

Crested wheatgrass



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CRESTED WHEATGRASS

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Crested wheatgrass is a major cultivated grass in Western Canada. It is particularly well adapted to the Brown soils of southwestern Saskatchewan, southern Alberta, and the intermountain area of British Columbia. Farm use of the grass in Canada began around 1930. In the subsequent drought period it was extensively used to reseed soil-drifted areas and abandoned farmland. Canadian seed production from 1959 to 1963 averaged 2,409,000 pounds per year, about half of which was exported to the United States. Crested wheatgrass is also useful for seeding roadsides, both in the dry prairie and adjacent mountain areas.

ADAPTATION

Crested wheatgrass withstands the extreme cold and drought of the open prairie area. It is suited to most soils, including sands and clays. However, crested wheatgrass is not tolerant of flooding and if submerged for a week to 10 days yields will be reduced. It does not grow as well on saline soils as more tolerant grasses such as Russian wild ryegrass or slender wheatgrass.

DESCRIPTION AND VARIETIES

Crested wheatgrass is a bunch-type plant. Single plants in thin seedings may form large tufts 12 to 15 inches across. Roots penetrate deeply, reaching 8 feet in old stands. The amount of root fiber added to the soil by crested wheatgrass is remarkable. At Saskatoon, 2-year-old stands produced 2 tons of fiber in the top acre-foot of soil. This increased to 4 tons in 8-year-old fields.

Two forms of crested wheatgrass are grown in Canada. One is the diploid form represented by the Fairway and Parkway varieties. The other is the tetraploid form represented by the Summit and Nordan varieties. These two forms are not easily crossed. However, pollen from the Fairway variety will cause some sterility in the Summit variety if the two varieties are grown side by side.

Figure 1 shows typical heads of the Fairway and Summit varieties. Parkway resembles Fairway, and Nordan is similar to Summit in head type. There are variations from plant to plant in all varieties. Additional differences between varieties are summarized in Table 1. Nordan and Summit remain greener than Fairway or Parkway under severe drought. Fairway and Parkway, however, live longer in the Black soil zone than Summit or Nordan.

Parkway was selected out of Fairway and released in 1969. It is taller than Fairway, more resistant to lodging, and has slightly higher hay and seed yields (Table 2). Certified seed of Parkway will not be readily available until 1972.

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Figure 1. Heads of crested wheatgrass varieties: *A*, Fairway or Parkway; *B*, Summit (Nordan is similar to Summit but usually lacks tip awns).

Fairway is widely used for pasture, roadside seedings, and dryland turf. The Nordan variety is the principal crested wheatgrass variety in the United States. Summit was originally released in 1953 and Summit 62, a reselection with somewhat better seed production, was released in 1962.

Basic seed of these varieties is called Breeder seed and is maintained by the originating stations. These are the University of Saskatchewan, Saskatoon, for Fairway; the Canada Agriculture Research Station, Saskatoon, for Summit and Parkway; and the Northern Great Plains Field Station, Mandan, North Dakota, for Nordan.

SEEDING CRESTED WHEATGRASS

Time of Seeding and Land Preparation

Sow in early spring or in late October just before freeze-up. Seedings made in July and August risk loss from drought and heat damage, but in northern areas summer seedings are often satisfactory.

Table 1. Comparison of crested wheatgrass varieties

Feature	Variety			
	Fairway	Parkway	Summit	Nordan
Head shape	Short, wide	Short, wide	Long, narrow	Long, narrow
Leaf hairs	Upper side	Upper side	Nil	Nil
Plant height	24 inches	27 inches	28 inches	28 inches
Number of seeds per pound	220,000	220,000	165,000	165,000
Tip awns on seeds	Present	Present	Variable	Usually absent
Heading, year of seeding	Yes	Yes	Nil	Yes

Table 2. Yields (Fairway = 100 percent) of crested wheatgrass varieties in Western Canada from experimental tests, 1962-68

Variety	Hay, percentage of Fairway	Seed, pounds/acre
Fairway	100	100
Parkway	107	110
Summit	103	97
Nordan	104	108

Seeding may also be done directly into cereal stubble right after the spring breakup. Later spring seedings generally need prior land preparation to control weeds. If a companion crop is used, it is better to use fallow than stubble land because this reduces competition for moisture. Always pack freshly worked land right after working so it will not dry out before seeding. Packing also helps to control depth of seeding. There is real danger of getting poor stands if the soil is loose. Fall seedings should be made into stubble as this prevents loss from soil drifting.

