PUBLICATION 799
FARMERS BULLETIN 146

ISSUED MAY 1950
REPRINT

CANADA DEPARTMENT OF AGRICULTURE

WINTER WHEAT VARIETIES

AND

THEIR PRODUCTION

IN

ALBERTA

Winter Wheat Harvesting Near Nobleford, Alberta

ublished by authority of the Rt. Hon. James G. Gardiner, Minister of Agriculture,
Ottawa, Canada.

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Winter Wheat Varieties and Their Production in Alberta

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Southwestern Alberta has always been looked upon as the most important winter wheat growing district in the Prairie Provinces. The area where this crop thrives best might be considered roughly as the southwestern corner of the province extending from the foothills of the Rockies to about forty miles east of Lethbridge, and from the Montana border to about sixty miles north of Lethbridge. The greater precipitation and snow coverage in the western part of this area makes the winter wheat crop a little safer and more successful there than in the eastern part.

Experimental work with winter wheat has been conducted continuously at the Lethbridge Experimental Station ever since its establishment in 1907. The first annual reports issued from the Station show that Odessa, a variety of soft winter wheat, had been grown in the Cardston and Pincher Creek districts for about twenty years previous to 1907, but the first commercial crop of hard winter wheat was produced in 1902. This was grown by Mr. E. E. Thompson of Spring Coulee who imported a carload of Turkey Red from Nebraska. Mr. Thompson's grain was distributed widely and used for seed purposes. Most of the four million bushels of hard red winter wheat produced in Alberta in 1908 descended from this carload, imported by Mr. Thompson. In 1907 the Lethbridge Station brought in from the Kansas State College of Agriculture several bushels of pure seed of a few leading varieties of winter wheat. One of these was called Kharkov. It proved very satisfactory and has been the most important variety in the district ever since. The acreage of winter wheat expanded rapidly and by 1911 over 300,000 acres were devoted to this crop. The official grade "Alberta Red Winter" was established for this class of wheat.

Winter wheat continued to increase in popularity until 1913 when it received a definite set back from root-rot damage.

Eelworms were found in many of the fields and it was though at first that they were the cause of the abnormal appearance of the crops, but investigation showed that the trouble had arisen from root-rot. Farmers in the Judith Basin of Montana encountered much the same experience in their winter wheat crops at that time, and results of investigations there coincided closely with those obtained in Alberta.

At that time the seeding of winter wheat extended over a long period of time, many of the fields being sown in July while others were sown almost as late as the first of December. Those who investigated the trouble were of the opinion that damage from root-rot was much more severe in the early sown

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fields, and since that time it has been recommended that the seeding of winter wheat should be delayed until after September 1, in order to escape damage from this disease.

Previous to the introduction of Marquis wheat, Red Fife was the chief variety of spring wheat grown in southern Alberta. It was frequently damaged by frost and consequently tended to retard the production of spring wheat. Marquis, however, popularized it, and since its introduction spring wheat has been much more commonly grown than winter wheat in southern Alberta.

Origin of Winter Wheat Grown in Alberta

The first hard winter wheat grown in Alberta, as previously stated, was imported from the United States and was known as Turkey. This was the name applied to the Crimean group of hard winter wheats imported from Russia. The history of wheat introductions to the United States, recorded by Carlton, shows that the original home of the hard winter wheats grown in the States and Canada was that part of Russia, north and east of the Black Sea and north of the Caucasus Mountains. In that region wheat was generally called, simply, winter wheat, but was known locally by various names such as Kharkof, Beloglina, Stavropol, Don, etc.

The introduction of winter wheats from Russia to the United States was closely associated with the immigration of Russian Mennonites to the wheat-growing areas of the United States. Carlton states that these people originally went from west Prussia to southern Russia about 1770, and a hundred years later their descendants emigrated to the middle Great Plains area and settled principally in Kansas. The first settlements in Kansas were made in 1873. Each family brought over a bushel or more of seed wheat and this produced the first crop of hard winter wheat in Kansas. Crimean is really the correct name for the whole group of hard wheats that came from that part of Russia, and which became known as Turkey in the United States. After it became grown in appreciable quantities in Canada the grade name, Alberta Red Winter, was established and the name, Turkey Red, then came into common use.

