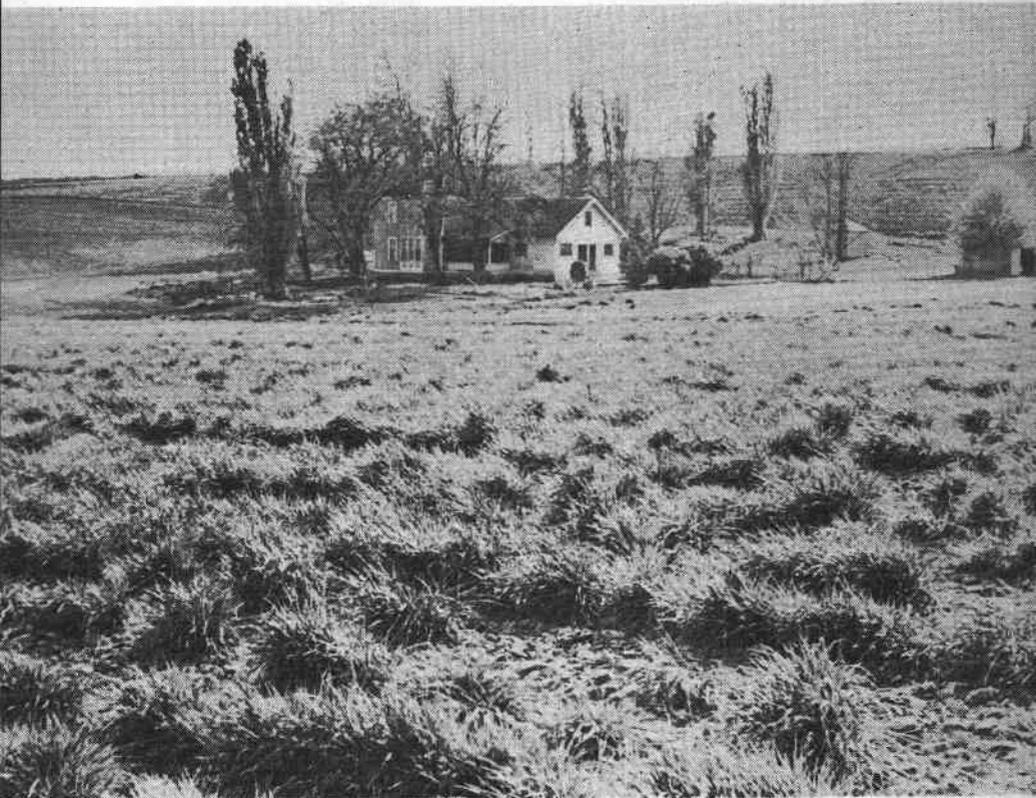


Cost of Production and Utilization of
CRESTED WHEATGRASS

On Eastern Oregon Wheat Farms



Oregon State System of Higher Education
Agricultural Experiment Station
Oregon State College
Corvallis
and

United States Department of Agriculture
Soil Conservation Service
Cooperating

Station Circular 167

May 1945

FOREWORD

Crested wheatgrass is serving an important place on eastern Oregon wheat farms. It protects soil from erosion and provides pasture for thousands of head of livestock. This twofold use of the grass assures it a permanent place on many wheat farms. In the final analysis its contribution to the farm business is decided by the farmer himself according to the use he makes of the grass. For that reason, wheat farmers will be interested in the results presented in this publication which show some of the preferred practices in planting crested wheatgrass, the cost of establishing a stand, its various uses, its carrying capacity, and its probable economic return.

Wm. A. Schoenfeld

Dean and Director

Illustration on cover—

Crested Wheatgrass near the farmstead serves as a protection against dust and fire in addition to providing convenient pasture.—*Courtesy of E. R. Jackman.*

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SUMMARY

Status of crested wheatgrass (1943)

Crested wheatgrass occupied about 173,269 Oregon acres in 1943. More than 90 per cent of this acreage was in the Columbia Basin wheat counties.

Scope of this study

This study, started in 1943, included 16,752 acres of crested wheatgrass on 73 wheat farms in Jefferson, Wasco, Sherman, Morrow, and Umatilla counties. Detailed records of the cost of establishing a stand of grass were completed on 55 farms, and detailed grazing records were completed on 99 fields aggregating 7,994 acres of grass.

Establishing the stand

It usually requires at least 2 years to establish a stand of grass. Some farmers prefer to wait 3 years before making heavy use of the grass.

The important considerations in planting crested wheatgrass are: (1) Prepare a firm seedbed. (2) Plant in the fall when moisture conditions are most favorable, using a regular grain drill with all the drill outlets open. Remove the hose from the boot and cover as lightly as possible by merely dragging the chains. (3) Plant at the rate of 4 to 6 pounds per acre in most parts of the Columbia Basin. Heavier seedings with a mixture of bulbous bluegrass and legumes are recommended in the higher rainfall areas. (4) Clip the first year to control weeds and in later years if necessary to get rid of coarse, dead growth.

Cost of establishing crested wheatgrass

The average per acre costs of establishing crested wheatgrass on summer fallow in 1943 were: seedbed preparation and planting \$2.34, seed \$1.59, interest \$2.34, and taxes \$0.67 or a total of \$6.94. When planted in stubble without seedbed preparation the cost per acre was as follows: seed \$1.29, seeding \$0.65, interest \$1.03, and taxes \$0.33, or a total of \$3.30. The latter method is usually practiced only in the low-rainfall and light-soil areas where it is difficult to get a firm seedbed with fallow. In most parts of the crested wheatgrass area a better stand can be obtained by planting in the fallow.

Use and management of crested wheatgrass

Crested wheatgrass is used primarily for grazing. The main problem in this use is to maintain a balance between livestock and grass. To accomplish this it is necessary to have enough animals on pasture to keep it properly grazed down during the rapid growing season and still not have too many animals during the ensuing dry summer. Some farmers partly solve this problem by marketing livestock in late June or early July.

Clipping the grass in the spring apparently stimulates growth, causing it to remain green longer in the summer and to "green up" earlier in the fall. Mowing the grass in late spring or early summer removes nonpalatable, coarse, wiry grass, which interferes with grazing. Fields enclosed with wheat, where the grass cannot be grazed during the spring, may be mowed for hay or harvested for seed.

SUMMARY—Continued

Carrying capacity of crested wheatgrass

A careful study of 99 fields of crested wheatgrass in 1943 indicated an average use of about 1.2 animal unit months of grazing per acre. An average of 4 acres of grass was used to pasture a cow from mid-March through August. Farmers may not want to graze their grass so heavily every year, but under the wheat fallow system many fields of grass are rested until after wheat harvest every other year. Under these conditions the foregoing rate of use should maintain the stand indefinitely.