Mixtures and Rates of Seeding

Crested wheatgrass should be grown with alfalfa to produce higher yields of hay or pasture. Grass-alfalfa mixtures yield $1\frac{1}{2}$ to 2 times as much as grasses seeded alone. Competition from the grass may eliminate the alfalfa in dry areas after a few seasons. Summit and Nordan appear more suitable than Fairway in alfalfa mixtures as they are much less competitive. Parkway is slightly less competitive than Fairway. Suggested mixtures using crested wheatgrass are shown in Table 3.

The rates of seedings given for crested wheatgrass in Table 3 are for the Fairway and Parkway varieties. Rates should be increased by one half for Summit and Nordan. If the field is intended for hay, alfalfa should be seeded at 2 pounds per acre. For pasture, seed only 1 pound of alfalfa per acre as this reduces the danger of bloat.

A handy method of checking seeding rates is to run the drill over a hard

Table 3. Recommended mixtures for crested wheatgrass*

Mixture	Seeding rate, pounds/acre	
	For hay	For pasture
Brown and Dark Brown soils, rows spaced 12 to 18 inches		
Crested wheatgrass and alfalfa	4 + 2	4 + 1
Crested wheatgrass, brome, and alfalfa	2 + 4 + 2	2 + 4 + 1
Black, Dark Gray and Gray Wooded soils, rows spaced 6 to 7 inches		
Crested wheatgrass and alfalfa	7 + 2	7 + 1

* As recommended in the *Guide to Farm Practice in Saskatchewan, 1969*.

surface and count the seeds falling per foot of drill run. About 20 to 30 seeds per foot of row usually give a good stand.

Depth of Seeding

Seed crested wheatgrass shallow. Deep seeding is the most common cause of stand failure with this grass. Seed should be sown 1/2 to 3/4 of an inch deep. This is very important on heavy soils. One way of ensuring shallow seedings is to have a firm seedbed such as unworked stubble. Pressure on the disks may be released but if the soil is loose the seeds may still go too deep. Depth-control bands have been used with double-disk drills to control depth of seeding. When seeding with a companion crop both grain and grass must be sown shallow as deep seeding will result in poor emergence of the grass. Seeding also can be done twice, with the grass seeded shallow in the second operation and preferably crosswise to the direction of seeding the grain.

Row Spacings

Experiments show that rows spaced 2 and 3 feet apart yield as much or more hay or seed than rows 6 or 12 inches apart (Appendix A). Wide rows allow plants to escape damage from drought. Disadvantages of wide row spacings are lower yields for the first year after seeding, more difficult weed control, and an uneven surface when harvesting for hay or seed. Combinations of various widths of rows may be used in growing the crop for seed so the swath can be placed on rows seeded close together.

In the Brown and Dark Brown soil zones, rows 12 to 18 inches apart are recommended for hay or pasture. Six-inch rows are recommended for hay and pasture in the Black soil zone. For seed production, it is advisable to use 36- to 42-inch spacings for single rows or groups of rows if the crop is to be kept in production for 4 or 5 years. Where seed will be taken for 1 or 2 years, rows 12 or 18 inches apart are preferable.

CONTROL OF WEEDS

Old plants of crested wheatgrass compete well with weeds but young stands are sensitive to competition from weeds or a companion crop. This competition may

cause low hay or seed yields the year following seeding. Competition from the companion crop is less severe when the seeding rate of the grain crop is halved, or the cereal cut early for hay or silage.

The grass should be 3 to 4 inches high before applying herbicides. Pasturing young stands is undesirable as cattle tend to graze the grass and leave the weeds. For weed control mowing is preferable to grazing. Older stands being harvested for seed should be sprayed before the end of May. For perennial weeds use herbicides after the seed crop has been taken off.

USE FOR HAY

Crested wheatgrass compares well with other grasses in hay yield and hay quality (Appendix B). Quality, however, deteriorates rapidly after heading. Heading occurs around June 10 at Saskatoon and flowering around July 1. To secure a favorable balance of yield and quality it is recommended that hay be cut between the middle and the end of June. Crested wheat – alfalfa mixtures may be cut until July 1 without great loss in hay quality.

USE FOR PASTURE

Crested wheatgrass 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. To obtain maximum utilization grazing should be heavy during the early spring period. Once crested wheatgrass has headed out it will be grazed unevenly and if cattle have access to other grasses or native prairie, they will leave crested wheatgrass to graze these other grasses. With favorable fall rains, crested wheatgrass may make sufficient growth to provide fall pasturage.