Kharkov (spelled Kharkof in the United States) is almost identical with Turkey Red in appearance. In 1900 Carlton introduced two strains of wheat from the district of Kharkof, much further north, with the expectation that they would be much more winter hardy. Other importations followed in the next two seasons from the same district. This Kharkov wheat then became widely grown throughout the wheat-growing area of the States, and it was introduced to Alberta about that time. For several years it gave slightly better results than Turkey Red. In later years little difference in hardiness and yield was noticed except in northern Wyoming and Montana where greater yields were consistently obtained from Kharkov.

Description of Varieties Grown in Alberta

Turkey Red

(C.A.N. 2447)

Origin: Brought into the plains area of the United States by Russian settlers in the latter part of the nineteenth century and introduced into southern Alberta by E. E. Thompson from Nebraska in 1902.

Description: Plant winter habit, mid-season, mid-tall; stem white, slender, weak; spikes awned, fusiform, mid dense, inclined, glumes glabrous, white, mid-long, mid-wide; shoulders wanting to narrow, oblique; beaks 2 to 8 m.m. long; awns 3 to 8 c.m. long; kernels dark red, mid-long, hard, ovate to elliptical; germ small; crease narrow to mid-wide; cheeks rounded; brush small, mid-long.

Milling and Baking Qualities: Considered the standard of quality for hard red winter wheat. It is more suitable for bread production than for other flour purposes, especially if the protein is high. In contrast to high quality Manitoba Northern hard red spring wheat it is not looked upon as a good supporting wheat in blends with wheats of intermediate or weak quality and under English milling practice it would be considered as an intermediate or filler type wheat.

Status and Distribution: Turkey Red now occupies only a very small proportion of the winter wheat acreage of Alberta. It is confined mostly to the foothills area where winter wheat growing has continued throughout the years since grain growing commenced. Elsewhere in the Province it appears only in isolated areas.

Description for varieties taken from Technical Bulletin No. 795, United States Department of Agriculture, Washington, D.C.

Kharkov

(C.A.N. 2461)

Origin: First introduced into the United States by M. A. Carleton in 1900 from Kharkof, Russia, and introduced from Kansas State College by the Dominion Experimental Station, Lethbridge, Alberta, in 1907.

Description: Kharkov can be described as practically identical with Turkey Red in all respects, excepting that the heads of Kharkov are slightly longer.

Milling and Baking Qualities: Similar in quality to Turkey Red and would rank with this variety in this respect. By itself it makes very acceptable bread. It mills freely and produces a high yield of flour. The flour is creamy yellow.

Status and Distribution: The acreage devoted to Kharkov in Alberta is greater than that of all other varieties combined. For many years it has been considered the best variety from the standpoint of winter hardiness and general suitability. A superior strain, Kharkov 22 M.C., C.A.N. 2360, with stronger straw was developed at Macdonald College, Quebec. This strain was accepted for registration by the Canadian Seed Growers' Association and is now widely grown throughout the winter wheat area. Since it is the only registrable strain of a winter hardy, hard red winter wheat variety, it has been distributed in small lots for a number of years.

Yogo

(C.A.N. 2502)

Origin: Yogo was produced from a cross (Minturki × Beloglina) × Buffum made in 1919 at the Kansas Agricultural Experiment Station, Manhattan, Kansas. The variety was first tested on farms in Montana in the fall of 1932, in which year it was registered as an improved variety.

Description: Plant winter habit, mid-season, mid-tall; stem white, weak; spikes awned, fusiform, mid-dense to lax, nodding; glumes glabrous, white, mid-long, narrow; shoulders wanting to narrow, rounding to oblique; beaks 1 to 2 m.m. long; awns 3 to 10 c.m. long; kernels red, mid-long, semi-hard to hard, ovate to elliptical; germ small; crease narrow, mid-deep; cheeks rounded; brush small, mid-long. It is easily distinguished from Turkey wheat by its lax, nodding spikes.

