1274	—	—	1537
1946	—	—	—	—	1785	785	—	1090
1947	1190	785	—	770	1267	1298	1146	2468
1948	780	685	—	585	840	936	1005	1726
1949	763	800	—	1476	820	818	796	1385
1950	1283	675	—	950	700	—	1455	1772
1951	1220	555	—	1150	990	—	—	—
1952	1406	560	—	1100	941	—	788	—
1955	1573	1005	638	996	700	592	674	1095
1956	—	856	1280	928	860	504	—	—
1957	—	—	1630	1020	1160	1180	—	—
1958	—	—	1600	920	1280	1787	—	—
1959	—	—	670	975	820	1120	—	—
1960	—	—	660	310	700	450	—	—
1961	—	—	835	356	640	650	—	1200
1962	1398	1316	1740	1590	1790	1740	440	1019
1963	2384	2016	2750	1426	2173	2265	1008	1377
1964	1677	1268	1602	1279	1746	1405	735	1524
Average	1357	916	1341	1003	1138	1109	894	1602

^a Yield plots at Oneida County are mostly fairway wheatgrass.



Fig. 2. Crested wheatgrass, seeded in 1933 at the U. S. Sheep Experiment Station at Dubois, has been grazed moderately to heavily for 30 years. Seed from seeded plants, carried by wind and livestock, produced a good stand in the unseeded area beyond the fence. In 1963 the seeded area produced 2,016 lb/acre of grass air-dry weight.

Several areas were seeded in the spring of 1934. One of the areas has been heavily grazed each year by horses and sheep. In 1942 this area was mowed to remove invading threetip sage-

brush, and in September 1952, it was burned. Burning completely killed the brush with no apparent damage to the grass. The area is now almost brush-free and the grass forms a full

stand. Grass has spread to rocky areas and surrounding native range where it was not originally seeded. Yields have been taken on this area in lb/acre during 5 years:

1942	514
1956	896
1962	1,890
1963	2,320
1964	1,792

In 1946 an area of depleted native range was plowed to kill threetip sagebrush and the grass understory. Twelve species were drilled with 8 replications of each to be used for a grazing study. After 18 years, six species are doing well and some have spread to several times their original plot area (Table 3). Species that have spread most are fairway and pubescent (*A. tri-chophorum* (Link) Richt.) wheatgrasses. Crested and intermediate (*A. intermedium* (Host) Beauv.) wheatgrasses have spread, but not as far as the first named species. Siberian wheatgrass (*A. sibiricum* (Willd.) Beauv.) and Russian wildrye (*Elymus junceus* Fisch.) have spread erratically. The following six species were also seeded, but stands became progressively poorer under sheep grazing and competition with other species: thickspike (*Agropyron dasystachyum* (Hook.) Scribn.); tall (*A. elongatum* (Host) Beauv.); western (*A. smithii* Rydb.); and bluebunch (*A. spicatum* (Pursh) Scribn. and Smith) wheatgrasses; big bluegrass (*Poa ampla* Merr.); and alfalfa (*Medicago sativa* L.).

Blackfoot.—In 1933 Howard Hartman seeded crested wheatgrass on a dry sagebrush site 14 miles northwest of Blackfoot. Seedings were continued for several years on areas supporting big sagebrush of medium size and a sparse understory of native grass. Most areas were plowed, fallowed and seed was broadcast. Stands established slowly. The seeded areas were closely grazed by sheep until

1954 (Fig. 3). Since then they have been grazed moderately by cattle. Heavy rabbit concentrations have been present on these seedings. The oldest seeding is still productive with a good stand of vigorous plants (Table 2) and with only a slight amount of sagebrush reinvasion on any of the seedings. The grass has spread to rocky areas and sagebrush range where it was not originally seeded. Part of the 1933 seeding was flooded during spring run-off in 1962 and 1963. The flooded area produced 3,558 lb/acre of herbage in 1962 and 3,940 lb in 1963.

In 1946 several species were drilled in experimental plots on

recently abandoned land. Yields of Russian wildrye and crested and fairway wheatgrasses are shown in Table 4.

Other species which produced seedling stands, and either failed to establish well or declined to very poor stands, were as follows: tall, intermediate, western, pubescent, and beardless (*Agropyron inerme* (Scribn. and Smith) Rydb.) wheatgrasses; Indian ricegrass (*Oryzopsis hymenoides* (R. & S.) Richter); Nevada bluegrass (*Poa nevadensis* Vasey ex Scribn.); and mountain rye (*Secale montanum* Guss.).