The average rate of grazing for the three years 1938, 1943, and 1944 was 0.92 animal unit months per acre.

Pasture

Farmers estimate that crested wheatgrass yields from 2 to 4 times as much grazing as native pasture. The latter, however, is often depleted to such an extent that native bunchgrass is entirely absent.

Place of crested wheatgrass on wheat farms

Crested wheatgrass is already well established in the wheat farm organization. It occupies the steep land that is most susceptible to erosion, field strips and corners that are inaccessible to heavy machinery, and land that normally returns more in grass than in wheat. Most farmers expressed a desire to maintain their grass acreage, in spite of the war demand for wheat, feeling that this crop is making a valuable contribution to their income and therefore has a permanent place on wheat farms.

Cost of Production and Utilization of Crested Wheatgrass on Eastern Oregon Wheat Farms*

by

H. L. THOMAS, G. W. KUHLMAN, and D. CURTIS MUMFORD†

INTRODUCTION

CRESTED wheatgrass is now well established on eastern Oregon wheat farms. From less than 2,500 acres prior to 1936, the acreage increased to more than 180,000 in 1942. Most of this increase was accompanied by a decrease in wheat. Obviously, such a change in land use has affected the organization and operation of the farm as well as the income from the land involved.

The original purpose of crested wheatgrass was to protect steep land from excessive soil erosion, and to make more effective use of low yielding land and isolated segments of wheat fields. Later, it became part of a broad national land use program to limit the acreage and production of wheat. Most of the shift from wheat to grass was in response to this cooperative effort. From this has developed the idea that crested wheatgrass or other grasses of a similar nature may be the means of maintaining soil productivity and thus permitting the permanent production of wheat throughout the Columbia Basin area. Now, in 1945, this grass is making a valuable contribution in the form of meat, and a substantial contribution to farm income in addition to its value in soil improvement.

Objectives

The objectives of this study were: (1) to determine the methods and cost of establishing crested wheatgrass under different conditions of wheat farming, and (2) to study the several uses being made of crested wheatgrass especially with regard to seasonal grazing and carrying capacity.

* Acknowledgments: The authors express their appreciation to the 73 wheat farmers who cooperated by supplying the basic data for this publication. Appreciation and thanks are also due the following county agents who assisted in making personal contacts with cooperating farmers: K. W. Sawyer, W. Wray Lawrence, LeRoy C. Wright, Wm. F. Marshall, C. D. Conrad, Walter A. Holt, and P. T. Fortner. Special acknowledgment is made to D. D. Hill, head, Department of Farm Crops, and to E. R. Jackman, extension agronomist, both of whom made valuable suggestions for the improvement of the manuscript. All photographs were contributed by Mr. Jackman.

† H. L. Thomas, agricultural economist, Economic Research Section, Soil Conservation Service; G. W. Kuhlman, associate economist; and D. Curtis Mumford, head, Department of Farm Management, Oregon Agricultural Experiment Station.

Scope and method of study

Crested wheatgrass is grown to some extent in most eastern Oregon counties, but more than 93 per cent is produced in six Columbia Basin wheat counties (Figure 1). This study included 73 farms located in Jefferson, Wasco, Sherman, Gilliam, Morrow, and Umatilla counties (Figure 2).

The basic data were gathered through a field survey in the fall of 1943. The farms selected for study were those with extensive acreages of crested wheatgrass; for the most part, they had well developed livestock enterprises. A detailed cost of production record was completed on 55 of the farms surveyed, and a detailed grazing record was completed on 99 individual fields of grass.* Supplemental information included data on methods of establishing a stand, cultural practices in the production of grass for seed, grazing practices, and general land use information. The study was also drawn on the records maintained by the Oregon Agricultural Adjustment Agency and of other crested wheatgrass studies. Observations on rate of stocking wheat grass pastures were continued on a portion of the farms in 1944.

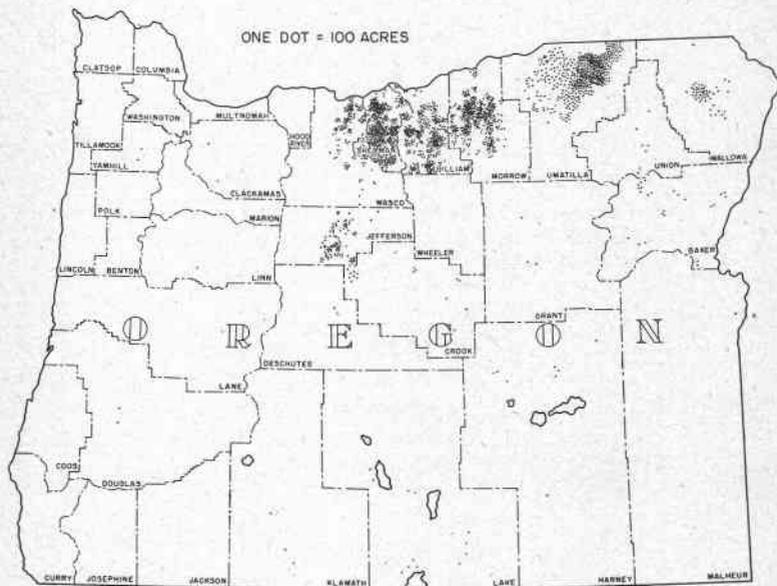


Figure 1. Distribution of Crested Wheat Grass in Oregon, 1942.

* In 1944 detailed grazing records were kept on 18 selected fields. The results are presented in this report.

DESCRIPTION OF THE AREA STUDIED

The Columbia Basin presents a wide range in soil and climatic conditions that affect the production and use of crested wheatgrass. The elevation ranges from 500 to 3,000 feet above sea level. The rainfall varies from less than 10 inches near the Columbia River in Gilliam, Morrow, and Umatilla counties to 20 inches or more along the west slopes of the Blue Mountains. The soils are residual from basalt, modified by wind action. They are generally from 3 to 4 feet in depth but are more shallow on lands adjacent to the main drainageways, particularly on slopes with a southwest exposure. Soil textures range from fine silt loam to sandy loam. Light textures are common to the low rainfall area just indicated.*

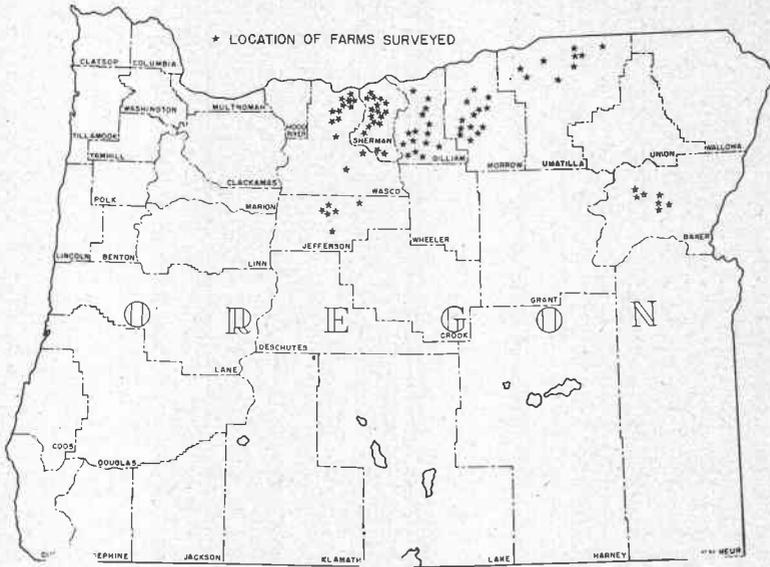


Figure 2. Location of farms included in the Crested Wheat Grass Survey, 1943.

