

M. A. Carleton, Pioneer Durum Wheat Scientist

By
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Plant Explorer

IN 1901, Mark Alfred Carleton said, "... introductions of new crops should proceed upon the basis of previous scientific investigation of environment." This recognition of the importance of soil and climate in locating new crops was the key to his success in helping to establish durum wheat in this country.

Carleton was cerealist in the Department of Agriculture. Apparently his interest in cereals dates back to his boyhood days on a Kansas farm. He took his undergraduate and graduate training at Kansas State College, Manhattan, and joined the U.S.D.A. in 1894, after working on the experiment station staff at Manhattan.

It is now less than half a century ago that he made his first trip to Europe. Leaving July 4, 1898 as a plant explorer, he visited several countries, Sweden, Germany, Austria-Hungary and Rumania, but most of his time he spent in Russia. After six months he returned with many new collections, not only of durum wheats, but also bread wheats, oats, barley, emmer, rye, corn, millet, buckwheat and peas. He described these in one of the early publications of the Department, "Russian Cereals," Bulletin 23, published in 1900.

A Crop Which Had Failed

At the turn of the century, durum wheat was not unknown in the United States. It has been brought over from Russia by the U.S.D.A. and by immigrants as early as 1864, but was not widely grown. Apparently the previous failure of durum wheat to establish itself was due to a combination of reasons:

- (1) It was tried in eastern states and found not adapted.
- (2) It was tested in favorable regions but dropped following a single unfavorable year.
- (3) The kernel was harder than that of bread wheats and was difficult to mill.
- (4) It was used for bread rather than for macaroni.

Sound Basis for a New Crop

Carleton recognized and publicized these difficulties. His persevering efforts at overcoming them were perhaps even more important than his work as a plant explorer. First he carefully studied the soil types and climatic features of the Russian areas in which durum wheat was native. Then he selected comparable areas in the United States and sent seed of the new introductions to many cooperators in these areas. At the same time, he urged cooperators to continue the trial over a period of years, before drawing too definite conclusions.

He conducted a voluminous correspondence with cooperators and published many of their letters. Of interest is the following from Dr. J. H. Shepperd, then professor of agriculture and later president of North Dakota Agricultural College,

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"I am planning to do considerable work with macaroni wheat in this district. The two best Russian sorts outranked everything else. In 1899 Pererodka . . . gave a yield of 39.9 bushels per acre and Kubanka . . . yielded 30.1 bushels per acre. Both were very hardy and thrifty and were early enough to be entirely safe in this district . . ."

What Is It Good For?

Millers found the hard vitreous durum kernels very difficult to mill. There were no established sources of durum semolina for making macaroni. The small amount of macaroni products manufactured in this country was made from inferior bread wheats. Carleton urged ". . . the majority of American people really have never tasted the very best macaroni" and "There is now a distinct demand for one or more enterprising millers in this country to arrange for specializing in the manufacture of semolina from durum wheats for our macaroni factories." He gathered extensive statistics from macaroni manufacturers and exporters to show that durum wheat was preferable to any other wheat for making macaroni. His viewpoint was ". . . that there is before us the possibility of establishing practically a new wheat industry of great magnitude."

Production of durum wheat increased from 60,000 bushels in 1901 to 7,000,000 bushels in 1903 and about 50 million bushels in 1906. In the first four years of the century, durum wheat production increased 300-fold. Since then production has fluctuated considerably, but it seems evident that Carleton's concept of the place durum might fill in our agriculture was well justified.

In his "Commercial Status of Durum Wheat," Carleton (with J. S. Chamberlain) listed sixty recipes using macaroni products for fritters, soups, baked dishes, timbales, croquettes, salads, Italian recipes

and even desserts, secured from a wide variety of sources.

Durum Wheat for Bread?