Milling and Baking Qualities: Quality tests on this variety indicate that it is of similar type to Kharkov. It mills freely and produces a high yield of flour. The flour is creamy yellow.

Status and Distribution: It was brought into Alberta about 10 years ago and has become fairly widely distributed throughout the winter wheat area. The kernels are closely held in the head and this variety is preferred by some on account of its resistance to shattering. It is quite winter hardy and is resistant to a number of races of bunt or covered smut.

Jones Fife

(C.A.N. 2464)

Origin: Jones Fife was originated by A. N. Jones of Newark, N.J., and according to Carlton it descended from a cross between Fultz, Mediterranean and Russian Velvet. It is grown in Canada under several names, the chief ones being Velvet Chaff, Crail Fife, Silver King and Burbank.

Description: Plant winter habit, mid-season, mid-tall; stem white, mid-strong; spikes awnleted, oblong, fusiform, mid-dense, nodding; glumes pubescent, white, mid-long, mid-wide to wide; shoulders mid-wide, oblique to square; beaks wide, obtuse, ·5 to 1 m.m. long; awnlets few to several, lower ones often incurved, 3 to 8 m.m. long; kernels red, short to mid-long, soft to semi-hard, ovate, humped; germ mid-sized; crease mid-wide to wide, mid-deep to deep; cheeks angular, brush mid-sized, mid-long.

Milling and Baking Qualities: Jones Fife is a soft red winter wheat of different quality to Turkey Red and Kharkov. It is less desirable for bread production but is useful in the production of flours for the soft wheat flour trade. It has weak gluten and when its protein is low it may be used for the production of satisfactory biscuit, cake, pastry and cracker flours.

Status and Distribution: Jones Fife is somewhat lacking in winter hardiness and has a definite tendency to shatter at harvest time. Since it is definitely less winter hardy than other varieties of winter wheat grown in Alberta it is much less widely distributed. It is confined very largely to the districts centring around Pincher Creek, Cardston, and Magrath, where rainfall is usually more plentiful and winter killing is less severe.

Advantages in Growing Winter Wheat

There are a few very good reasons why it is advantageous to-day to devote a part of the wheat acreage to winter wheat on farms where it can be depended upon to winter successfully. Part of the renewed interest in winter wheat is the fact that it has been selling at a premium of ten cents a bushel over spring wheat, and this premium has been paid almost since the commencement of the war. Previous to the war years, Canadian milling companies imported their supplies of low-protein flour, for pastry purposes, from the west coastal area of the United States and from Australia. When the importation of wheat from other countries was prohibited by the Canadian Government it became necessary for Canadian millers to obtain their supplies locally, and flour from winter wheat has been filling at least some of the trade requirements satisfactorily. The increased price has undoubtedly been largely responsible for the rapid increase in acreage of winter wheat in the last three seasons.

Having part of the farm seeded to winter wheat helps to relieve the rush of spring work, and while the seeding of the winter wheat crop comes at an extremely busy season it can be done quite rapidly, and harvesting should not be delayed to any appreciable extent on account of it. Since winter wheat usually ripens about two weeks earlier than spring wheat, and therefore, lengthens the harvesting season to that extent, the farmer is much less dependent upon hired help in his harvesting operations. The crop is much less likely to stand longer than is necessary after ripening and losses from hail, shattering and adverse weather conditions are, therefore, reduced.

In the years when wheat was marketed on a quota basis, winter wheat was not included, and farmers who had winter wheat to market in those years found it a great advantage.

Canada thistle is one of the bad weeds on irrigated land and some farmers have used winter wheat fairly successfully to control it. Two crops of winter wheat have been grown in succession and the land has been ploughed deeply before each one and again after the second crop. One crop reduces the thistles considerably, but it requires two crops to make a fairly complete job of eradicating them.

