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CRESTED WHEAT GRASS

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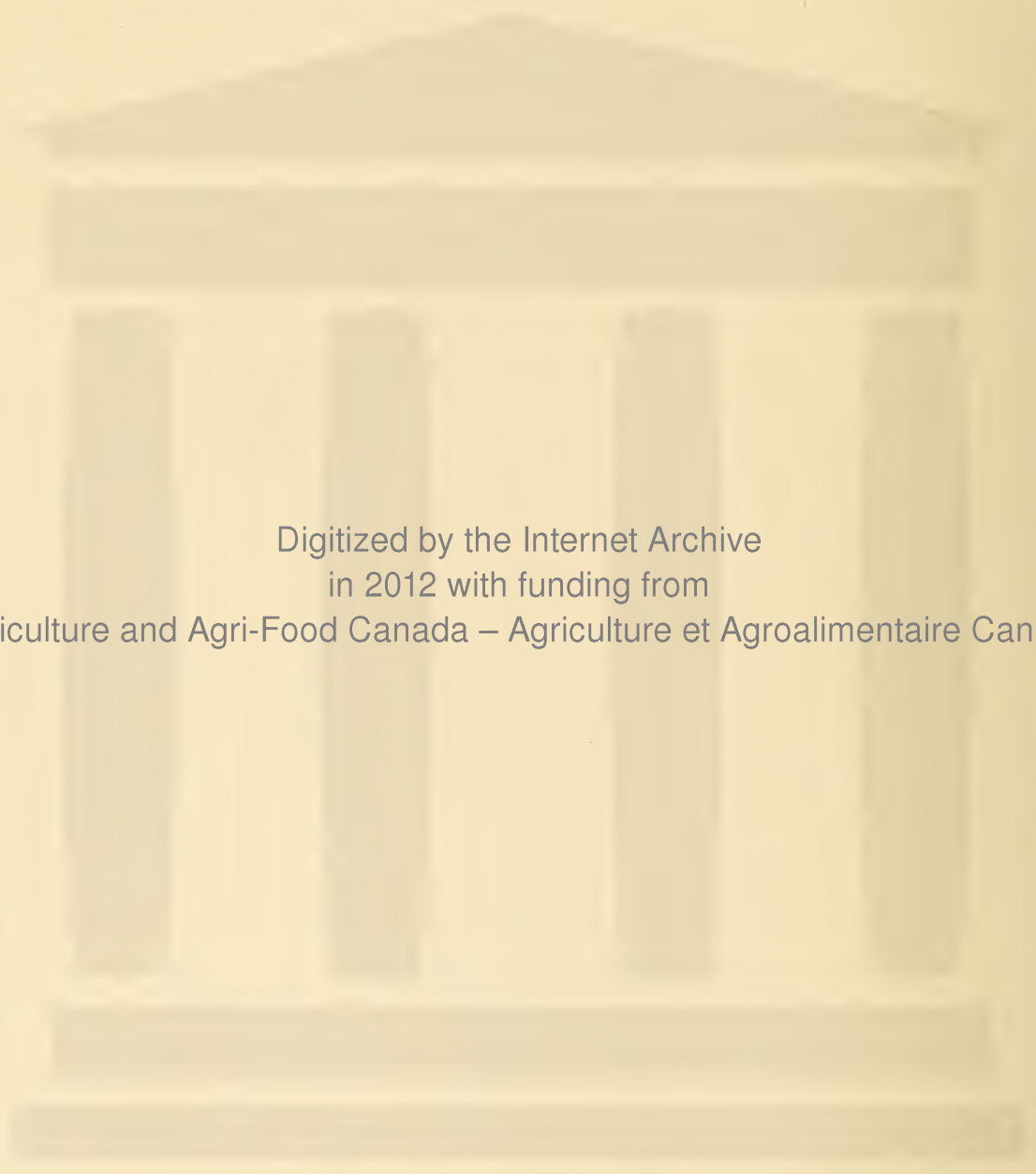
Forage Crops Laboratory,
Saskatoon, Sask.

