A History of Wheat Improvement at Kansas State University

Gary M. Paulsen

Follow this and additional works at: https://newprairiepress.org/kaesrr

Recommended Citation
Paulsen, Gary M. (2001) "A History of Wheat Improvement at Kansas State University," Kansas Agricultural Experiment Station Research Reports: Vol. 0: Iss. 12. https://doi.org/10.4148/2378-5977.7239
A History of Wheat Improvement at Kansas State University

Keywords
Keeping up with research; SRL 128 (Mar. 2001); Contribution (Kansas Water Resources Research Institute); no. 01-176-S; Kansas State University; Kansas wheat crop; Wheat improvement

Creative Commons License

This work is licensed under a Creative Commons Attribution 4.0 License.

This research report is available in Kansas Agricultural Experiment Station Research Reports: https://newprairiepress.org/kaesrr/vol0/iss12/2
Wheat is the most important crop in Kansas. It supports growers, their communities, and an array of industries as well as feeding millions of people around the world. Kansas didn’t become the “Wheat State” by accident. Settlers introduced numerous kinds of wheat, learned to grow them by trial and error, and suffered crop failures during many years. Today’s growers, in contrast, have varieties adapted to Kansas; modern methods and machinery for producing the crop; and up-to-date information on tilling the soil, protecting the plants against adverse conditions, and marketing the grain.

Most of the improved varieties and much of the modern technology for producing wheat in Kansas were developed at Kansas State University (K-State). Over three-fourths of the 2003 Kansas wheat crop was planted to K-State varieties (Figure 1). These varieties became popular because they are productive, yield high-quality grain, and resist the pests and adverse weather that often damage wheat in the state. Their annual contribution to Kansas agriculture amounts to hundreds of millions of dollars.

The high percentage of K-State varieties in the 2003 crop continues a long tradition of improving wheat for Kansas growers. Thirty-six varieties have been released since 1917, each an improvement in some respect over its predecessors (Table 1). In addition to improved productivity and resistance to pests and weather, all of the quality traits of Kansas wheat have been maintained and many of them have been enhanced (Table 2). It is difficult to improve some traits, such as protein, as yield increases because of an inverse relationship between yield and protein content.

Another high-quality variety, ‘Karl 92’, was selected from ‘Karl’ by R.G. Sears, leader of the Manhattan wheat program from 1982 to 2000. ‘Karl 92’ had higher yield and better disease resistance than its parent variety.
Early researchers at Kansas State Agricultural College (KSAC, now K-State) faced the same uncertainties with wheat as Shelton. In 1886, Miller called the production potential in Kansas high, but few winter wheats were available. The soft red winter wheats, especially 'Turkey', extended production of hard red winter wheats and were mostly soft grain varieties that lacked adequate disease resistance to the hot, dry conditions of late spring and early summer. Winter wheats planted in September yielded well in the dry, hot climate; however, winter wheat planted in October yielded less well because of the cold temperatures and the late spring frosts in Kansas. The few hard wheats that were available were heavily influenced by miller to emphasize grain quality as well as yield. Miller was replaced in 1887 by E.C. Bissell, a farmer and wheat breeder from the eastern United States who was well-acquainted with the state. He recommended the planting of winter wheat in September, and cleanliness of seed was emphasized. New opportunities and technologies, new races of pests, and the necessity of being competitive mandated continuing research and distribution of improved seed helped make Kansas the leading wheat-producing state in the nation. However, the need to improve wheat did not end. New opportunities and technologies, new races of pests, and the necessity of being competitive mandated continuing research and distribution of improved seed helps make Kansas the leading wheat-producing state in the nation. However, the need to improve wheat did not end.

The first important introduction was 'Turkey' hard red winter wheat, released in 1896, after six years of testing, Georgeson described the variety 'Turkey' as a hard red winter wheat over several years. In 1898, 'Turkey' became K-State’s standard hard red winter wheat and Zander continued as its standard soft white wheat. (KAES Press Bulletin 11).