Mr. Carleton was convinced that good bread could be made from durum wheat. In 1903 he arranged a "blindfold test" of durum versus hard red spring wheat bread. A large eastern bakery baked the bread, 250 loaves from a durum patent flour milled at Lisbon, North Dakota, and 250 loaves from the bakery's own best hard spring wheat blend. One loaf of durum bread and one loaf of the bakery's bread were sent to 240 persons in various parts of the country, prominent millers, bakers, flour inspectors, chemists and teachers of domestic science. The loaves were identified only as "X" loaf and "P" loaf.

Carleton made an extensive analysis of the replies to his questionnaire and reported that the vote was 108 to 74 in favor of the durum wheat loaf as "the better loaf." In response to specific questions, the durum loaf was judged superior in freshness, flavor, texture, moisture and "nutrition." The hard red spring loaf was judged better in color and crust. Many comments were quoted in his report, among which were: "X (durum) is better if you eat with your palate; P if you taste with your eyes," and "X is better, because it will wear better; will require less addition of butter or jam to make it palatable," and "P is the better loaf commercially, because whiter and it looks lighter, but X would satisfy the family better where home baking is carried on."

The years have not vindicated Carleton's expectation that durum wheat bread would find a place on the American table, because of the greater expense in milling the flinty kernel, the narrower tolerance to bake shop conditions, and the creamier color of the bread. Durum wheat bread does have a characteristic nutty flavor, pleasing to some persons, and when proper-

ly handled gives satisfactory loaf volumes. Certainly it is superior in texture to some of the specialty types of bread now sold in quantity.

A New Crop for a New Land

One of the reasons leading to Carleton's trip to Russia, was a concern lest there be a shortage in the wheat supply of the world within the next generation. It was estimated that the increasing demand, for wheat would require drouth resistant varieties suitable to the then virgin areas lying west of the 100th meridian. Carleton was so impressed with the success of the durum wheats in the arid sections of Russia, that he first predicted they would find a place primarily in the arid sections of this country. The fact that durums are not now grown in the drier sections of the U. S. (or of Russia), perhaps is due to the availability of earlier or more drouth resistant bread wheats which were not available then. But in 1901 Carleton recognized that "The two states in which macaroni wheats have so far proved to be most successful are North and South Dakota. The wheats not only give excellent yields in these states, but the grain produced is often apparently of better quality than the original imported seed."

Carleton urged the use of durum wheats because they were "early" and more stem rust resistant than the fine and bluestem wheats then grown. Since that time, the newer bread wheats have been progressively earlier and earlier, until now the durums are considered late. Carleton recognized that the stem rust resistance of durums was only relative, as indicated by his statement, "On the other hand, in unusually damp, cloudy seasons, all these macaroni wheats are likely to be severely affected by the black stem rust. In the Don territory, near Taganrog, some fields were almost ruined by that rust in 1900, as observed by the writer."

Plant Doctor

Carleton's contributions to agriculture were not limited to durum wheat. In the early nineties he was a plant pathologist. In 1899 he wrote a comprehensive bulletin on "Cereal Rusts of the United States." In this publication he credited Bolley with reporting differences in varietal resistance to rust as far back as 1899. Carleton was one of the first to make carefully controlled artificial inoculations with stem rust, and to recognize the need for studying the rust itself as well as the wheat. In the severe stem rust epidemic of 1904, he noted the high degree of resistance of Yaroslav emmer which McFadden crossed twelve years later with Marquis to give Hope wheat, the variety which enters into all the modern rust resistant wheats except Thatcher. He also recorded the resistance of Iumillo, which went into Thatcher.

Plant Breeder

Carleton had rather advanced ideas as to the possibilities of improvement by hybridization, which then was rather new. In 1900 his "The Basis for the Improvement of American Wheats" outlined the needs and potentialities of the various wheat regions of the country. He suggested not simply random hybridization, but planned crosses, the use of durums to improve resistance to leaf rust, and spelt to improve resistance to shattering in common wheats. He suggested specific sources for such characters as high protein, stiffness of straw, high yielding power, fertility, early maturity, cold resistance, and resistance to heat and drouth. At this date most workers were occupied in trying to improve wheats by selection.