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CRESTED WHEAT GRASS

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Crested wheat grass is one of the major cultivated grasses of the Canadian Prairie region. This grass and brome grass grown singly or in mixtures form the major part of grass seedings in the prairie area. Farm use of crested wheat grass in Canada began around 1930 and during the subsequent drought period it was used for reseeding drifted areas and abandoned farms. Crested wheat grass is the grass most extensively used for reseeding under the Prairie Farm Rehabilitation program. From 1935 to 1954 reseedings of grass in community pastures by this agency totaled 190,548 acres.

Adaptation

Crested wheat grass is well adapted to withstand extremes of drought and cold. It is particularly suited to the Brown and Dark-Brown soil zones of southwestern Saskatchewan and southeastern Alberta. It also produces well in the Black soils or park area but here brome grass shows somewhat better adaptation. In the intermountain areas of British Columbia in localities with less than 12 inches of precipitation crested wheat grass is useful for reseeding depleted range.

During dry periods crested wheat grass stops growing and becomes dormant. With a return of more favorable conditions new growth will appear. Crested wheat grass grows well on a wide variety of soil types. Productivity on sandy and infertile soils is generally superior to that of other grasses. Crested wheat grass is not tolerant of prolonged flooding and if submerged for a week or ten days will kill out. It withstands saline conditions moderately well. Tests have shown it to be slightly inferior to brome grass on saline soils.

Description

Crested wheat grass has a bunch root. In thin stands, however, single plants will produce pronounced tufts as a result of strong tillering tendencies. Roots penetrate deeply and have been found at a depth of eight feet in two-year-old plants. Additions of root fiber to the soil from crested wheat grass are remarkable. Studies at Saskatoon have shown two-year-old stands to yield 2 tons of fiber for the top acre-foot of soil. This amount increased to 4 tons per acre-foot of soil in eight-year-old stands.

Two forms of crested wheat grass are cultivated. The shorter-growing form, *Agropyron cristatum*, is generally used in Canada at present. This was distributed by the Field Husbandry Department, University of Saskatchewan, in 1927 and licensed in 1932 as the Fairway variety. The taller-growing form.

⁽¹⁾ Agricultural Research Officer in charge of grass breeding.

Agropyron desertorum, or "Standard" type was distributed in preference to Fairway in the United States. Some distribution of the Standard type was made in Canada where it was known as the "forage" type. Summit is a variety of the Standard type released in 1953 by the Forage Crops Laboratory, Saskatoon. The Fairway and Standard types do not cross naturally. A few sterile hybrid plants have been produced from experimental pollinations.

Figure 1 shows typical heads of the Fairway and Summit varieties. Summit has longer heads than Fairway and spikelets are more closely appressed to the central axis of the heads in the Summit variety. Summit grows 3 to 4 inches taller than Fairway and this difference is particularly noticeable in old stands. Stems and leaves of Summit are coarser than for Fairway but the two varieties do not differ materially in leafiness. Seeds of Summit are approximately 50 per cent heavier than seeds of Fairway and seeds of Summit are not so uniformly tip-awned.