The agriculture of the Columbia Basin in Oregon is virtually a one-crop system of wheat alternated with summer fallow. Livestock, however, occupies a minor but important place in the organization of many wheat farms. In the more productive areas wheat occupies practically all the crop land, and the farmer devotes all his resources

* For a more detailed account of soil and climate see Bulletin 473, Oregon Agricultural Experiment Station, *Land Use and Production Cost on Dry-Land Wheat Farms, Columbia Basin, Oregon* by A. S. Burrier and W. W. Gorton, 1940.

to the production of that crop. Most wheat farms, however, have some native pasture with which to develop a livestock enterprise. Fifty-three of the farms studied averaged 87 animal units of livestock.*

Both soil and climate in the area are adapted to the production of crested wheatgrass. It responds readily to good soil and ample rainfall, but it has the highest comparative advantage over other grasses at low elevations where the rainfall is less than 10 inches per year.† Under these conditions no other cultivated grass is available to challenge its supremacy on the land taken out of wheat cultivation. Under higher rainfall conditions, crested wheatgrass pasture is measurably improved with a mixture of other grasses and legumes. Where the rainfall averages more than 15 inches per year, as in the Blue Mountain foothill region of Umatilla County, other grasses and legumes may offer sufficient competition to replace crested wheatgrass entirely in the pasture mixture.

Table 1. CRESTED WHEATGRASS: THE ACREAGE FOR SEED, PASTURE, AND HAY, OREGON, 1939-1943.*

Year	Number of farms reporting	Acreage reported as pasture, hay, or idle	Acreage reported for seed	Acreage of new seeding reported†	Total acreage reported
	<i>Farms</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
1939	1,219				63,218
1940	1,984	138,748	7,868	25,412	172,028
1941	1,921	158,294	3,732	11,416	173,442
1942	1,930	174,114	1,800	5,764	181,678
1943	1,782	166,636	602	6,031	173,269

* Data from Agricultural Adjustment Agency.

† Acreage reported is more nearly complete in some years than in others.

PRESENT STATUS OF CRESTED WHEATGRASS IN OREGON

Under the impetus of the Agricultural Adjustment Program the acreage of crested wheatgrass increased rapidly in Oregon. From less than 2,500 acres prior to 1936 the acreage jumped to 172,028 by 1940 (Table 1). Of this amount 7,868 acres (the largest acreage on record) was reported harvested for seed. The total land in grass reached 181,678 acres in 1942 with only 1,800 acres harvested for

* In this study an animal unit consists of a mature cow, or her equivalent in other livestock.

† Crested wheatgrass makes its best growth between 2,000 and 4,000 feet. Most of the Columbia Basin wheat lands are less than 2,000 feet, but so far no other grass has challenged its supremacy, even in the lower elevations where, admittedly, it is not at its best. In these lower areas bulbous bluegrass does well planted with it, but the bluegrass alone is very low yielding.

seed. An insignificant amount is used for hay, so that practically all of the 181,678 acres was used for grazing or, in the absence of livestock or because of crop interference, left idle.*

More than 90 per cent of the crested wheatgrass is produced in six Columbia Basin wheat counties (Table 2). Wallowa and Baker are important grass producing counties lying outside the Columbia Basin. Umatilla County reported the highest acreage of new planting in 1942, and Jefferson County reported the highest acreage of grass harvested for seed.

Table 2. CRESTED WHEATGRASS: THE ACREAGE FOR SEED, PASTURE, AND HAY BY COUNTIES, OREGON, 1943.*

Counties	Pasture, hay or idle		Seed		New planting		Total	
	Farms	Acres	Farms	Acres	Farms	Acres	Farms	Acres
Umatilla	422	37,554	1	120	15	417	431	38,091
Morrow	217	34,033	....	....	5	232	220	34,265
Sherman	226	34,289	....	....	4	318	225	34,607
Gilliam	184	30,666	1	5	6	276	186	30,947
Wasco	185	12,106	....	....	5	63	188	12,169
Jefferson	79	6,836	2	157	....	....	79	6,993
Wallowa	113	4,242	4	78	7	234	117	4,554
Baker	54	1,685	2	8	3	179	55	1,872
Other eastern Oregon counties	140	4,575	17	182	117	4,304	248	9,061
Western Oregon....	27	650	6	52	1	8	33	710
STATE TOTAL	1,647	166,636	33	602	163	6,031	1,782	173,269

* Data from Agricultural Adjustment Agency.

This study included 16,752 acres of crested wheatgrass or an average of 229 acres per farm for 73 wheat farms (Table 3). This represents about 13 per cent of the total crop land or 14 per cent of the land ordinarily used for wheat or fallow.

The acreage of crested wheatgrass in Oregon increased very rapidly from 1936 to 1940, reaching a high point in 1942.

Under the impact of war, 5.9 per cent of the grass acreage studied was plowed for wheat in 1943 (Table 4). The plow-up was especially heavy on high-yielding land in Umatilla County, where 13.6 per cent of the grass on farms visited was plowed in 1943. The survey indicated that 5 per cent of the grass was to be plowed in 1944. Most farmers expressed a desire to maintain their grass because of the length of time required to get a stand. Many farmers are making good use of the grass in the production of livestock, and practically all appreciate the saving in labor and machinery ef-

* Each year many thousands of acres of crested wheatgrass may not be grazed, at least until fall, because such acreages are located in fields planted to wheat. This study included 16,752 acres of crested wheatgrass. Of this amount, a grazing record was completed on 7,994 acres, of which only 3,994 acres was grazed separately from other pasture.

fectured by having a portion of the land in grass during the critical years of war.

