Grass Seed Production from Seeded Range Lands[1]

CHESTER L. CANODE AND J. K. PATTERSON

Research Agronomist, U.S. Department of Agriculture, Crops Research Division, Agricultural Research Service and Associate Professor of Agronomy, Washington State University, Pullman, Washington.

Millions of acres of range lands in the Northwest have been depleted of perennial grasses to the extent that only revegetation with adapted forage grasses will restore them to their production potential. Although many problems concerning range revegetation remain unsolved, a large amount of information is available on the cultural techniques necessary for establishing and maintaining grass under various conditions. Several superior grasses have been developed or selected and seed stocks are available from commercial sources.

At the present time only a small percentage of the range lands are being seeded even though proper cultural practices are generally known and seed is available. The prime reason for this situation appears in the economics of range seeding. General recommendations specify 6 to 9 pounds of seed per acre to produce adequate grass stands in a reasonable length of time. Seed of improved range grasses from commercial sources costs from $.40 to $1.00 per pound. Narrow operating margins make it necessary for the rancher to reduce seeding cost.

Records of the Idaho State Office, Bureau of Land Management, U. S. Department of the Interior[2], indicate the potential of seed production from range seedings. This agency secured 990,000 pounds of seed of crested wheatgrass (*Agropyron desertorum* (Fisch.) Schult.) and a small quantity of intermediate wheatgrass (*Agropyron intermedium* (Host) Beauv.) seed during the years of 1956 and 1957 from range lands seeded in South-central Idaho. Yields for these 2 years averaged approximately 50 pounds of clean seed per acre, without fertilization, in an area receiving between 8 and 10 inches of annual precipitation (Figure 1). The seed was harvested on a contract basis with the price for clean sacked seed in 1956 ranging from $0.16 to $0.22 per pound. In 1957 the average contract price for harvesting was $0.13 per pound for clean seed. As a general policy, the Bureau retains all the seed harvested for the seeding of federal range lands.

The research reported here was designed to determine the feasibility of producing seed from seeded ranges to provide an economical source of seed and in some instances to provide a cash income crop to pay a portion of the seeding costs.

Methods

The study was located on the McGregor Land and Livestock Company Ranch at Hooper, Washington at an elevation of approximately 1,500 feet. The soil was a silt loam overlying basalt rock to a depth of about 3 feet. Precipitation averaged from 12 to 13 inches with 3 to 4 inches being received during the growing season.

In the fall of 1951, crested wheatgrass was seeded at a rate of approximately 6 pounds per acre in rows 1-foot apart. In the fall of 1952, the area was divided into 8 x 20 foot plots and treated with ammonium nitrate at 0, 20, 40, 60, and 80 pounds of nitrogen per acre. Fertilizer treatments were replicated three times and the same rate applied to the designated plot each fall during the remainder of the experiment. Seed yields were taken in 1953, 1954, 1956, and 1957. The plots were not harvested in 1955 because of excessive shatter.

Another experiment was planted in the same area in March 1956 to determine if varieties or strains of other grass species would produce economical seed yields under limited rainfall. Fifteen varieties or strains (Table 1) were planted in 12 x 30 foot plots replicated 4 times. The row width in this ex-

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[2] *Personal communication from Mr. Joe T. Fallini, State Supervisor, Idaho State Office, Bureau of Land Management, U.S. Department of Interior, Boise, Idaho.*