Winter Wheat in Soil Erosion Control

The belief that winter wheat can be used to good advantage in checking soil drifting is frequently expressed by some of the best farmers in the winter wheat area. Striking examples have been observed where land has gone into the winter with a good cover of winter wheat and suffered no damage whatever from drifting, while bare fallows in the same vicinity have drifted badly. However, some winter wheat fields having a light fall cover have suffered badly. The value of the crop as a protection against wind will depend almost entirely upon the amount of cover which it produces before winter sets in, and the cover will depend upon the earliness of seeding and the weather conditions which follow. A good cover of winter wheat also affords protection against water erosion, especially in the early spring. In order to get a coverage which is ideal from the standpoint of protection it is necessary to advance the date of seeding to the middle of August. The growing weather extends much later into the fall in certain seasons than in others, and crops sown in the latter part of September frequently make such light growth that the ground is unprotected and the plants

become badly cut off in heavy winds. If further trials indicate that the date of seeding can be advanced to the middle of August without serious losses from root-rot, winter wheat can be expected to play a much more important part in soil erosion control than it has played in past years.

Photo taken June 5, 1947, of Kharkov winter wheat grown on dryland summer-fallow. The early maturity of winter wheat gives it an advantage over spring wheat in counteracting midsummer drought.

Land Preparation

Land preparation for winter wheat is essentially the same as for spring wheat. It should be remembered that the two chief causes of loss in winter wheat crops are winter killing and wind damage, and precautions should be taken to avoid these losses as far as possible. The greatest returns can, of course, be expected when the crop is sown on clean fallow. It is advisable, however, to conduct all tillage operations in such a way that as much stubble and trash as possible are left on the surface to give protection against soil drifting and to help in retaining a snow cover. In districts where rainfall is not too limited winter wheat is frequently sown in spring wheat stubble. One cultivation with a duck-foot cultivator or Noble blade is usually sufficient preparation for seeding.

In certain seasons it is necessary to harrow winter wheat lightly, early in the spring, to control annual weeds or to break a crusted soil surface. This can usually be done without damaging the winter wheat crop too severely, but where weeds are very plentiful their thorough destruction cannot be expected. Spraying winter wheat fields in the spring for weed control was done on a commercial basis in the spring of 1947 for the first time and showed promise.

Methods of Seeding

In the vast majority of cases farmers use the same seed drill for winter wheat as they use for spring wheat and other grains, which is usually an ordinary press or wheel drill. Some favour a furrow type of drill as they believe there is much less likelihood of winter killing or wind damage from this method of seeding, and that the yield is not reduced. Both methods of seeding have been compared at the Lethbridge Station for the past nine seasons on dry land summerfallow. A van Brunt press drill and a Dempster No. 20 furrow-seeding machine were used. The Dempster furrow-seeding machine scatters the seed evenly over a six-inch furrow bottom on a firm, flat, moist seed bed, and the seed is then packed by specially constructed packer wheels. The rows are fourteen inches apart from centre to centre making a six-inch furrow and an eight-inch ridge.

Results obtained at the Lethbridge Station from these two methods of seeding showed that the furrow-drill method gave an average yield for a nine-year period of 24 bushels per acre, while the press-drill method gave 25·7 bushels. The Kharkov variety was used throughout the test and the rate of seeding by each method was one bushel per acre. Weeds were much more troublesome on the land sown with the furrow-seeding as they had a better opportunity to thrive under the wider spacing of rows. Two unusually heavy winds from the north damaged the plots from both methods of seeding to a slight extent in the spring of 1944, but that season was so dry that the crop was a total failure in both cases. That was the only season when any appreciable amount of winter killing or wind damage occurred.

Date of Seeding

From experimental data secured early in the history of the Lethbridge Station, and experience throughout the years which followed, the first week in September has been recommended for many years as the best time to sow winter wheat. However, there is reason to believe that earlier seeding may be preferable. If winter wheat can be sown safely early in August it should provide sufficient growth before winter to furnish protection against soil erosion. Extensive tests are now being conducted throughout the district to secure more complete information on the effect of earlier seeding.