Table 3. LAND USE ON 73 WHEAT FARMS STUDIED.
(Columbia Basin wheat area—Oregon, 1943)

Land use	Number of farms reporting	Acreage per farm reporting	Acreage per farm	Per cent of crop land
	<i>Farms</i>	<i>Acres</i>	<i>Acres</i>	<i>Per cent</i>
Crested wheatgrass	73	229	229	12.9
Fallow	69	796	752	42.0
Wheat	73	648	648	36.2
Barley or oats	39	105	56	3.1
Peas	18	101	25	1.4
Hay	55	41	31	1.7
Pasture, idle, etc.	17	210	49	2.7
Total tillable	73	.....	1,790	100.0
Native pasture	69	1,088	1,030	.....
Farmstead, roads, etc.	69	20	19	.....
TOTAL	73	.....	2,839	.....

Table 4. CRESTED WHEATGRASS: ACREAGE IN 1943 AND YEARLY PERCENTAGE OF CRESTED WHEATGRASS PLOWED UP ON 73 FARMS STUDIED.
(Columbia Basin wheat area—Oregon, 1943)

County	Number of farms studied in 1943	Acreage of crested wheatgrass on farms studied in 1943	Per cent of crested wheatgrass plowed			Per cent planned to plow
			1941	1942	1943	1944
	<i>Farms</i>	<i>Acres</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Jefferson	5	727	.....	4.4	1.7	4.1
Wasco	12	1,924	0.6	0.3	0.7	6.0
Sherman	16	2,513	.....	0.2	1.8	7.3
Gilliam	15	4,395	2.4	3.9	7.0	2.0
Morrow	13	5,009	0.8	.....	2.2	4.3
Umatilla	7	2,047	0.8	4.0	13.6	9.9
Baker	5	137	10.6	30.5	16.5	.....
TOTAL OR AVERAGE	73	16,752	1.2	2.2	5.9	5.0

ESTABLISHING A STAND OF CRESTED WHEATGRASS*

It requires at least two years to establish a stand of crested wheatgrass planted on summer fallow. Some farmers stated that only light grazing was afforded the second year and maximum use could not be expected until the third year.

Under conditions of low rainfall (less than 12 inches), it is not easy to establish a stand of grass. Frequently the moisture is insuf-

* For more detailed information on the agronomic aspects of crested wheatgrass see Oregon Agricultural Extension Bulletin 494 (1936), *Crested Wheatgrass in Eastern Oregon* by E. R. Jackman, D. E. Steplens, and D. E. Richards.

ficient to sprout the seed. Seedbed preparation and time and depth of planting are important considerations.

Seedbed preparation

Crested wheatgrass requires a firm seedbed. This condition has proved difficult to obtain in the dry, light-textured soil areas. Under these extreme conditions farmers favor planting in wheat stubble to get firmness, whereas farmers in heavier soil areas favor a seedbed prepared from the usual fallow. The stubble planting may have the advantage of shortening the period between planting and grazing by one year.

Farmers reported both good and bad results from each kind of seedbed, the soil type being the deciding factor. That is, the stubble planting gave best results only under extremely light soil conditions. More than three-fourths of the farmers interviewed indicated a decided preference for the fallow prepared seedbed.

Method of planting

In the Columbia Basin, crested wheatgrass is planted in the fall, early enough to be benefited by the first fall rains (Table 5). The regular grain drill is ordinarily used with all the drill outlets open (Table 6). The drill is set to sow as shallowly as possible. This is

Table 5. CRESTED WHEATGRASS: TIME OF SOWING BASED ON FARMER'S PREFERENCE. (Columbia Basin wheat area—Oregon 1943).

Month sowed	Number of growers	Per cent of growers
September	5	9
October	38	69
November	8	15
March	4	7
All growers	55	100

Table 6. CRESTED WHEATGRASS: SPACING OF DRILL ROWS BASED ON ACTUAL PLANTINGS. (Columbia Basin wheat area—Oregon, 1943)

Width of rows	Number of growers	Per cent of growers
Broadcast by hand	1	2
Regular drilling (7-inch rows)	24	44
12-inch rows	1	2
14-inch rows	17	31
16-inch rows	2	4
18-inch rows	3	5
21-inch rows	3	5
24-inch rows	1	2
36-inch rows	3	5
All growers	55	100

accomplished satisfactorily by removing the hose from the drill boot, permitting the seed to fall on the soil surface in the drill row. The seed is covered lightly by the drill chains.

Wider spacing of drill rows may be desirable under low rainfall conditions. Planting in rows 14 inches apart was done by 17 farmers and a wider spacing was used by 12. Most farmers indicated a preference for 7-inch rows for future planting.

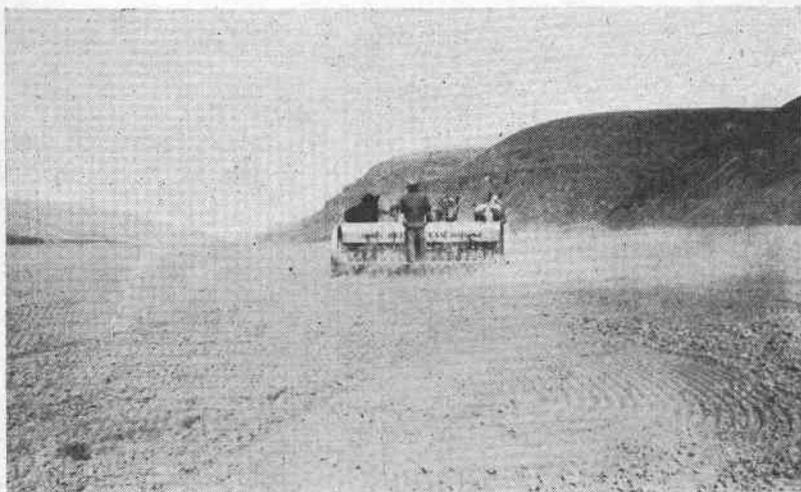


Figure 3. Crested wheatgrass is usually drilled late in the fall on a firm summer-fallow seedbed.

Rate of sowing

The rate of seeding ranged from 2 to 16 pounds of seed per acre (Table 7), depending on the prevailing rainfall. The average rate for conditions under 12 inches of precipitation was 5 or 6 pounds of crested wheatgrass per acre. Under more favorable rainfall conditions the predominating rate of seeding was from 7 to 10 pounds per acre. Under such conditions the addition of bulbous bluegrass (*Poa Bulbosa*, an annual grass) and other grasses materially improves the quality and carrying capacity of the pasture. Farmers stated, however, that bulbous bluegrass would not reproduce itself in dry years.

In summarizing, it appears that shallow planting at the rate of from 4 to 6 pounds per acre, in a firm seedbed, in October can be recommended for most of the Columbia Basin wheat region. In the lighter soil areas stubble planting may be necessary to get a firm

seedbed. A heavier rate of sowing with a mixture of crested wheat and other grasses would seem advisable in the heavier rainfall portions of the region.