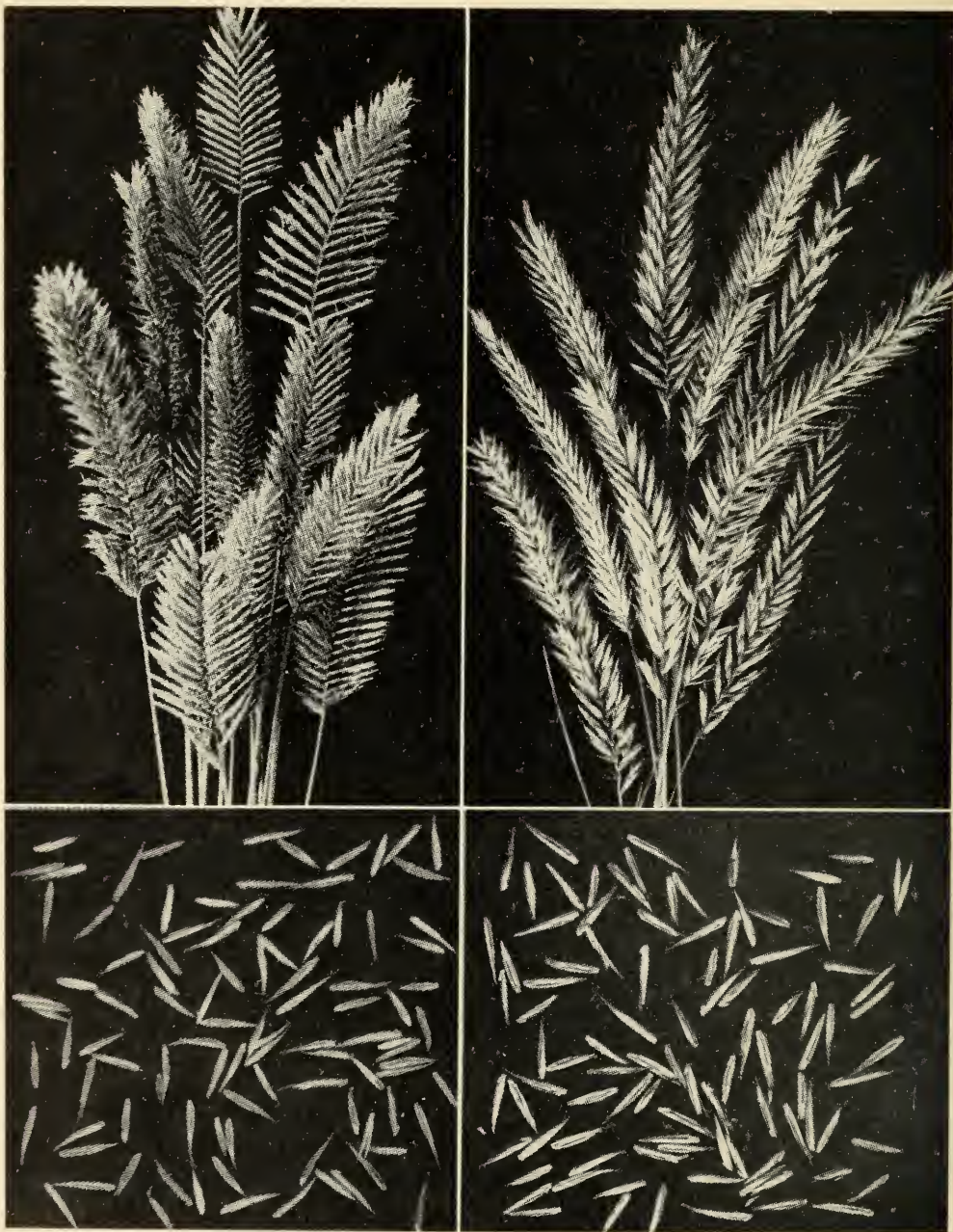


Figure 1.

Left (upper): Heads of Fairway Crested Wheat Grass (Lower): Seeds of Fairway Crested Wheat grass (natural size). Right (upper): Heads of Summit Crested Wheat Grass (Lower): Seeds of Summit Crested Wheat Grass (natural size).

Summit has yielded more hay than Fairway at most Experimental Farms in Western Canada (see Table 1). However, Fairway grows more rapidly in the year of seeding and will outyield Summit if harvested for hay the year of seeding. In mixtures with alfalfa Summit also has yielded more hay than mixtures of Fairway with alfalfa. Pasture yields of the two strains as determined by periodic clipping have been similar. The Fairway variety has produced 10 to 15 per cent more seed than Summit.

Summit has shown less persistence than Fairway in certain tests at northern areas. Thinning of stands of Summit was noted after three years, presumably as a result of root rot diseases. Preliminary tests on saline soils also have shown Fairway to have slightly better tolerance than Summit to saline conditions.