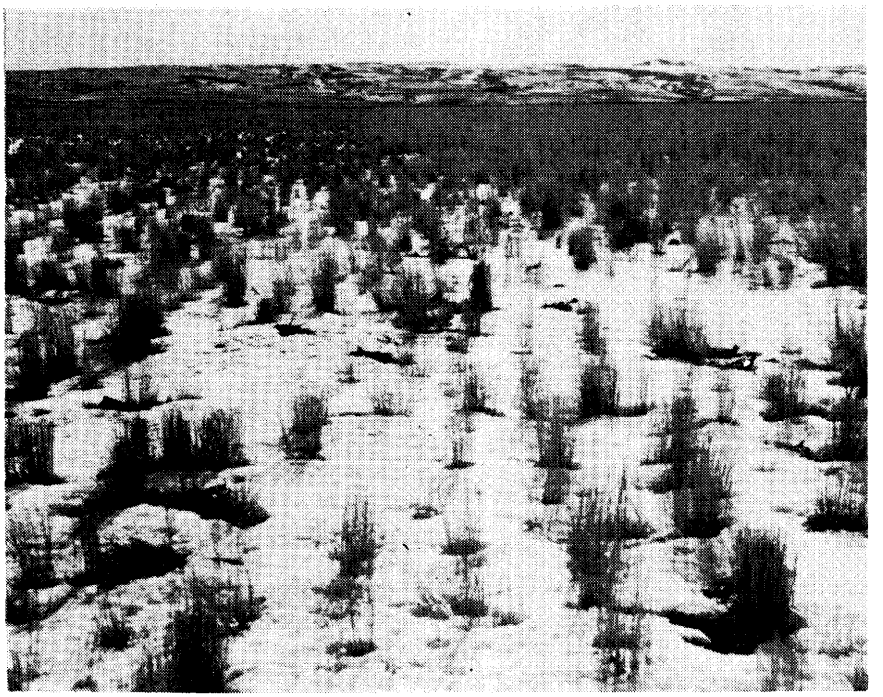

FIGURE 1. Crested wheatgrass seeding near Hollister, Idaho, harvested for seed on the left and not harvested for seed on the right. Picture courtesy of the Idaho State Office, Bureau of Land Management, U.S. Department of Interior.

periment was also 1-foot. Each plot was split in the fall of 1956 and one-half received 40 pounds and the other half received 60 pounds of actual nitrogen per acre. Seed yields harvested in 1957 indicated no differences in the two fertilizer treatments, therefore, the area was uniformly fertilized at the rate of 50 pounds of nitrogen per acre in the fall of 1957 and 1958.

During 1958 the variety nursery was invaded by cheatgrass (*Bromus tectorum* L.) which responded to the fertilizer treatments. As a result, no seed could be harvested from any of the seeded varieties. The nursery was burned in the fall of 1958 to remove the excess vegetation due to cheatgrass and to reduce rodent damage. One-half of each plot was sprayed in the spring of 1959 with 4 pounds of Isopropyl N-phenylcarbamate (IPC) per acre for cheatgrass control.

Results

The crested wheatgrass seeded in the fall of 1951 established good stands during 1952. The yields for 1953 (Table 2) indicate the desirability of harvesting at least one seed crop before using a seeding for grazing. Even the plots that received no nitrogen produced 219 pounds of clean seed per acre. The 40 pound rate of nitrogen gave a significant and economical increase in seed yield (505 pounds per acre) over the plots that received no fertilization. Rates of nitrogen over 40 pounds per acre stimulated the vegetative growth (Table 3) in 1953, evidently to the point of being detrimental to seed production.

Data in Table 2 show the reduction in seed yields as the stand of grass became older. It is evident that without nitrogen fertilization only one or two good seed crops could be harvested in this area. However, with as little as 40 pounds of nitrogen per acre even the fourth seed crop (1956) produced over 400 pounds of clean seed per acre. It should be noted that the 60 and 80 pounds of nitrogen per acre resulted in higher seed yields than the 40 pounds application as the stands become older (1956 and 1957).

Variety and Species Evaluation

The variety or strains of the different species used in the second experiment and the percent of stand for each are given in Table 1. The 1956 season was very favorable, with above average precipitation, 15.16 inches for the year. All adapted species should have established good stands. Five entries of the 15 planted made good stands but only 4 of the 5 were harvested in 1957 since the Russian wild-rye

Table 1. Stands of varieties and strains of grasses at the end of the first year of growth.

Strain or variety*	Scientific Name	Estimated Acre Stand
Ky 31 tall fescue	*Festuca elatior* var *arundinacea*	40
Alta tall fescue	*Festuca elatior* var *arundinacea*	30
Manchar smooth brome	*Bromus inermis*	50
Lincoln smooth brome	*Bromus inermis*	30
P-2447 Russian brome	*Bromus tomentellus*	50
P-2517 hard fescue	*Festuca ovina* var *duriuscula*	60
P-9839 Amur wheatgrass	*Agropyron intermedium*	50
Greenar intermediate wheatgrass	*A. intermedium*	50
Alkar tall wheatgrass	*A. elongatum*	10
Sodar streambank wheatgrass	*A. riparium*	80
Topar pubescent wheatgrass	*A. trichophorum*	40
Whitmar bluebunch wheatgrass	*A. inerme*	70
P-27 Siberian wheatgrass	*A. sibericum*	100
Nordan crested wheatgrass	*A. desertorum*	100
PI 75-737 Russian wild-rye	*Elymus junceus*	100

*P—Plant Material Center, Pullman, Washington
PI—Plant Introduction, U. S. Department of Agriculture.