New seedings should not be grazed the first year. At least one clipping the first spring is recommended to prevent weeds from going to seed. A light springtooth or disking in the early spring is desirable the second year to control weeds and undesirable grasses. Grazing practices to maintain a good stand will be discussed below.

THE COST OF ESTABLISHING A STAND OF GRASS

The cost of establishing a stand of grass varies with the method used. Based on the results of this study, the estimated cost of establishing a stand of crested wheatgrass on summer fallow is \$6.94 per acre, and \$3.30 on stubble (Tables 8 and 9). The main items of cost are: (1) tillage operations incident to making summer fallow, (2) cost of the seed, and (3) interest charge on the land for one or two years. When establishing crested wheatgrass on summer fallow the farmer foregoes any income from the land for two years.

The cost is reduced where stubble plantings are necessary to get a firm seedbed, but this cost advantage may be more than offset by a poor stand of grass with a correspondingly lower carrying capacity. Hence stubble plantings are not recommended as a measure of economy in establishing crested wheatgrass.

Table 7. CRESTED WHEATGRASS: PREFERENCE AS TO RATE OF SOWING AND SEEDING MIXTURE AS INDICATED BY ACTUAL PERFORMANCE.
(Columbia Basin wheat area—Oregon, 1943)

Mixture and rate per acre	Number of farms	Per cent of farms
<i>Crested wheatgrass alone</i>		
2-4 pounds	5	9
5-6 pounds	16	29
7-10 pounds	16	29
15 pounds	2	3
<i>Crested wheatgrass with bulbous bluegrass*:</i>		
6 pounds (3-3 or 4-2)	5	9
7 pounds (5-2)	3	5
8 pounds (6-2)	1	2
9 pounds (6-3)	1	2
10 pounds (8-2)	1	2
12 pounds (10-2)	1	2
<i>Other mixtures†:</i>		
9 pounds (6-3)	1	2
12 pounds (6-4-2)	1	2
15 pounds (10-5)	1	2
23 pounds (3-20)	1	2
All Growers	55	100

* The first figure in the parenthesis is the number of pounds of crested wheatgrass.

† These consist of the crested wheatgrass (first figure in each case) and 3 pounds of big bluegrass in the first mixture, 4 pounds of bulbous bluegrass with 2 pounds of alfalfa seed in the second mixture, 5 pounds of alfalfa seed in the third mixture, and 20 pounds of wheat in the fourth mixture.

USE OF CRESTED WHEATGRASS

Crested wheatgrass is grown for erosion control, soil improvement, seed, hay, and grazing.

Much of the land now in crested wheatgrass is good wheat land and ultimately will be plowed again for that purpose. The effect of the grass on the organic matter content and physical condition of the soil, and the effect of these on the yield of the following crop of wheat are being watched with much interest. The Moro Branch Experiment Station has been conducting experiments on this problem for the past several years. It is accumulating information on the best methods of handling crested wheatgrass sod and the effect of crested wheatgrass on subsequent wheat yields. As wheat growers in this area become familiar with the beneficial effects of crested wheatgrass, and as wheat lands decline in productivity, substantial increases in the acreage of crested wheatgrass may be expected. Some farmers will plan a definite long-time wheat-grass rotation whereas others will return crested wheat land to wheat if and when economic conditions favor such action.

Table 8. CRESTED WHEATGRASS: ESTIMATED COST PER ACRE OF ESTABLISHING GRASS ON SUMMER FALLOW.*
(Columbia Basin wheat area—Oregon, 1943)

Operation	Number performing operation	Cost per acre	
		Farms reporting†	All farms
Plowing	38	\$.74	\$.67
Spiketooth harrowing	12	.27	.08
Springtooth harrowing	27	.35	.23
Disking	8	.43	.08
Rod weeding	39	.59	.55
Drilling	41	.45	.44
Mowing	8	.91	.17
Miscellaneous	42	....	.12
Total operations	42	....	\$2.34
Seed	42	....	\$1.59
Tax on land (2 years)	42	....	.67
Interest on land (2 years)	42	....	2.34
TOTAL COST	42	....	\$6.94

* Cost based on prewar prices.

† Represents cost of performing individual operations.

Seed production reached a maximum of 7,868 acres in 1940, and then declined to 602 acres in 1943. This decrease was undoubtedly caused by a sharp decline in the price of seed resulting from an increase in the supply and a decrease in the demand after the maximum acreage of crested wheatgrass was reached.

The hay acreage is generally known to be insignificant. Only two farmers included in the survey reported harvesting crested wheatgrass for hay. The yield was about .75 ton of good quality hay per acre.

Under the wheat-fallow system approximately half of the crested wheatgrass is located each year in fields with wheat. This precludes the use of these fields for grazing until after wheat harvest. By that time the grass has matured and dried up. The coarse stems are relatively unpalatable. Except for the use of fall growth, farmers get very little benefit from the grass the year the field is in wheat. Some farmers mentioned that livestock ate the coarse grass in the late fall and winter after the grass had been softened by rain and snow.

Table 9. CRESTED WHEATGRASS: ESTIMATED COST PER ACRE OF ESTABLISHING GRASS IN WHEAT STUBBLE.*
(Columbia Basin Wheat area—Oregon, 1943)

Operation	Number performing operation	Cost per acre	
		Farms reporting†	All farms
Drilling	13	\$.50	\$.50
Disking	3	.64	.15
Total operations	13	....	\$ .65
Seed	13	\$1.29	\$1.29
Tax on land (1 year)	13	.33	.33
Interest on land (1 year)	13	1.03	1.03
TOTAL COST‡	13	....	\$3.30

* Cost based on prewar prices.

† Represents cost of performing individual operations.

‡ On a two-year basis for establishing the stand for taxes and interest on land would be doubled, increasing the total cost to \$4.66 per acre.

Use of the grass only every other year is undoubtedly beneficial and stands used in that manner should last indefinitely. Eastern Oregon has examples showing that alternate use of native bunch grass has improved stands whereas continuous use has killed them. Crested wheatgrass is closely related to native bunch grass and the same grazing principles would apply.

Some farmers would like to use their grass every year. Those who do may follow one of several courses:

1. Fencing in separate fields

At the present time crested wheatgrass seedings occupy odds and ends of wheat fields. Farmers could perhaps consolidate many of these with future seedings so as to make solid fields that could be fenced and grazed independently.

2. Clipping

Farmers not able to follow the foregoing practice may consider clipping the grass in the spring. This would have the effect of removing the coarse, unpalatable grass and of stimulating new growth for late summer and fall. Some farmers resort to the undesirable practice of burning off the grass in late June or early July, saying that livestock object to reaching among the sharp, wiry stems for the young, tender grass.