Carleton had an important part in starting the breeding program for disease resistance in cereals. The new wheat varieties introduced from Russia and other countries were tested in cooperation with the

appropriate state experiment stations. Those showing resistance were used in a crossing program with the fife and bluestem wheats then being grown commercially. Carleton stressed cooperation of the Department with state experiment stations, in contrast with the earlier policy of the Department which somewhat promiscuously released free seeds to individuals, with too little regard for the adaptability of the crop, or the ability of the individual to give it a scientific trial. In 1901 he wrote "... it is nevertheless to the experiment stations that we must look for conclusions that are to be considered final concerning the behavior of varieties in their particular districts, as their variety tests are not only carried out scientifically and systematically, but in a highly comparative way, dozens, or even hundreds of varieties of different wheat groups being tested side by side, under the same conditions."

Pioneer Author and Scientist

In 1916 Carleton published "The Small Grains." This book has been called a "landmark of progress in creating a science of agronomy in the service of the art of crop production." It brought together in well organized form the voluminous literature of the previous twenty years on crop improvement. This was a critical period because it included the rediscovery of Mendel's laws, and the interpretation

of these laws in terms of the modern concept of plant breeding. "The Small Grains" served as a text book in crops for many years, serving well the author's objective of "placing the leaders of agriculture on a firmer scientific footing."

One cannot read Carleton's writings of forty years ago without being impressed by his foresight, the clarity of his thinking and his persistence. Where others were willing to get along with the old, he went out in search of something better. Where others had tried durum wheat and given up, he studied its native environment and determined the most suitable areas for its culture. He spread the seed to numerous cooperators and patiently collected reports of their results. He made sure of the purity and increase of new seed stocks. He persisted in his contacts with millers and macaroni manufacturers, and persuaded them to accept the new crop and adapt their equipment to take advantage of its good qualities. He even published macaroni recipes for consumers and contacted exporters for the foreign market. He helped lay the basis for future progress in cereal breeding by his studies of stem rust and his outline of a planned program of hybridization. He pioneered with a textbook on crop improvement. Carleton crystallized into action the best crop improvement thought of his time.

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Home Grown Fruit

Small commercial fruit plantings have a distinct place in North Dakota when suitable conditions can be found. Extension Horticulturist Harry Graves points out that the western slope of the Red River Valley affords desirable sites and that the rolling land in many parts of western North Dakota provides desirable sites.

He calls attention to the success Mr. Chris Geir, of Edinburg, Pembina County, is having in growing strawberries, apples, grapes, and raspberries on one of the western shore lines of glacial Lake Agassiz. Mr. R. L. Wodarz, of Wyndmere, successfully manages a 5 acre orchard on the western slope of the Red River Valley.

Looking farther west, Graves calls attention to the successful small fruit and market garden

operated by Mr. C. L. Benzi, of Washburn, an irrigated garden located on the banks of Painted Woods Creek in the Missouri River bottoms. In 1944 Mr. Benzi sold about 2500 quarts of strawberries at 40 cents a quart from slightly less than an acre of sprinkler-irrigated Gem strawberries.

What these men have done, many others can do. In fact, much can be done to create a favorable site. Where there's a will, there may be home grown fruit. (H.L.W.)

North Dakota's 1944 growing season precipitation, April to September, inclusive, was 42 percent above the 1892-1944 average in western North Dakota, 40 percent above in middle North Dakota, 29.2 percent above in eastern North Dakota, and 36.5 percent above for the State as a whole. The May plus June precipitation in 1944 was even more above the long-time average (1892-1944), exceeding it by 78.3 percent in western North Dakota, 70.3 percent in middle North Dakota, 24.1 percent in eastern North Dakota, and for the State as a whole by 54.9 percent. (H.L.W.—from U. S. Weather Bureau data.)