Table 3 gives suggested mixtures of crested wheatgrass for grazing. The seeding rate of alfalfa in the mixture is reduced from 2 pounds to 1 pound in pasture as a precaution against bloat. Second growth 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 wheatgrass often is used along with native grasses for pasture. Experiments at the Manyberries Range Experimental Farm indicate that best production is obtained when crested wheatgrass 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 wheatgrass. Pasture yields of crested wheatgrass are generally estimated as double those of native prairie.

Taint in milk may occur where cattle are grazed on crested wheatgrass in the early spring. This taint can be very objectionable. Difficulties of tainting may be reduced if cows are removed from the crested wheatgrass 2 to 3 hours before milking. Experiments on tainting have 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 wheatgrass.

SEED PRODUCTION

Crested wheatgrass is a good seed producer. Yields up to 1,000 pounds per acre have been recorded. Seed yields depend greatly on moisture conditions, row spacing, age of stand, and fertilizer application (see Figure 2, Table 4, and Appendix A).

Rows 2 and 3 feet apart give more seed than rows 6 and 12 inches apart if stands are left down 3 to 4 years. Irrigation improves seed yields, particularly if fertilizer is also applied. Yields usually decline after the second seed crop but fertilizers help keep yields up. Seed yields are often low for the first seed crop if a companion crop was used when the grass was seeded.

When seeding crested wheatgrass in rows 3 feet apart, use a seeding rate of 2 to 3 pounds per acre. Herbicides should be used to control weeds during the year of seeding. In subsequent years inter-row cultivation should be done in the spring and early fall to kill weeds and volunteer crested wheatgrass. Inter-row cultivation tends to build up the rows above the general field level and this makes it difficult to pick up combine swaths. A 3 and 3 combination of rows will provide a strip to lay the swath on (see Figure 3). This consists of groups of three rows spaced 1 foot apart, with 3-foot cultivated strips between these groups. Various combinations of rows can be made for various sizes of swathers.

An alternative method for short-term production is the use of 12-inch-spaced rows with fairly heavy annual applications of nitrogenous fertilizers.

Swathing is preferable to straight combining because the crop shatters easily. Shattering also may occur when picking up the swath. Fairway and Parkway shatter more than Summit or Nordan. Crested wheatgrass is usually ready to swath in late July or the first week in August. Heads will be brown and stems still rather green at this time. When ready to cut, the heads should shatter a few seeds when struck across the palm of the hand.

In threshing crested wheatgrass do not feed the machine too heavily. Concaves should be set to give a minimum of straw breakage as this will prevent clogging decks and sieves. Reduced cylinder speed with normal forward speed will reduce straw breakage. Concave clearance should be just enough to break up the

Table 4. Effect of fertilizer on seed yields of Summit crested wheatgrass at Indian Head, Sask. (200 pounds ammonium nitrate, 33.5-0-0, applied each fall)

Treatment	1958	1959	1960	1961	1962	1963	1964	1965	Average
12-inch spacing									
Fertilized	151	182	422	4	234	236	46	138	177
Not fertilized	132	111	144	4	115	41	20	39	76
3-row group*									
Fertilized	124	164	381	8	233	297	47	218	184
Not fertilized	134	148	218	8	137	80	23	146	112

* 3-foot space between each 3-row group, rows 12 inches apart in the group.