TABLE 1.—COMPARATIVE AVERAGE YIELDS OF FAIRWAY AND SUMMIT
CRESTED WHEAT GRASS IN WESTERN CANADA, 1939-1955

Station	No. of tests	Yield per acre	
		Fairway	Summit
<i>Grown alone for hay—(tons dry matter)</i>			
Saskatoon.....	13	1.32	1.54
Scott.....	3	0.82	0.91
Swift Current.....	3	0.59	0.64
Indian Head.....	3	1.44	1.58
Melfort.....	4	2.07	2.26
Morden.....	4	1.62	1.84
Brandon.....	1	1.71	1.83
Beaverlodge.....	1	0.73	0.90
Lacombe.....	4	1.89	2.00
Manyberries.....	1	1.37	1.48
Average.....		1.36	1.50
<i>Grown with alfalfa for hay—(tons dry matter)</i>			
Saskatoon.....	2	1.93	2.13
Lacombe.....	3	1.92	2.02
Beaverlodge.....	1	0.93	1.32
Average.....		1.59	1.82
<i>Grown alone for pasture—(tons dry matter)</i>			
Saskatoon.....	1	1.15	1.14
Lacombe.....	1	1.92	1.81
Beaverlodge.....	1	0.45	0.56
Average.....		1.17	1.17
<i>Grown alone for seed—(lb. seed per acre)</i>			
Saskatoon.....	8	378	348
Indian Head.....	1	517	438
Average.....		447	393

SEEDING CRESTED WHEAT GRASS

Time of Seeding and Land Preparation

Three seeding dates are recommended: early spring, early fall around September 1, and late fall at the time of freeze-up. Seedings should not be made during July and August in open-prairie areas as high temperatures during these months cause poor germination and a high loss of seedlings. In northern park

areas summer seedings often succeed. Early fall seedings should be made only when moisture conditions are favorable. If the soil is dry at the time of early fall seedings germination will be delayed and seedlings will not develop sufficiently to survive the winter. Temperatures for late fall seedings must be low enough that germination will not occur until spring.

Seedings made soon after the spring break-up may be made directly into clean stubble without previous land preparation. Later spring seedings generally need prior land preparation to control weeds. When a nurse crop is used stands of crested wheat grass are more successful where seeding is done on summer-fallow land than on stubble. There is danger of seeding too deeply if the summer-fallow is loose. Fall seedings are more successful on stubble than on summer-fallow as stubble collects snow and affords protection to seedlings.

Mixtures and Rates of Seeding

It is recommended that crested wheat grass be grown in a mixture with alfalfa when used for hay or pasture. Higher yields are secured from the mixture and a higher quality feed produced. In the Dark Brown soils and park area a three-way mixture of crested wheat grass, brome grass and alfalfa is recommended. Table 2 gives suggested mixtures with recommended rates of seeding. Rates of seeding refer to the Fairway variety of crested wheat grass. For the Standard type strains such as Summit rates 1 to 2 pounds higher than those recommended for Fairway should be used. Slightly higher seeding rates than those shown in Table 2 are recommended if a six-inch row spacing is used. When grown in rows 36 to 42 inches apart for seed production a seeding rate of 3 pounds per acre is recommended.

TABLE 2.—RECOMMENDED RATES OF SEEDING FOR FAIRWAY CRESTED WHEAT GRASS AND VARIOUS MIXTURES*

Mixture and rate of seeding in pounds per acre—12-inch row spacing

Crested wheat grass alone 6
 Crested wheat grass 5, alfalfa 1 or 2
 Crested wheat grass 3, brome 5, alfalfa 1 or 2
 Crested wheat grass 3, intermediate wheat grass 5, alfalfa 1 or 2
 Crested wheat grass 3, Russian wild rye 3, alfalfa 1

* Extract from "Guide to Farm Practice in Saskatchewan", 1954

Depth of Seeding

Too deep seeding is a common cause of stand failure in crested wheat grass. Seed should be sown $\frac{1}{2}$ to $\frac{3}{4}$ inch deep. When seeded over 1 inch deep in heavy soils emergence may be poor. One method of facilitating shallow seeding is to seed into a firm seedbed. Pressure on the disks may be released but if the soil is loose seeding may still be too deep. Depth control bands have been improvised for attachment to double disk drills to control depth of seeding. When seeding with a nurse crop both cereal and grass must be shallow seeded or the seeding done twice with the grass seeded at a shallow depth.