Rate of Seeding

The early records of the Lethbridge Station show that there was a wide diversity of opinion among the farmers as to the best rate of seeding for this crop. An experiment was commenced in the fall of 1907, in which eight plots one-eighth acre in size were sown on September 3, the first at one peck per acre, the second at two pecks per acre, the third at three pecks per acre, and so on up to two bushels per acre. This test was conducted for three seasons and the conclusion arrived at from the average results for the three-year period was that one should sow at least a bushel per acre. Many farmers at that time apparently believed that lighter seedings were preferable for heavier yields, however, one bushel per acre has become the usually accepted rate.

Diseases Affecting Winter Wheat

In order of their importance the principal diseases of winter wheat in Alberta are at present the two common root-rots, the take-all root-rot, and covered smut (bunt or stinking smut). Covered smut is effectively controlled by the standard mercurial dust treatments. However, the root-rots are much

more difficult to combat than smut, because the fungi causing them are native to the soil, and their increase must be checked by the growing of resistant crops or by summerfallow.

Common root-rot, caused by two different soil fungi, (*Helminthosporium sativum* and *Fusarium culmorum*) may be fairly destructive, especially where successive crops of winter wheat have been grown on the same land. The yielding ability of diseased plants may be greatly reduced. Plants having common root-rot rarely develop the bleached appearance characteristic of the take-all root-rot, and they are not easily pulled from the ground. The roots and bases of the diseased stems are more or less discoloured and rotted, depending on whether or not weather conditions are favourable and the attack is early and severe. Grain from fields where common root-rot has been severe may carry a heavy load of spores of these root-rotting fungi, but treatment with a standard mercurial dust will readily kill them.

At present the take-all root-rot (*Ophiobolus graminis*) is recognized as the most serious disease problem in the successful growing of winter wheat. This fungus, which is native to the soil, increases quite rapidly when winter wheat is grown year after year on the same land. Its increase is greatly favoured by a wet season and checked by a dry one.

Under conditions in Alberta, symptoms of the take-all root-rot do not show until fairly late in the season. From heading time until maturity, affected plants become more or less bleached, with bases and roots often severely rotted and usually blackened. Such plants are easily pulled up and the grain in their spikes may be slightly, moderately, or very much shrunken, depending on the severity and earliness of the attack.

The only control available is crop rotation in which winter wheat does not appear too often. Spring wheat, which has a short crop season, favours the increase of the take-all fungus in the soil much less than does winter wheat, and may be seeded alternately with it to good effect where the disease is likely to be severe. A crop of oats is even more effective than summerfallow. Flax, legumes, and other resistant crops are also effective. The take-all disease is not seed-borne. Apparently all varieties of winter wheat are equally susceptible.

Winter Killing

Winter killing occurs occasionally and the extent of the damage done by it varies widely between different locations. Temperature, soil moisture, and wind are probably the most important factors influencing the survival of the winter wheat crop. Winter killing was severe in the winter of 1946-47 when almost 50 per cent of the winter wheat fields required re-seeding. This was a winter of excessive snowfall with considerable ice forming from melted snow. This may have been an important cause of the winter killing.

Winter killing is less likely to occur when the crop is sown in stubble than when it is sown in summerfallow, probably because the stubble retains a better snow cover, giving the crop more protection. When summerfallowed land is used for winter wheat it is important to follow cultural practices that will leave as much stubble and trash as possible on the surface.

In the southeastern part of Alberta winter killing has not by any means been a limiting factor in the production of winter wheat. At the Lethbridge Station winter wheat in the rotation plots on dry land has killed out completely only twice in a period of thirty-five years. In a few other seasons, however, the plots were partially destroyed by winter killing but not sufficiently to

warrant seeding them to some other crop. Kharkov, which has been the most winter hardy variety obtainable during this period, was the one used in these tests. Where complete winter killing occurs there is very little expense other than the cost of seed and seeding involved, since the land can be cultivated and seeded to another crop.

In the fall of 1945 twenty varieties of winter wheat were sown at seven of the substations in districts served by the Lethbridge Station. The winter survival of these varieties gave some indication of how winter wheat can be depended upon to survive in different parts of Southern Alberta. At four points in the south, namely: Whitlaw, Foremost, Pincher Creek and Claresholm, all varieties survived at least 90 per cent. At Craigmyle and Drumheller two strains of Kharkov survived 100 per cent, Yogo and Minhardi survived 90 per cent and the survival of the remaining varieties ranged from 90 per cent down to zero. In the test conducted at Acadia Valley all varieties killed out 100 per cent.