Oneida County.—In 1936 the Rural Resettlement Administration began drilling the first of 57,000 acres of

crested and fairway wheatgrasses on the land utilization project in Curlew and Black Pine Valleys in Oneida County. Early seedings were made in fallow, wheat stubble, or in annual weeds such as Russian thistle and mustards. In later seedings the big sagebrush and perennial plants were plowed out of abandoned wheatland or depleted rangeland before drilling to grass.

The Bureau of Land Management now administers the public land in Black Pine Valley, while the Forest Service administers the public land in the Curlew Valley as the Curlew National Grassland. On the Grassland, use is rotated so that fields may be used any time from May to February for seasonal grazing by cattle (Fig. 4). Stands of crested and fairway wheatgrasses which have

Table 3. Yield for six species (air-dry herbage lb/acre) and the area now occupied by each species in the grazing study at the U. S. Sheep Experiment Station. Average of 8 replications.

Species	Area ^a	Years							
		1950	1952	1953	1954	1955	1962	1963	Average
Crested wheatgrass	169	672	718	1318	975	1056	1299	2238	1268
Fairway wheatgrass	438	579	708	1194	952	942	1060	1738	1099
Siberian wheatgrass	131	579	692	1232	913	1009	1096	1513	1076
Intermediate wheatgrass	155	586	790	1314	919	898	1198	2037	1192
Pubescent wheatgrass	210	493	796	1378	1160	869	1287	2038	1254
Russian wildrye	112	542	578	902	574	705	668	1794	870
Average	203	575	714	1223	915	913	934	1893	

^a Percent spread and area covered in 1963 as compared to the original plot area of 100 percent as seeded in 1946.

Table 4. Yields (air-dry herbage lb/acre) of grasses seeded in 1946.

Year of yield	Crested wheatgr.	Fairway wheatgr.	Russian wildrye
1955	949	737	1089
1956	876	770	1220
1957	1480	1080	2150
1958	1280	960	1937
1959	970	550	1410
1960	560	340	975
1961	750	610	1695
1962	1179	1541	1778
1963	2320	2180	2340
1964	1502	1352	1574
Average	1187	1012	1617

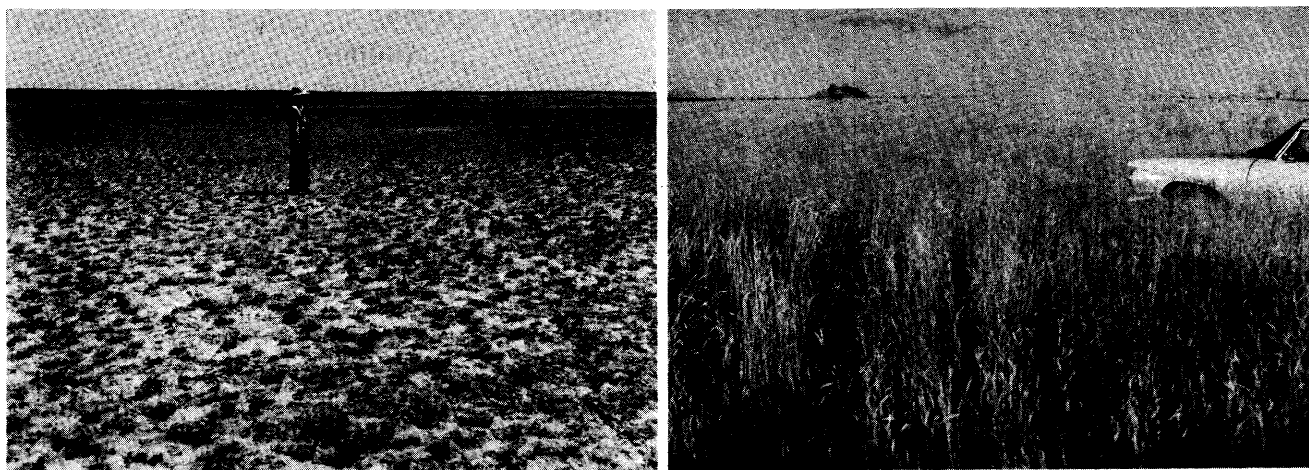


Fig. 3. This area northwest of Blackfoot was seeded in 1933 and heavily grazed by sheep and rabbits until 1954. Left—This 1946 photograph is typical of the grazing during the first 13 years of the life of the stand. Right—In 1963, possibly the year of the highest production, this stand produced 2,750 lb/acre.



Fig. 4. Crested wheatgrass seeding began on this large, abandoned land area in Curlew Valley in the fall of 1936. The area has now been grazed for 28 years and a good stand of grass remains. Photographed December 1963.

been grazed for over 20 years still are vigorous with no signs of deterioration. Pastures are grazed at approximately 3 acres per animal unit month.