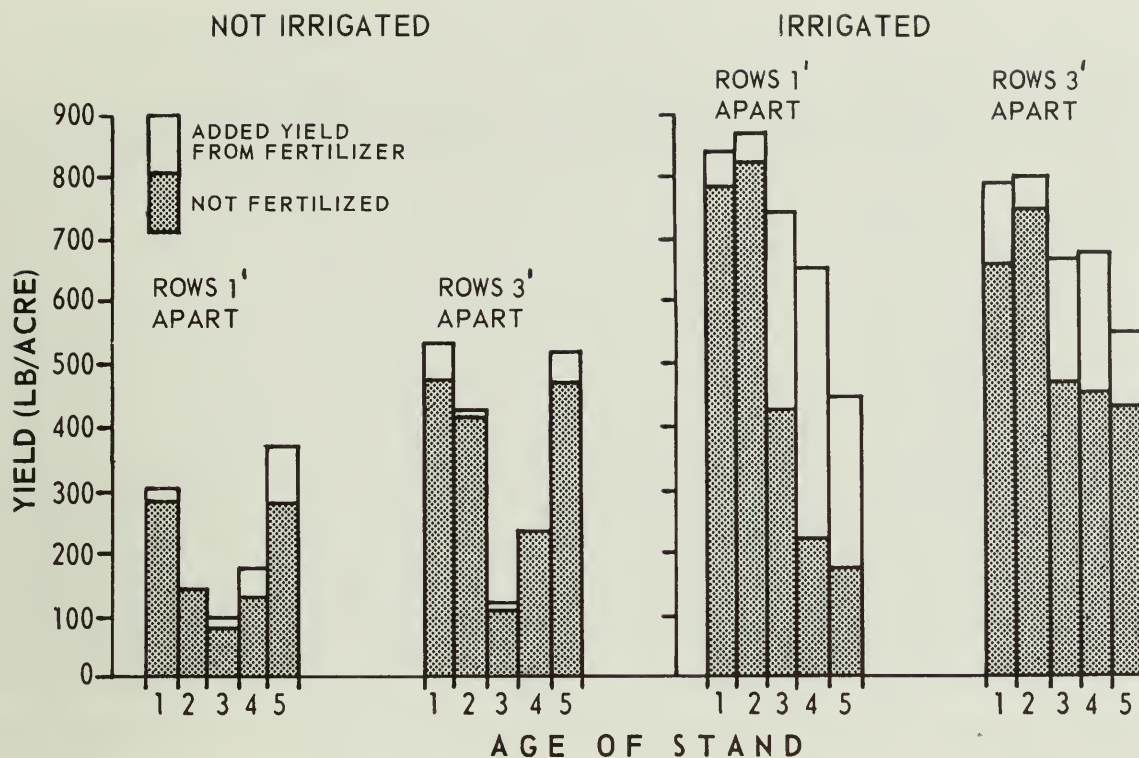


Figure 2. Seed yields of Summit crested wheatgrass, Scott, Sask., at narrow- and wide-row spacing, and with and without irrigation and fertilization. Fertilizer — 150 pounds per acre ammonium nitrate each year. Irrigation — 15 inches by sprinkler.

heads into separate seeds. If spikelets are not broken up, they will be lost in later cleaning. With spike-tooth machines the cylinder speed should be reduced by one half and all concaves removed and replaced by boards or planks. This usually will give sufficient threshing. The air blast and adjustable sieve should be checked carefully.

Satisfactory cleaning can be done on the farm with the ordinary fanning mill. As a guide, the size of the opening in the top sieve should range from 3/64 to 5/64 inch wide and 1/4 to 1/2 inch long. For the bottom sieve circular openings 2¹/₂/64 to 3¹/₂/64 inch in diameter are suggested.

Seed growers should grow Certified seed of named varieties rather than unnamed common seed. To grow Certified seed it is necessary to become a member of the Canadian Seed Growers' Association and follow its regulations. The Association handbook, Circular 6, states the classes of seed to sow in order to grow Certified seed and gives the isolation distances required. To produce Certified seed it is necessary to plant Foundation seed, although for Nordan Foundation or Registered seed can be used. Certified seed fields must be isolated from other crested wheatgrass seed fields and volunteer plants by 50 yards. For further details on Certified seed production write to the Canadian Seed Growers' Association, Box 455, Ottawa 2, Ontario.

Seed yields can be maintained at a higher level by broadcasting nitrogen fertilizers (see Figure 2 and Table 4). There is little response to phosphorous fertilizers such as ammonium phosphate 11-48-0. Yield increases are greater in wet years



Figure 3. Crested wheatgrass sown in 3-row groups, showing the swath from three groups laid on one group.

and on old stands. Fertilizers should be applied in the fall to get the greatest increase in seed yields the next year.

The effect of fertilizer is much less in dry years. However, in dry years there is a carry-over of fertilizer in the soil giving a residual response the next year. Where fertilizer is applied to the same field year after year there is little difference between spring and fall applications in total yields.

From 35 to 70 pounds of nitrogen are recommended for seed production on Brown and Dark Brown soils. This may be increased to 35 to 100 pounds on Black, Dark Gray, and Gray Wooded soils. The number of pounds of nitrogen carried by 100 pounds of various fertilizers are as follows:

Ammonium nitrate (33.5-0-0)	– 33.5 pounds nitrogen
Ammonium sulphate (21-0-0)	– 21 pounds nitrogen
Anhydrous ammonia (82-0-0)	– 82 pounds nitrogen
Urea (45-0-0)	– 45 pounds nitrogen

Forage yields also are increased with fertilizers, and time of application is not as important as with seed yields.

REJUVENATION AND BREAKING OF OLD STANDS

Crested wheatgrass not growing with alfalfa and not fertilized usually shows a marked decline in production after four hay crops (see Appendix C). 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.

At the Swift Current Research Station rejuvenation of old stands of crested wheatgrass 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 wheatgrass would be better plowed, cropped for a few years, and seeded to a grass-alfalfa mixture.