Row Spacing

Experiments have shown row spacings of 2 and 3 feet to yield more hay and seed than spacings of 6 and 12 inches (Table 3). Wide row spacings with inter-row cultivation have a definite advantage where stands are used for seed production over a period of years. Disadvantages of wider spacings are (1) lower yields in the first year after seeding; (2) more difficult weed control; and (3) an uneven field surface which makes harvesting for hay or seed more difficult.

TABLE 3.—FORAGE AND SEED YIELDS OF FAIRWAY CRESTED WHEAT GRASS AT VARIOUS ROW SPACINGS

Station and Period of Testing	Row spacing in inches	Hay—tons per acre	Seed—lb. per acre
Saskatoon—2 tests—1951-1955.....	6	0.90	215
	12	0.93	215
	24	1.07	277
	36	0.97	277
Scott—single test—1953-1955.....	6	1.09	—
	12	1.08	—
	24	1.09	—
	36	1.25	—
Lethbridge—3 tests—1940.....	6	1.37	118
	12	1.56	220
	24	1.90	308
Beaverlodge—1 test—1950-1952.....	6	—	189
	12	—	256
	18	—	303
	24	—	332

In the Brown and Dark Brown soil zones it is recommended that a twelve-inch row spacing be used where the crop is to be used for hay or pasture. Six-inch row spacings are recommended in the Black soil zone. For seed production it appears advisable to use a 36- to 42-inch spacing if the crop is to be kept in seed production for 4 or 5 years. Where seed will be taken for one or two years it would appear preferable to seed in rows 12 or 18 inches apart.

Control of Weeds in New Seedings

Although crested wheat grass is strongly competitive when established it is sensitive to weed and nurse crop competition in the seedling stages. A nurse crop may cause serious reductions in hay and seed yields the year after seeding. If stands are kept in production for several years the initial set-back to the grass from the nurse crop is largely overcome. Competition from the nurse crop may be minimized by reducing the seeding rate of the cereal to half the normal rate or cutting the cereal crop early for hay. Table 4 presents seed and forage yields of crested wheat grass following different methods of weed control.

TABLE 4.—HAY AND SEED YIELDS OF FAIRWAY CRESTED WHEAT GRASS AT SASKATOON USING DIFFERENT METHODS OF WEED CONTROL IN THE YEAR OF SEEDING

Method of Weed Control	Yield seed—lb/acre		Yield hay—tons/acre	
	First Crop	4 Crop Average	First Crop	4 Crop Average
No nurse crop—2,4-D spray*.....	488	274	1.23	1.04
No nurse crop—weeds mowed.....	397	233	1.09	0.95
Nurse crop—2,4-D spray*.....	194	231	0.66	0.91

* 2,4-D ester applied 8 oz. acid equivalent per acre when grass 4 inches high.

Where seedings do not contain a legume the use of 2,4-D at rates used for cereal crops gives good weed control. The grass should be 3 to 4 inches high before applying 2,4-D. Grazing young stands is undesirable unless very heavy weed growth is present. Cattle tend to graze out the grass and leave the weeds.

Mowing high is a better method of controlling weeds than grazing. The use of 2,4-D on older stands that will be harvested for seed appears hazardous unless spraying is done early in May or after mid-July when seed formation has commenced.

There is evidence that a cereal crop offers some protection to grass seedlings from wireworms and cutworms. If the cereal nurse crop is treated with gamma BHC, aldrin, or dieldrin, prevention of wireworm damage to the grass may be still more effective. Chemical seed treatments should not be applied directly to the crested wheat grass seed since germination may be retarded or reduced following the use of these seed treatments.

USE AS A HAY CROP

Crested wheat grass compares well with other grasses in hay yields and hay quality. Table 5 gives a comparison of average hay yields and protein contents of grasses grown at Experimental Farms in Western Canada.