With good range management the sagebrush reinvades slowly in this area. Some areas need spraying with 2,4-D or mowing with brush cutters every 10 to 20 years to hold down the sagebrush.

A grain stubble area was drilled experimentally in 1937 to fairway and crested wheatgrasses with 9 other species. The area was not grazed until 1946 when it was used as a bull pasture and heavily grazed until 1959. Since 1960 it has been moderately grazed by horses. Where species other than fairway and crested wheatgrasses were seeded and failed, big sagebrush soon occupied the plot areas. Sagebrush invasion has been slow where there was a good initial stand of the two wheatgrasses. The 28-year-old wheatgrass stand is still vigorous (Table 2). It has spread into fence rows and unseeded areas and now forms a good understory to the sagebrush on plots where other seeded species failed.

Malta.—East of Malta near Sublette a large area of depleted big sagebrush was burned and seeded by drilling crested wheatgrass in 1943.

Sampling commenced in 1945 when the stand was two years old. The plants are vigorous and the stand produced its highest yield, 2,173 lb/acre in 1963, a favorable year (Table 2).

Raft River.—On the Raft River flat, 15 miles east of Rupert, large seedings of crested wheatgrass and smaller seedings of several species were made on depleted sagebrush range in 1944. The area was protected for about four years. Since

then it has been grazed moderately. Crested wheatgrass has been the best species (Tables 2 and 5). It yields well and is spreading into areas which were missed in drilling and where other species failed. Seeded species which did not maintain good stands are: bluebunch, intermediate, tall, and thickspike wheatgrasses; big, Nevada, and bulbous (*Poa bulbosa* L.) bluegrasses; mountain rye; alfalfa; and sicklepod milkvetch (*Astragalus falcatus* Lam.). Some big sagebrush is invading the crested wheatgrass areas.

Arrowrock.—Crested wheatgrass was seeded 5 miles southeast of the Arrowrock Dam and about 20 miles southeast of Boise in 1936. The seeding was on a dry 10% south slope. It established slowly but there is now a vigorous 28-year-old stand of wheatgrass (Table 2). In this area intermediate and pubescent wheatgrasses were first seeded in 1941. Consistent annual yields have not been taken on these grasses, but they are spreading more rapidly and yielded more than crested wheatgrass in 1963 and 1964.

Boise.—Twenty-four miles southeast of Boise, near Regina, some sagebrush and cheatgrass (*Bromus tectorum* L.) areas were plowed and drilled to several species in 1943. The stands have been lightly to moderately grazed. Crested wheatgrass plants are vigorous and keep out the cheatgrass and other invaders (Table 2). Spreading by seed has been much slower in southwestern than in eastern Idaho.

Table 5. Yield of 7 species (air-dry herbage lb/acre) at Raft River, Seeded in 1944.

Year	Crested wheatgr.	Fairway wheatgr.	Siberian wheatgr.	Pubescent wheatgr.	Beardless wheatgr.	Russian wildrye	Ave.
1946	785	—	—	—	—	—	785
1947	1298	1002	—	—	—	—	1150
1948	936	402	—	296	251	172	411
1949	818	734	—	560	882	856	770
1955	592	546	610	549	—	673	594
1956	504	402	427	502	920	709	577
1957	1180	930	1280	825	1310	1000	1087
1958	1787	1075	1472	865	1430	1252	1313
1959	1120	840	1240	630	1200	1135	1027
1960	450	375	550	455	570	535	489
1961	650	445	580	435	760	717	596
1962	1740	1666	1952	1326	1538	1721	1657
1963	2265	1905	1650	1560	1150	1055	1598
1964	1405	1222	1098	1478	1254	1219	1280
Average 1109		888	1086	790	1024	920	

American Falls.—In 1932 Herman Winter seeded crested wheatgrass on a small area of fallow wheat land located in the moderately dry sagebrush zone 15 miles northwest of American Falls. Most of the seeded area was later plowed, but on the remainder there is a good 33-year-old stand. The grass spread from the original seeding and forms a good volunteer stand on unseeded, rocky areas and waste places.

Dixie.—On the Weaver ranch on Long Tom Creek near Dixie, a small area of big sagebrush was grubbed, and crested wheatgrass was drilled on a good seedbed in the fall of 1934. The stand, protected during the first few years, has since been moderately to heavily grazed. There is still a good stand of crested wheatgrass, but sagebrush has invaded most of the seeding. Where sagebrush has not invaded, this stand produced 1,539 lb/acre of air-dry herbage in 1963 and 1,725 lb in 1964. In this area crested wheatgrass yields are equalled by several fields of intermediate wheatgrass seeded in the early 50's.