Table 2. Seed yield of crested wheatgrass planted in rows one foot apart in fall of 1951.

N per acre	Clean seed per acre* 1953	1954	1956	1957	Ave.	Pounds of seed for each pound of N over O
(Pounds)	— — — — — (Pounds) — — — — —					
0	219	102	91	47	115	
20	322	182	159	53	179	3.2
40	505	266	412	123	326	5.2
60	369	210	471	147	299	3.1
80	451	136	614	150	338	2.8
Average	373	179	349	104	251	
LSD 05[1]	NS	NS	176	NS	92	
C. V. (Percent)[2]	37	33	27	50	19	

* Seed was not harvested in 1955 because of high losses due to shattering.
[1] Least significant difference
[2] Coefficient of variation

(Elymus junceus Fisch.) produced only a few seed heads in each plot.

The data in Table 4 further demonstrate the seed production potential of crested wheatgrass from range seeding. Siberian wheatgrass *(Agropyron sibiricum* (Willd.) Beauv.) appeared to be superior in seed production (428 pounds per acre) compared with crested wheatgrass (345 pounds per acre) in this trial. Whitmar bluebunch wheatgrass *(Agropyron inerme* (Scribn. & Smith) Rybd.) produced 96 pounds of seed per acre, even after serious seed loss due to shattering. Sodar streambank wheatgrass *(Agropyron riparium* (Scribn. & Smith), which is considered a soil conservation grass, but not a good forage species, also performed well in the first harvest year by producing 117 pounds of seed per acre.

The IPC application made in the spring of 1959 was only partially effective in controlling cheatgrass. But since this weedy grass did not become a problem that season, it can be eliminated as a major factor affecting 1959 seed production. The data in Table 5 indicate that the IPC did not reduce seed production because of chemical damage. Although chemicals for cheatgrass control are not economical for range use, there may be situations where their use would be economical in seed production under the more favorable soil and climatic conditions on range seedings. It should be noted that both Siberian and crested wheatgrass produced over 150 pounds of seed per acre in 1959, the fourth year of growth. None of the other varieties or strains produced seed worth harvesting in 1959.

In an area adjacent to the test reported above, an eight-year-old stand of intermediate wheatgrass *(Agropyron intermedium)* planted in 3-foot rows was badly damaged by a soil sterilant used for cheatgrass control in February of 1958. The intermediate wheatgrass recovered with approximately one-half of the plants left, and in 1959 produced an average of 206 pounds of clean seed per acre compared with 25 pounds of seed in plots where the cheatgrass had been controlled with 4 pounds of IPC per acre without injury to the intermediate wheatgrass. The check plots in this experiment where cheatgrass was allowed to grow produced only 18 pounds of clean seed per acre.

Discussion

The seed yields of crested wheatgrass and other species of *Agropyron* presented in this paper point out the possibility of producing seed from range seedings. In many areas of the northwest a rancher could start with a small seeding of an improved range grass on his best range land and produce enough seed in two to three years to seed a large acreage. The larger area in turn should produce seed at least once. Any surplus seed produced above the amount needed for seeding his own ranch could, in some instances, be used as a cash crop to help defray the cost of his seeding program.

Under many circumstances, it would be economical to use marginal or sub-marginal wheat lands for producing seed needed for seeding ranges. Land of the type used in this research is generally considered range land, however, this type of land is sometimes used for wheat and barley production. Wheat produces approximately 30 bushels per acre under these conditions on a wheat-summer-fallow rota-

Table 3. Forage yields of crested wheatgrass planted in rows one foot apart in the fall of 1951.

N per acre	Oven-dry forage per acre 1953	1954	1956	1957
(Pounds)	— — — — — — — (Pounds) — — — — — — —			
0	2,130	1,050	1,120	970
20	2,680	1,450	1,150	990
40	3,350	2,160	2,550	1,590
60	4,020	2,390	3,420	2,040
80	4,180	2,570	3,680	3,050
Average	3,270	1,920	2,380	1,730
LSD 05[1]	1,520	560	990	1,180
C.V. (Percent)[2]	25	16	22	24

[1] Least significant difference
[2] Coefficient of variation

Table 4 Seed produced in 1957 by varieties and strains of *Agropyron* planted in rows one foot apart in March, 1956.