TABLE 5.—HAY YIELDS AND PROTEIN CONTENT OF CRESTED WHEAT GRASS IN COMPARISON WITH OTHER GRASSES IN WESTERN CANADA

Grass	Yield of hay—Tons per acre		Protein content in percentage Grass grown alone
	Grass grown alone	Grass grown in alfalfa mixture	
Crested wheat grass.....	1.44 (16)*	1.94 (7)	11.3 (11)
Brome grass.....	1.44 (16)	1.81 (7)	12.5 (11)
Intermediate wheat grass.....	1.70 (16)	2.07 (7)	10.7 (7)
Tall wheat grass.....	1.47 (16)	1.94 (7)	10.6 (8)
Russian wild rye grass.....	1.10 (13)	1.52 (6)	13.6 (6)

* Bracketed numbers refer to the number of tests on which values are based.

The quality of crested wheat grass hay deteriorates fairly rapidly following heading. Heading occurs around June 10 at Saskatoon. It is recommended that hay be cut between the middle and the end of June to secure a favorable balance of yield and quality. When grown in alfalfa mixtures cutting may be delayed until July 1 without great loss in hay quality.

USE AS A PASTURE CROP

Crested wheat grass is used extensively for pasture in the drier parts of Saskatchewan and Alberta. The grass makes rapid growth in May and June but comparatively little growth in July and August. Grazing should be heavy during the early spring period to obtain maximum utilization. Once crested wheat grass has headed out it will be grazed unevenly and if cattle have access to other grasses or native prairie they will leave crested wheat grass to graze these other grasses. With favorable fall rains, crested wheat grass may make sufficient growth to provide fall pasturage.

Mixtures listed in Table 2 for hay production also are suitable for grazing. The seeding rate of alfalfa in the mixture is reduced from 2 pounds to 1 pound as a precaution against bloat. Second growth in hay fields usually shows a preponderance of alfalfa. If this growth is grazed there is more danger of bloat than when pastures are grazed continuously through the summer.

Crested wheat grass often is used in conjunction with native grasses for pasture. Experiments at the Manyberries Range Experimental Farm indicate that best production is obtained when crested wheat grass is grazed until the

last week in June and native prairie after this date. Cross fencing is necessary to force cattle to conform to this grazing schedule. Production of native pastures often can be increased by breaking and seeding a portion of the pasture to crested wheat grass. Pasture yields of crested wheat grass are generally estimated as double those of native prairie.

Taint in milk may occur where cattle are grazed on crested wheat grass in the early spring. This taint can be very objectionable. Difficulties of tainting may be reduced if cows are removed from the crested wheat grass 2 to 3 hours before milking. Experiments on tainting have to date shown no consistent difference between Fairway and the Standard type in the degree to which they cause taint. There also appears to be considerable variation among individual cows in the extent of taint in milk after grazing crested wheat grass.

SEED PRODUCTION

Crested wheat grass is a high yielding seed crop. The average seed yield of the first four seed crops of the Fairway variety at Saskatoon has been 246 pounds per acre. This compares with 158 pounds per acre for brome grass and 102 pounds per acre for intermediate wheat grass. As indicated in Table 3 seed yields are considerably higher at spacings of 18, 24, and 36 inches than at narrow spacings. Seed yields are higher following the establishment of crested wheat grass without a nurse crop than with a nurse crop.

When seeding in rows three feet apart a seeding rate of 3 pounds per acre is satisfactory. If 15 pounds of wheat per acre are seeded with the crested wheat grass the rows can be more readily identified for inter-row cultivation the first year. In the second and subsequent crop years cultivation should be done in spring and early fall to kill weeds and volunteer grass. Inter-row cultivation tends to build up the rows above the general field level. This makes for a rough field surface for harvesting operations. Picking up swaths for combining is difficult if swaths fall between the rows. Crested wheat grass usually produces no seed the year of seeding. However, the Fairway variety if seeded early in the spring without a nurse crop may produce a low yield of seed the same year.



Fig. 2. Crested wheat grass in rows for seed production.