3. Seed production

Harvesting the grass for seed or hay would have the same effect as clipping and in addition would provide some economic return. The results in Table 10 show that seed production is profitable at assumed prices on limited acreages. Harvesting seed on a large scale, however, may not prove feasible for the following reasons:

- (a) Harvesting and cleaning machinery is not available to permit large scale operation.
- (b) Seed harvest may conflict with wheat harvest if conducted on large acreages, and wheat farmers are reluctant to engage in an enterprise that will interfere with wheat.

Table 10. CRESTED WHEATGRASS SEED PRODUCTION: ESTIMATED COST PER ACRE AND PER 100 POUNDS, AND ESTIMATED GROSS INCOME PER ACRE.*

(Based on 27 records including 1,786 acres of grass cut for seed; averaging 101 pounds per acre. Columbia Basin Wheat area—Oregon, 1943.)

Item	Total cost	Cost per acre	Cost per 100 pounds	Per cent of cost
Cultivation	\$ 714	\$.40	\$.39	5.1
Harvesting	4,048	2.27	2.24	30.2
Use of truck	633	.35	.35	4.7
Cleaning	2,714	1.52	1.50	20.2
Sacks	457	.25	.25	3.4
Supervision	254	.14	.14	2.0
Depreciation of stand	2,484	1.39	1.37	18.5
Taxes on land	660	.37	.36	4.7
Interest on land	1,491	.84	.83	11.2
Total cost	\$13,455	\$7.53	\$7.43	100.0
Gross income per acre (101 pounds at 15¢) .....	.....	\$15.15	.....	.....
Gross income per acre (101 pounds at 10¢) .....	.....	\$10.10	.....	.....
Yield per acre required at 10¢ to cover cost .....	.....	75.3 lb.	.....	.....

* Cost based on prewar prices.

- (c) The supply of seed might exceed the demand and the price would then decline to unprofitable levels.

4. Hay production

Wheat farmers with livestock have needed hay for winter feed and crested wheatgrass normally yields from one-half to three-fourths ton of good hay per acre. Here again the limiting factor is capacity hay machinery and a method of handling on a scale comparable to wheat. Obviously, the method must be one that will make it economical to harvest low yield hay. Such a method, if devised, would offer possibilities of making better use of thousands of acres of crested wheatgrass on wheat farms. If cut for hay, it should be cut before it blooms. If cut later, the hay is neither so nutritious nor so palatable.*

The Fairway strain of crested wheatgrass has finer stems and more leaves than the standard variety. For that reason it is more palatable in the mature stage when used for either hay or pasture.



Figure 4. Good hay may be obtained from crested wheatgrass if it is cut in the prebloom stage.

* Experimental results at the Union Branch Experiment Station indicate that crested wheatgrass cut for hay in the prebloom stage not only is more palatable but has a higher protein content than when cut in the late bloom stage.

CRESTED WHEATGRASS FOR PASTURE

It has been shown that crested wheatgrass on wheat farms is used almost entirely for grazing. Its economic position in the farm organization is determined by its carrying capacity relative to other kinds of pasture, and its net return relative to other land uses. Soil, climate, and management all are factors in determining the total yield of crested wheatgrass in terms of animal months of grazing per acre, and whether it will be grazed so as to make a maximum utilization of the grass for a short or a long period. The method of grazing goes a long way in finally determining the economic return from the grass and its contribution to the farm business.

Seasonal use

Crested wheatgrass "greens up" about the first of March, or earlier in areas of light soil and lower elevations. As the season advances, growth is accelerated until late May or early June when it reaches maximum production. If the grass is allowed to grow and mature, it produces seed late in June and dries up in July.

The grass is highly palatable throughout the spring and early summer. The seed-producing stalks, however, are stiff and wiry and if the grass is allowed to go to seed animals soon leave it for other kinds of pasture. For maximum utilization, this grass should be grazed lightly at first and then sufficiently heavy in most years to prevent seed production.* This practice will tend to keep the grass in a growing stage to take advantage of any moisture that falls during the summer and fall. The objection raised by some farmers is that the grass is unpalatable or cannot be conveniently grazed because of coarse stalks. This problem can largely be overcome by proper grazing during the season of rapid growth.

As with other pasture in this part of eastern Oregon, crested wheatgrass passes through a dormant period in late summer, but it "greens up" again in the fall and often provides two or three months of grazing before winter. Some farmers mentioned grazing it through the winter, saying that coarse grass, unpalatable when dry, had been eaten by all kinds of livestock when softened by winter rain and snow.

Only 70 per cent of the grass acreage studied was grazed in March as compared with 98 per cent in May, 73 per cent in June, 74 per cent in July and 61 per cent in August (Figure 5). Following the wheat harvest and consequent opening of the stubble fields

* Seed production should be allowed every four or five years to prevent deterioration of the stand.

for grazing, the stock was moved off crested wheatgrass until October when only 13 per cent of the grass acreage was grazed.

The intensity of grazing crested wheatgrass in 1943 is presented by months in Figure 6. As would be expected, April through July is the period of heavy grazing when 3.8 acres of grass were used per month to carry one animal unit as compared with 6.7 acres in March, 4.8 acres in August, and 7.3 acres in September and October.

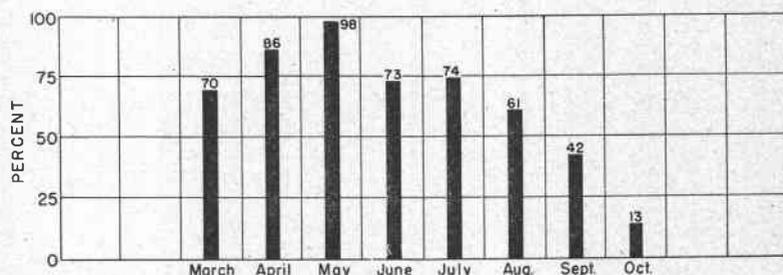


Figure 5. Percent of crested wheatgrass grazed by months—1943.

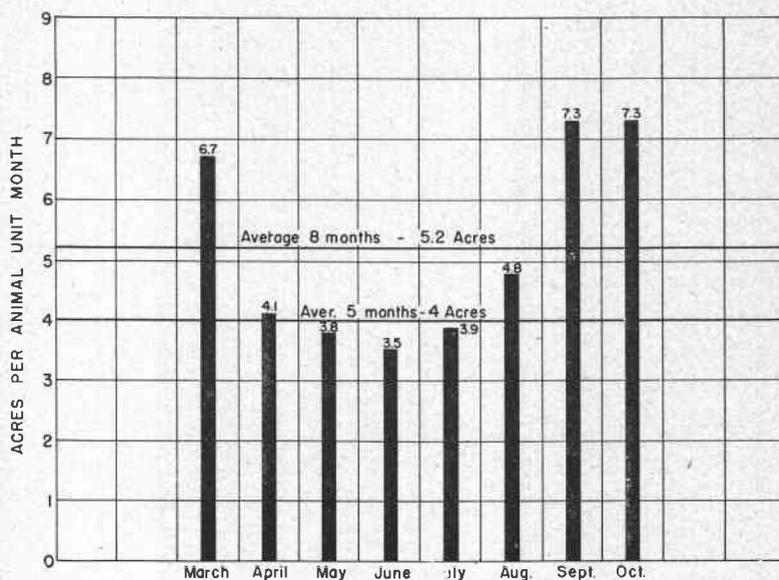


Figure 6. Acres of crested wheatgrass grazed per animal unit month.