Yielding Capacity of Winter Wheat as Compared with Spring Wheat

The relative yield of winter and spring wheat depends very largely upon the time when the spring and early summer rains occur. In most seasons, however, the most critical drought periods come in late June or early July. Winter wheat is further advanced than spring wheat at that time and consequently suffers less. It can, therefore, be expected to give a little higher average yield than spring wheat over a long term of years, as has been well demonstrated in two rotations on dry land at the Lethbridge Station. These are three-year rotations outlined as follows:

A.	1st year	Summerfallow
	2nd "	Kharkov winter wheat
	3rd "	Marquis spring wheat
B.	1st year	Summerfallow
	2nd "	Marquis spring wheat
	3rd "	Marquis spring wheat

The Kharkov winter wheat following summerfallow (A) gave an average yield for the eighteen-year period (1929-1946 inclusive) of 19·7 bushels per acre, as compared with 18·1 bushels per acre for the Marquis following summerfallow (B).

There is not an outstanding difference in yielding capacity of the different varieties of winter wheat commonly grown in southern Alberta. In the variety tests conducted on dry land at the Lethbridge Station for a six-year period (1940-1946 inclusive) the average yields of four varieties used widely at present were as follows:

Kharkov M.C. 22	35·3 bushels per acre
Kharkov (Lethbridge strain)	35·0 " " "
Yogo	35·0 " " "
Jones Fife	33·6 " " "

Markets for Winter Wheat

For the past several years Canadian mills have been using Alberta red winter wheat to supplement their requirements for soft wheat flour for the cracker, biscuit, cake and pastry trade. Under price control, this crop has been bought to advantage for the domestic market over Ontario winter wheat—the demand being for low-protein wheat. The increased production of soft

white spring wheat on irrigated land in Alberta may lessen this demand. Furthermore, the extension of winter wheat to dry land areas is conducive to high protein wheat which is undesirable for the above purpose.

A large increase in the production of Alberta red winter wheat will mean that this wheat, in general, will have to compete with hard red spring wheat for bread flour production. When exported, it will be used in the same manner as American hard red winter wheat. Its suitability for this purpose will depend on the variety and whether it is grown on land favouring high protein such as the dry land areas. There would appear to be two markets open to Alberta red winter wheat, a soft low-protein type and a hard, high-protein type. The quality of Jones Fife makes this variety suitable for the former, and that of Kharkov and Yogo for the latter. Fortunately, Kharkov and Yogo are winter hardy and from this standpoint alone, will be favoured in those areas where high protein wheat can be produced. It is in this type of wheat for which a wider market will be available.

Summary

In 1911 and before the introduction of Marquis spring wheat, Alberta produced a winter wheat crop of over 300,000 acres. After 1913, the acreage devoted to this crop decreased rapidly until the past three years when it was again on the increase and this interest has spread into southwestern Saskatchewan.

Since winter wheat ripens earlier than spring wheat, it helps to spread out the harvesting operations and if drought occurs in mid-summer, it will be further advanced and thus escape serious injury. It may be useful in the control of weeds and there is evidence to show that it is useful in checking soil drifting. Where winter wheat can be grown successfully, it can be expected to outyield spring wheat. Those who have not grown winter wheat on their farms should not risk too large an acreage until they have learned by experience whether this crop is adapted to their area. Even though winter-hardy varieties are available it is not likely that this crop will have a wide adaptability.

The principal varieties, Kharkov, Yogo, Turkey Red and Jones Fife are described. Land preparation, methods of seeding, rates and dates of seeding are given from experience gained at the Dominion Experimental Station, Lethbridge, over a long period of years.

A description and the control of the common diseases, bunt or covered smut and the root-rots are given.

There is, at present, a limited market for Alberta winter wheat of low protein content for the Canadian soft wheat flour trade. High protein wheat of the Kharkov type will have a wider market for the export trade.

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1950