Direct combining of crested wheat grass is to be avoided as shattering may be serious when the crop is ready for straight combining. Shattering also will be extensive when sheaves are picked up in the field. Tight-bottomed racks or a canvas should be used to prevent this loss. Crested wheat grass usually is ready to cut with binder or swather the last week of July or the first week of August. Heads will be brown and stems still rather green at this time. Seeds should be in the late dough stage. When ready to cut with the binder or swather heads should show some tendency to shatter when struck across the palm of the hand.

In threshing crested wheat grass care should be taken not to feed the machine too heavily. Concave settings should be such as to give a minimum of straw breakage as this will prevent straw from clogging the decks and sieves. Reducing cylinder speed from that used for wheat also will reduce straw breakage. Concave clearance should be sufficient to break spikelets up into individual seeds. If spikelets are not broken up some seed will be lost in later cleaning operations. With spike-toothed machines sufficient threshing often can be obtained by removing all teeth from concaves. The air blast and adjustable sieve should be set to obtain separation of straw and seed without blowing seed over.

Seed generally is marketed through seed companies or co-operatives. These agencies have good cleaning equipment. Satisfactory cleaning can often be done on the farm with the ordinary fanning mill. As a rough guide the size of opening in the top sieve should range from $3/64$ to $5/64$ inch wide and $1/4$ to $1/2$ inch long, depending on the size of seed. For the bottom sieve circular openings $2\frac{1}{2}/64$ to $3\frac{1}{2}/64$ inch in diameter are suggested. Seed of the Standard type generally is larger than that of Fairway but much variation occurs in either type depending on growth conditions in the field.

To grow Registered seed it is essential to be a member of the Canadian Seed Growers' Association and conform to regulations governing the production of Registered seed. This entails using Approved seed in seeding the increase field and maintaining isolation distances set forth by the Canadian Seed Growers' Association. Details of membership and regulations regarding the production of Registered seed may be obtained from the Canadian Seed Growers' Association, Ottawa.

Marked increases in forage and seed yields of crested wheat grass may result from the use of nitrogen fertilizers. Moisture conditions must be favorable to produce this response. Table 6 presents results from the Indian Head Experimental Farm showing the effect of fertilizers on the seed production of an old stand with six-inch row spacings. Fertilizer was broadcast on the surface for each year of testings.

TABLE 6.—SEED YIELDS OF CRESTED WHEAT GRASS FOLLOWING VARIOUS FERTILIZER TREATMENTS. EXPERIMENTAL FARM, INDIAN HEAD, SASK. 1954-1955

Treatment	Rate of fertilization lb. per acre	Seed yield lb. per acre	Increase over check
Check, not fertilized.....	—	44	—
Ammonium nitrate (33.5% N.) Fall.....	60	152	108
“ “ “.....	112	279	235
“ “ “.....	160	342	298
“ “ “.....	264	472	428
“ “ Spring.....	112	112	68
“ “ “.....	160	119	75
Ammonium phosphate (16-20) Fall.....	104	114	70
“ “ Spring.....	104	47	3
Ammonium phosphate (11-48) Fall.....	104	122	78

Fall fertilization was significantly better than spring applications. Yield of seed appeared proportional to the amount of nitrogen applied. Phosphorus was of little value. It is recommended that fertilizers high in nitrogen such as ammonium nitrate (33.5% N.) or ammonium sulphate (21% N.) be tried on old stands. Rates of 75 to 150 pounds per acre of ammonium nitrate or 100 to 200 pounds of ammonium sulphate should be used. Fall applications from September to freeze-up are recommended for seed production. For forage production fall and early spring application appear equally effective.

LAWNS, YARDS, ROADWAYS

Crested wheat grass is recommended for lawns and yards in dry areas where supplemental watering cannot be provided. This applies particularly to the Brown, and drier parts of the Dark Brown soil zone. Better quality turf grasses such as Kentucky blue grass and creeping red fescue need supplementary water in these areas. Since crested wheat grass forms a more durable sod than brome grass and is not as tall a grass it is recommended for farm yards, implement areas, sports fields, and roadways.