Species	Number of Replications	Estimated seed loss before harvest	Seed yield per acre
		(Percent)	(Pounds)
A. sibiricum	6	0	428
A. desertorum	6	0	345
A. inerme	6	50	96
A. riparium	4	10	117

tion. In a 4 year period wheat could be expected to produce a total of 60 bushels per acre. Over the same period, crested wheatgrass supplied with 40 pounds of nitrogen per acre would produce about 900 pounds of clean seed per acre. This allows 1 year for establishment of the grass and 3 years of production at 300 pounds per acre each year. Based on the price of wheat at $1.75 per bushel and crested wheatgrass at $0.20 per pound to the grower, the income from wheat on this land for the 4 year period would be $105.00 per acre compared with $180.00 for the crested wheatgrass seed. If the rancher had to purchase this grass seed on the commercial market probable cost would be about $0.40 per pound. This gives the 900 pounds of crested wheatgrass seed a value of $360.00 for the 4 year period for each acre in production.

Even under more adverse soil or climatic conditions it would appear that seed production from range seedings averaging between 50 and 100 pounds of clean seed per acre would be profitable if the seed was used by the rancher for seeding his own ranges. In the interest of good range management, it is advisable to defer grazing on new seedings until at least the second fall after planting in order to insure good establishment. Consequently, no use would be made of the range during the season the first seed crop was removed. Under these conditions the only added expense that could be directly chargeable to seed production would be for combining and cleaning. The records of the Bureau of Land Management in Idaho demonstrate that even on a contract basis grass seed can be combined and cleaned economically. Many ranches have their own combines that could be used with minor adjustments to harvest the grass seed crop which would reduce the cost considerably. If the seed were used on the producers' own ranges, cleaning could consist of a simple scalping operation to remove only the larger straw and foreign material so the seed would flow readily through a drill.

Care should be exercised to avoid harvesting any areas infested with noxious or troublesome weeds. Common weed seeds such as cheatgrass may occur in such abundance in the seed harvested from range reseedings as to keep the product from being qualified for the commercial market or may increase cost of cleaning to meet market specifications. However, if the rancher uses the seed on his own range lands, a small amount of common weed seed may not be detrimental enough to warrant the extra expense for removing them by cleaning.

In addition to the possibility of providing an economical source of seed for increased range seeding, the practice of taking at least one seed crop has at least three other desirable aspects in range management. Delaying grazing on the new range seedings until at least one seed crop has been produced insures good establishment of the plants before grazing. Removal of the seed heads of the second or third year of growth leaves the range area in a more uniform condition from the standpoint of old straw and is conducive to more uniform grazing when the area is actually put into range use. The stubble height established by the combine can be used to regulate the height of grazing in subsequent seasons since animals usually are hesitant in grazing forage that is mixed with the old stubble.

Table 5. Seed produced in 1959 by crested and Siberian wheatgrass planted in rows one foot apart in 1956, with one-half of each plot treated with IPC for cheatgrass control in the spring of 1959.

Variety or Strain	Clean seed per acre* Not treated	IPC 4 lbs/acre
	—— (Pounds) ——	
Nordan crested wheatgrass	167	179
P-27 Siberian wheatgrass	177	196

* Average of four replications, except only three replications for non-treated Siberian wheatgrass.

Summary

Three experiments conducted at Hooper, Washington under 12 to 13 inches average precipitation at an elevation of about 1500 feet demonstrate the feasibility and desirability of producing seed from range seedings before using them as grazing units.

Under the conditions of this experiment, crested wheatgrass produced an economical crop of seed (219 pounds per acre) in the second growing season without nitrogen fertilization. With an application of 20 pounds of nitrogen per acre, yields averaging 179 pounds per acre were obtained for the 4 years harvested. Forty pounds of nitrogen per acre produced an average of 326 pounds of clean seed per acre per year over the 4 year period.

Of fifteen varieties and strains of various species tested, only five produced good stands under limited moisture conditions. One of the five entries, Russian wildrye, produced good stands but made essentially no seed. The other four entries, all drought tolerant wheatgrasses, produced good yields of seed the second

growing season. Siberian wheatgrass and crested wheatgrass produced 428 and 345 pounds of clean seed per acre, respectively. Sodar streambank wheatgrass produced 117 pounds of seed after a slight loss by shattering. Whitmar bluebunch wheatgrass produced 96 pounds after loosing almost half of the seed by shattering. These four wheatgrasses did not produce enough seed for harvest in the third year due to competition from cheatgrass. In the fourth year, crested and Siberian wheatgrasses produced an average of 180 pounds of clean seed per acre.

Another experiment indicated that intermediate wheatgrass would produce good seed yields under limited rainfall if grown in thin, uniform stands on deeper soils.