Season long, continuous grazing will probably weaken the stand, cutting short its normal life period. Under the wheat-fallow system, many stands are either not grazed at all every other year or at least not until after the wheat is harvested. Where the grass is allowed to go to seed every other year, there is little danger of continuous over-utilization. Where the grass can be grazed every year, more moderate grazing would seem advisable to maintain growth and plant vigor, as all plants need extensive leaf growth at some season of the year to maintain their root systems.



Figure 7. To obtain a longer pasture season, crested wheatgrass should be grazed heavily enough during the early summer to prevent maturity and consequent unpalatability during the latter part of the season.

Problems of pasture management

Effective utilization of crested wheatgrass may give rise to problems in pasture-livestock management. For example, it may prove difficult on some farms to have on hand sufficient livestock to hold crested wheatgrass down in May and June, without having too many stock in the late summer, resulting in serious loss of weight and condition. This problem would be especially acute on small farms with little pasture other than crested wheatgrass. A few farmers overcome this problem by: (1) maintaining a careful balance between the number of livestock and the carrying capacity for the farm as a whole, (2) planning the livestock production program so as to reach the maximum numbers in May and June and disposing of market livestock about July 1, (3) planning supplemental pasture for the critical summer months. Winter wheat planted in the spring may serve this purpose in some locations. In other locations, where the annual rainfall is about 15 inches or more, legumes can provide summer pasture. Some farmers may find it advisable to feed grain in midsummer to avoid loss of weight in stock which is difficult to regain later in the season.

Crested wheatgrass contributes most to the livestock program if used to supplement other pasture. This is frequently the case where the grass is a part of large, fenced enclosures, containing also native pasture and wheat stubble. Under these conditions livestock can move freely from one kind of pasture to another, selecting that which is most palatable at a given time. Where crested wheatgrass is fenced separately it would seem advisable to alternate it periodically during the season with other pasture.

If the number of livestock is not sufficient to keep the grass down or if the grass cannot be grazed until after wheat harvest, it may be feasible to clip. Clipping crested wheatgrass or cutting early for hay should be standard practice if the pasture is seriously needed for fall grazing.

Carrying capacity of crested wheatgrass

A special effort was made in this study to determine the carrying capacity of crested wheatgrass as measured by the extent of grazing on wheat farms. A grazing record was completed on 99 individual fields, embracing 7,994 acres. The average rate of grazing in 1943 was 1.2 animal unit months per acre (Table 11). With the exception of Wasco and Jefferson counties, the rate of grazing was approximately the same in all counties studied. The average rate of grazing in Wasco County was 2.1 A.U.M. per acre, because most of the fields studied were located in the northern por-

tion where the annual rainfall is considerably above the average for the other counties studied. Due primarily to lower rainfall in Jefferson County, the rate of grazing was only 0.6 A.U.M. per acre.

Table 11. THE CARRYING CAPACITY OF CRESTED WHEATGRASS BY COUNTIES
(Columbia Basin Wheat Area—Oregon, 1943.)

County	Number of farms	Number of fields	Acres studied	A.U.M.* of grazing	A.U.M. per acre	Acres per A.U.M.
Wasco	12	21	697	1,496	2.1	0.47
Sherman	16	27	1,547	1,770	1.1	0.87
Gilliam	13	27	2,773	3,050	1.1	0.91
Morrow	9	15	2,472	2,850	1.2	0.87
Umatilla	4	6	278	389	1.4	0.71
Jefferson	3	3	227	127	0.6	1.79
Total or average six counties	57	99	7,994	9,682	1.2	0.83

* Animal unit month or one month of grazing by a mature cow or her equivalent in other livestock.

It was difficult in some instances for the farmer to estimate accurately the amount of grazing from crested wheatgrass where it comprised only a small portion of a large enclosure containing native pasture and wheat stubble. For this reason a special analysis was made of 46 of the fields, embracing 3,991 acres of grass grazed independently of other pasture. The average carrying capacity for these fields was 1.3 A.U.M. or 0.1 A.U.M. per acre higher than for 99 fields presented in Table 11.*

In spite of the high degree of uniformity of results between counties, and the closeness with which the results for 46 fields checked with the results for 99 fields, some farmers grazed their grass much more heavily than others, resulting in a range from 0.3 A.U.M. to more than 4.5 A.U.M. per acre (Figure 8).

A study of the carrying capacity of crested wheatgrass was continued on 18 selected fields in 1944. A detailed grazing record was kept by the farmer on which was recorded the number and kind of livestock, and the number of days grazed. In most instances utilization was limited by the amount of grass available and the amount of grazing the pasture was able to stand without danger of damage to the stand. Supplemental information was recorded as to

* A survey of 42 wheat farms in 1938 showed an average carrying capacity for crested wheatgrass of 0.70 A.U.M. per acre (Oregon Agricultural Experiment Station Circular of Information No. 203, *Crested Wheatgrass Practices in Four Eastern Oregon Counties*, by H. L. Thomas et al, 1939). Judged by subsequent years, 1938 was a relatively unfavorable year for crested wheatgrass. This may account for the lower carrying capacity when compared with the results of the present study.

Similar data from plot experiments on the Judith Basin Branch Experiment Station in Montana (1932-1939), indicate an average carrying capacity of 33.1 animal unit days or 1.1 A.U.M. per acre for crested wheatgrass (Montana Agricultural Experiment Station Bulletin 388, *Dry-Land Pasture Experiments at the Judith Basin Branch Station* by Ralph H. Williams and A. H. Post, 1941).

the amount of other feed and the weight and condition of livestock at the time of turning in and turning out.

The carrying capacity on 1,921 acres of grass in 1944 was 1,660 animal months of grazing or .86 A.U.M. per acre. At this rate it would require 1.16 acres to carry an animal unit one month as contrasted with only .83 acres in 1943. The lower carrying capacity in 1944 may have been the result of less moisture and a consciousness on the part of farmers not to graze too heavily. In most instances grass was left in the field at the time of turning out.

A summary of results for three years indicates that the carrying capacity of crested wheatgrass is about 1.0 A.U.M. per acre (Table 12). At this rate, 4 acres of grass would be required to pasture an animal unit from March until July.