For lawns, a seeding rate of 1 pound per 100 square feet is recommended and the seed should be broadcast and raked in. A seeding rate of 40 pounds per acre is satisfactory for large areas. The seed should be broadcast and the area harrowed and packed. Where a considerable acreage is involved the seed may be drilled in two directions. The Fairway variety is preferable to the Standard type as it will form a denser turf with finer stems. Additions of Kentucky blue grass and creeping red fescue to the crested wheat grass will improve the quality of the turf but at the risk of some killing out of these grasses.

When crested wheat grass is used for lawns it should not be mowed until the grass is 4 to 6 inches high. Clipping of new seedlings with little growth may cause injury to the stand. Old lawns that show yellowing of leaf growth may be improved by the use of nitrogen fertilizers. Ammonium nitrate at rates comparable to those recommended for seed production should be used. The fertilizer should be broadcast evenly on the surface when the grass is dry.



Fig. 3. Crested wheat grass lawn at the University of Saskatchewan. Lawn seeded 1933 and still in good condition 1955.

REJUVENATION AND BREAKING OF OLD STANDS

Crested wheat grass stands growing without a legume usually show a marked decline in production after four hay crops (see Table 7). Seed yields usually decline more rapidly than hay yields particularly if narrow row spacings are used or if there is volunteer growth from shattered seed.

TABLE 7.—HAY YIELDS OF FAIRWAY CRESTED WHEAT GRASS FOR VARIOUS AGES OF STANDS, TONS DRY MATTER PER ACRE

Age of Stand—Years	Test 1 1940-1955	Test 2 1936-1943	Test 3 1937-1943	Average 3 tests
1.....	0.89	1.01	0.82	0.91
2.....	1.16	0.50	1.72	1.13
3.....	1.63	1.60	2.24	1.82
4.....	0.90	1.42	0.53	0.95
5.....	1.09	0.51	0.72	0.77
6.....	0.35	0.70	0.95	0.67
7.....	0.24	0.83	0.56	0.54
8.....	0.20	0.47	—	—
9-16 average.....	0.31	—	—	—

At the Swift Current Experimental Farm rejuvenation of old stands of crested wheat grass with the disk, one-way, heavy duty cultivator, and Noble blade gave unsatisfactory yield increases. The greatest increase in hay yield of one-third ton per acre resulted from double one-waying. The increase in yield, however, was not sufficient to pay for the cost of cultivation. In addition, tillage treatments left the fields rough and difficult to mow. Unproductive haylands of crested wheat grass would be better plowed, cropped for a few years, and seeded to a grass-alfalfa mixture.

Crested wheat grass has a tough sod that is more difficult to plow than brome grass. Once plowed, sods also are difficult to work down and may accumulate on the surface of the field. When the crop is grown in rows three feet apart plowing and subsequent handling of sod is more difficult. One-waying row stands two or three times prior to plowing allows the heavy crowns to be cut up and spread more evenly over the field. Handling of sod also is easier if fields are left down for relatively few years before being broken up.

REGRASSING ABANDONED LAND AND DEPLETED RANGE

Crested wheat grass has been found very useful in regrassing abandoned farm lands and overgrazed prairie of the Brown and Dark Brown soil zones. If the land has not been abandoned long and only annual weeds are present it is not necessary to prepare a seedbed. By seeding the grass into dead weeds in the fall or early spring the seedlings will be protected from soil drifting by the weed cover. If perennial weeds are present or the land is hard or badly cracked, some cultivation such as double disking is desirable. Another good practice when perennial weeds are abundant is to plow or one-way and seed a cereal crop for one season. Crested wheat grass is then fall seeded or spring seeded into the cereal stubble. This practice is recommended where soil drifting is not likely to interfere with the establishment of the cereal crop.

Where the native range is overgrazed and weedy, production can be improved by reseeding to crested wheat grass. If the soil is sandy and likely to drift crested wheat grass should be seeded without previous cultivation. If drifting is not likely to be a problem, preparation of a seedbed by double disking

or one-waying is strongly recommended. Seed should be drilled in although on stony or rough areas the seed may have to be broadcast. Broadcasting, however, usually is much less successful in getting stands than drilling. Crested wheat grass under dry conditions may take three or four years to become fully established. Thin stands if not overgrazed will set seed and gradually establish a complete cover.

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