Crested wheatgrass has a tough sod that is harder to plow than bromegrass. Once plowed, sods also are hard to work down and may accumulate on the surface of the field. When the crop is grown in rows 3 feet apart, plowing and subsequent handling of sod is more difficult. One-waying wide-spaced rows two or three times before 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 a few years before being broken up.

REGRASSING ABANDONED LAND AND DEPLETED RANGE

Crested wheatgrass is very useful for regrassing abandoned farmlands 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. Seed the grass into dead weeds in the fall or early spring, as this will protect seedlings from soil drifting. 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 wheatgrass 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 wheatgrass. If the soil is sandy and likely to drift, crested wheatgrass 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 is usually much less successful in getting stands than drilling. Under dry conditions crested wheatgrass may take 3 or 4 years to become fully established. Thin stands, if not overgrazed, will set seed and gradually establish a complete cover.

LAWNS, YARDS, AND ROADSIDES

Crested wheatgrass has been used for turf in the Brown soil zone for many years. In recent years Russian wild ryegrass has been found to excel crested wheatgrass as a turf in several respects. It gives a denser cover than crested wheatgrass and stays greener in summer. Mixtures of the grasses are more suitable than crested wheatgrass alone. The Fairway variety of crested wheatgrass is best for turf because it is short and persistent. On small areas use 3 pounds of seed per 1,000 square feet. This may be reduced to 1 pound per 1,000 square feet (45 pounds per acre) when large areas are to be seeded.

Crested wheatgrass is a valuable grass for seeding roadsides of highways. It is commonly used to seed highway ditches and banks in the Brown soil zone of Saskatchewan. Crested wheatgrass also is used in mixtures for seeding roadside cuts in mountain areas. Crested wheatgrass has advantages of quick establishment and drought tolerance, which makes it useful for roadside seedings. It should not be used where water will accumulate or where there are high salt concentrations.

ACKNOWLEDGMENTS

Data from many of the Experimental Farms in Western Canada were used in the preparation of this bulletin. The following in particular made contributions that enlarged the scope of this publication: the Experimental Farm at Scott, the Research Stations at Melfort and Swift Current, Sask., and the Research Stations at Lethbridge and Beaverlodge, Alta.

Appendix A. Forage and seed yields of crested wheatgrass at various row spacings

Station	Row spacing	Hay, tons/acre	Seed, pounds/acre
Saskatoon – 3 tests	6	0.84	158
	12	0.87	158
	24	0.97	212
	36	0.93	239
Scott – 1 test	6	0.62	–
	12	0.62	–
	24	0.63	–
	36	0.88	–
Swift Current – 4 tests of hay; 1 of seed	6	0.38	–
	12	0.60	–
	18	0.63	113
	24	0.68	–
	30	0.77	–
	36	0.77	197
Lethbridge – 3 tests	6	1.37	118
	12	1.56	220
	24	1.90	308
Beaverlodge – 1 test	6	–	189
	12	–	256
	18	–	303
	24	–	332
Melfort – 4 tests	6	1.31	–
	12	1.81	585
	36	1.71	732

Appendix B. Yields of crested wheatgrass and protein content in comparison with other grasses

Grass	Yield of dry matter, pounds/acre		Protein content, percent	
	Hay	Pasture	Hay	Pasture
Swift Current – single test harvested 1952-56				
Crested wheatgrass	2069	1205	7.4	11.4
Russian wild ryegrass	1029	891	9.4	13.8
Saskatoon – three tests 1952-61, each test harvested for 4 years				
Crested wheatgrass	2689	1655	10.3	15.8
Russian wild ryegrass	2716	2230	10.2	17.6
Intermediate wheatgrass	3158	1867	9.1	14.9
Brome grass	2171	1563	11.5	16.6
Melfort – three tests 1949-56, each test harvested for 4 years				
Crested wheatgrass	2660	1687	14.6	16.3
Russian wild ryegrass	1820	1648	14.7	18.4
Intermediate wheatgrass	3480	2023	13.8	14.2
Brome grass	3260	1975	15.7	16.4

Appendix C. Hay yields of Fairway crested wheatgrass for various ages of stands, tons hay per acre (no fertilizer supplied)

Age of stand, years	Test 1 1940-55	Test 2 1936-43	Test 3 1937-43	Average 3 tests
1	0.9	1.00	0.8	0.9
2	1.2	0.5	1.7	1.1
3	1.6	1.6	2.2	1.8
4	0.9	1.4	0.5	1.0
5	1.1	0.5	0.7	0.8
6	0.4	0.7	1.0	0.7
7	0.2	0.8	0.6	0.5
8	0.2	0.5	–	–
9 – 16 average	0.3	–	–	–

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