Discussion

Crested wheatgrass is native over wide areas in Russia, Siberia, Mongolia and other countries. It withstands heavy grazing, is resistant to heat, drought, cold, and little damaged by disease (Konstantinov, 1923). Rogler (1960 a,b) states that crested wheatgrass is the most successful of all grasses introduced on the northern Great Plains in the United States. It has wide adaptation, long life, drought and cold resistance, relative freedom from disease, good productivity and palatability, persistence under abuse, good competitive ability, excellent seed production, ease of establishment, and sufficient seedling vigor to volunteer successfully. No other exotic or native grass has so many desirable characteristics. It also has been found to be well adapted in the prairie region of Canada (Knowles, 1956).

Crested wheatgrass was the earliest successful species seeded

in the sagebrush-grass type in southern Idaho. It has continued to be the best-adapted seeded species (Hull and Holmgren, 1964). Fairway wheatgrass has also proved to be well adapted. Siberian wheatgrass undoubtedly has the same characteristics. Other species should be adapted to some sagebrush sites, but they need further testing to determine their specific adaptability.

Age of stands, precipitation, and grass yields.—Under favorable growing conditions in Russia, crested wheatgrass reaches its greatest productivity in the second to fourth growing season (Konstantinov 1923). In the sagebrush-bunchgrass type near Burns, Oregon, crested wheatgrass attained maximum productivity during the second growing season, and declined with increased age to the fifth growing season (Hyder and Sneva, 1963). Barnes and Nelson (1950) in Wyoming found that this decline in production came after the third year. Bleak and Plummer (1954) found that crested wheatgrass in the sagebrush type in central Utah declined in yield after 7 years as the result of old age or decadence.

Westover and Rogler (1947) and Rogler⁴ observed that a 1915 seeding of crested wheatgrass at Mandan, North Dakota, returned its second highest hay yield of 3,400 lb/acre during its forty-second year of production. The highest yield was 3,550 lb/acre in 1916; and the lowest was 146 lb during the severe drought of 1936. The average for 30 consecutive years was 1,675 lb. The plants from this 1915 planting are still growing vigorously at the end of 50 years.

In southern Idaho there is a tendency for crested wheatgrass to reach its highest productivity 2 to 5 years after seeding and then decrease to the level of its long-time productivity (Hull and

Holmgren, 1964). Because of the extremes in annual precipitation on arid lands in southern Idaho, however, the highest yields have usually been more closely associated with favorable rainfall than with the age of the stand. In southeastern Idaho the highest yields were in 1962 or 1963, either during or following the high rainfall of 1962. Southwestern Idaho has fewer yield records, but those available indicate that grass production was highest during the 1940's when precipitation was also high.

Climatic extremes.—In southern Idaho there is a wide variation in temperatures and in annual precipitation. The highest temperature for the crested wheatgrass area was 110 F in 1955 near the Boise seeding. The lowest temperature was -40 F recorded in 1962 near the Raft River seeding. The Raft River and the Herman Winter seedings each withstood a range of 142°—Raft River from 101 to minus 41 and Herman Winter from 104 to minus 38. There have been many temperature readings above 100 and below minus 30.

The Malta seeding withstood the lowest recorded annual precipitation for the area when only 5.49 inches fell in 1954. There were several locations where the precipitation in one or more years dropped to less than 6 inches. In no instance did these climatic extremes result in loss of the seeded stand.

Sagebrush reinvasion.—When crested wheatgrass or other adapted grasses are seeded in the sagebrush-grass type, reinvasion by sagebrush can be expected. This is especially true when sagebrush seed is available during the year of establishment and while seeded plants are small and unable to suppress the brush. With proper grazing, sagebrush reinvasion has been of minor importance in most seeded areas. Where sagebrush does reinvade, it must be controlled be-

⁴Personal correspondence.

fore it reduces the productivity of the grass. This can be done with herbicides, burning, beating, or dragging.

Summary and Conclusions

The first crested wheatgrass seedlings in the sagebrush type in southern Idaho were made during 1932, 1933, and 1934.

An examination of the 20 to 30-year-old stands of crested wheatgrass in southern Idaho and surrounding areas shows it to be well adapted on all but the driest sagebrush lands. This grass has not died out when moderately used within the range of its adaptation. In many locations, even though heavily used and eaten to the ground level year after year, and though the vigor is low, crested wheatgrass still forms a good stand and produces seedheads when given a chance. It withstands heavy grazing and

is resistant to heat, drought, cold, fire, and disease. Other species also appear to be adapted on some sagebrush lands.

Throughout this area in southern Idaho when plots seeded to crested wheatgrass were compared to those seeded to native grasses, crested wheatgrass seems to withstand drought, cold, and disease just as well. It is more resistant to fire and severe grazing, and spreads better.

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