Table 12. SUMMARY OF RESULTS ON THE CARRYING CAPACITY OF CRESTED WHEATGRASS 1938-1944

Year	Number of fields	Acres	Total A.U.M. grazing	A.U.M. per acre	Acres per A.U.M.
1938	40	1,519	1,067	0.70	1.42
1943	99	8,014	9,661	1.21	0.83
1944	18	1,921	1,660	.86	1.16
Total	157	11,434	12,409	0.92	1.09

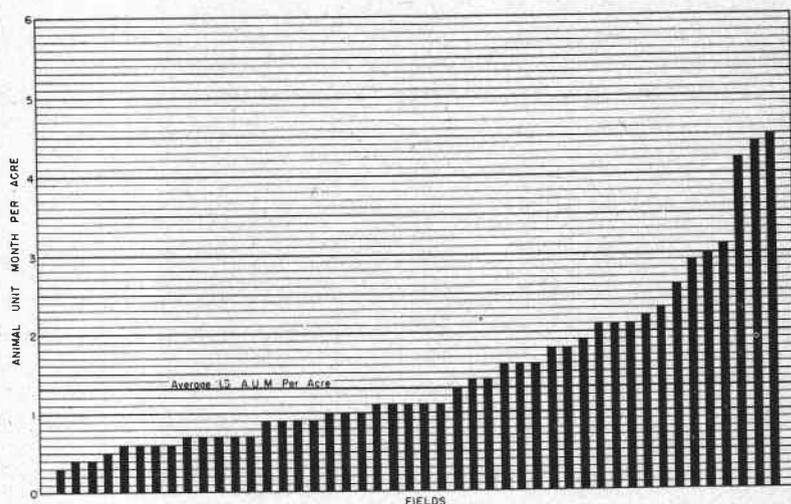


Figure 8. Animal unit months of grazing crested wheatgrass on 46 individual fields. (1943)

CARRYING CAPACITY OF CRESTED WHEATGRASS COMPARED WITH NATIVE

Pasture

A direct comparison between crested wheatgrass and native pasture is difficult in the wheat country because of differences in soil conditions and the composition of native pasture. For the most part crested wheatgrass is planted on cultivated land formerly used for wheat, whereas native pasture frequently occupies shallow soil and scab land unfit for cultivation. Native pasture may also consist largely of cheatgrass and annual weeds rather than native bunchgrass. Again crested wheatgrass is often grazed only every other year when adjacent land is fallow, whereas native pasture is usually fenced separately and grazed every year. Another factor that enters in is the length of the grazing season. If the comparison is made in the spring or early summer when crested wheatgrass is at its best, it may be rated much higher than native pasture, overlooking the fact that native pasture is used eight or nine months instead of five or six months as in the case of crested wheatgrass.

Farmers stated that crested wheatgrass will carry from 2 to 4 times as many animals as native pasture.* Crested wheatgrass, however, usually occupies better soil than native pasture and often gets a chance to rest and seed itself every other year. Thus, other things being equal, crested wheatgrass should yield more pasture per acre during the years grazed.

Farmers report that crested wheatgrass is more palatable during the growing stage than native grass, and that it "greens up" from one to three weeks earlier in the spring and stays green two or three weeks longer in the summer. It also "greens up" in the fall, whereas native grass usually remains dormant during the late summer and fall.

Place of crested wheatgrass on wheat farms†

Wheat farmers should take full advantage of the economic opportunities of crested wheatgrass. This does not mean that the number of farm livestock should necessarily be increased but rather that livestock numbers should reach a maximum during April to July when crested wheatgrass and other pastures are best, and be

*The 1938 study referred to in previous footnote showed that, whereas 9.7 acres of crested wheatgrass are required to pasture an animal unit for eight months, 20.7 acres of native pasture are required for the same period. The Montana station publication previously referred to showed that when crested wheatgrass has a carrying capacity of 33.1 animal unit days per acre, native grass has a carrying capacity of only 15.1 days or about half the carrying capacity of crested wheatgrass.

†The place of crested wheatgrass on eastern Oregon wheat farms will receive major consideration in another publication.

reduced to a minimum during the low pasture months of July, August, and September. Obviously, marketing should coincide with late spring or early summer when pasture starts to dry up.

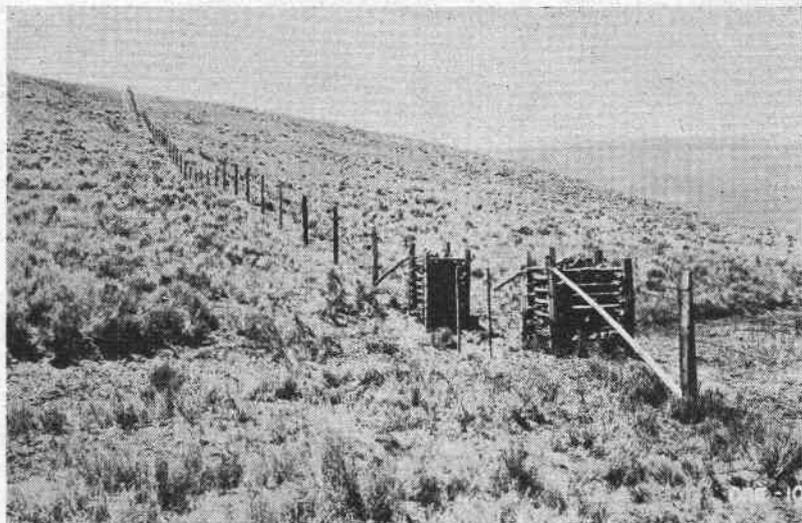


Figure 9. Typical native pasture scene in eastern Oregon wheat region. The less favorable soils and sites are left in native pasture.

Farmers with large acreages of crested wheatgrass in proportion to other kinds of pasture may plan to purchase ewes or feeder cattle in the fall and market them the following June or July. This operation would have the effect of expansion and reduction in livestock numbers in accordance with the availability of crested wheatgrass pasture. It also creates a need for additional hay that may be harvested from crested wheatgrass areas enclosed with growing wheat. Effective use of crested wheatgrass poses an important economic problem in the wheat country.

If properly grazed, crested wheatgrass can make a substantial contribution to the livestock program and the farm business on many wheat farms: (1) by providing early green feed, especially valuable for ewes with lambs; (2) by measurably increasing the carrying capacity of the farm from April to July; and (3) by supplementing other kinds of pasture during all seasons of the year. The grass may improve the farm business by insuring a profitable livestock enterprise and another source of income in addition to wheat. The income from livestock can be increased with crested wheatgrass either by an improvement in the weight and quality of animals or by an expansion of the livestock enterprise.