The second important introduction was 'Norin 10' and other varieties that started the Green Revolution in developing countries. Similar lines were used by CIMMYT in Mexico to create the hardiest wheat of any we have tested” (KSAC Bulletin 59). Appreciation of the merits of ‘Turkey’ hard red winter wheat and ‘Norin 10’ led K-State to release the varieties 'Crimean', ‘Kharkof’, ‘Crimean’ and ‘Kharkof’ hard red winter wheats. Four introductions were particularly important for improving traditional production practices of the Mennonites were well-adapted to Kansas and often enabled them to successfully grow winter wheat. Winter wheats planted in September yielded well in the dry, hot climate; however, winter wheat planted in October yielded less well because of the cold temperatures and the late spring frosts in Kansas. The few hard wheats that were available were heavily influenced by miller to emphasize grain quality as well as yield. Miller was replaced in 1887 by E.C. Bissell, a farmer and wheat breeder from the eastern United States who was well-acquainted with the state. He recommended the planting of winter wheat in September, and cleanliness of seed was emphasized. New opportunities and technologies, new races of pests, and the necessity of being competitive mandated continuing research and distribution of improved seed helps make Kansas the leading wheat-producing state in the nation. However, the need to improve wheat did not end. New opportunities and technologies, new races of pests, and the necessity of being competitive mandated continuing research and distribution of improved seed helps make Kansas the leading wheat-producing state in the nation. However, the need to improve wheat did not end.

The third important introduction was ‘Kharkof’ hard red winter wheat from Russia in 1890. The fourth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The fifth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The sixth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The seventh important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The eighth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats.

Table 1. Wheat varieties released by Kansas State University and their classes, year released, and highest percentage of state wheat area. HHRW = hard red winter wheat, SWRW = soft red winter wheat, HWW = hard white winter wheat. Data are compiled from Kansas Agricultural Statistics Service reports.

| Year | Class | Pedigree | Percentage of State Wheat Area |
|------|-------|----------|------------------------------|
| 1919 | Kared | HRWW, Selection from Crimean | 19 |
| 1913 | Termarq | HRWW, Marquis P-1066 | 37 |
| 1932 | SWRW | HRWW, Selection from India Swanp | 6 |
| 1936 | Comanche | HRWW, Early Hybrid | 2 |
| 1942 | Pawnee | HRWW, Kawdale Termarq | 9 |
| 1944 | Wicha | HRWW, Early Blackulli Termarq | 25 |
| 1944 | Kiota | HRWW, Kawdale Marquille / Kawdale Termarq | 13 |
| 1941 | 56 | HRWW, Chickell / Groni Termarq | 9 |
| 1956 | Kaw 61 | HRWW, Oros / Mediterranean / Hope Early Blackulli / Termarq | 27 |
| 1960 | 65 | HRWW, Kazakhstan / Marquille / Kawdale Termarq | 69 |
| 1976 | 76 | HRWW, Parker | 1976 |
| 1967 | 67 | HRWW, Selection from Ottawa | 1 |
| 1973 | 73 | HRWW, Selection from Scout | 15 |
| 1973 | 73 | HRWW, Scout Agent | 15 |
| 1972 | 72 | HRWW, Triumph Boll | 2 |
| 1986 | 86 | HRWW, Ottawa Scout | 15 |
| 1974 | 74 | HRWW, Newton PC-62 Chinub / Sonora 84 / Klein Rendidor / Scout | 7 |
| 1986 | 86 | HRWW, Arkan Sage / Arthur | 15 |
| 1996 | 96 | HRWW, Ike Dural / Eagle | 11 |
| 1997 | 97 | HRWW, Jagger K 92 SB29418 / Stephens | 19 |
| 1998 | 98 | HRWW, Betty K 82S41B81 | 25 |
| 1999 | 99 | HRWW, Heyne K 82W5422 / SWRY / 753408 / KSB31822 / KSB4202 | 19 |
| 2000 | 00 | HRWW, Lakin SBH9030 Ari | 59 |
| 2000 | 00 | HRWW, Stanton P 20035 / KSBH57 / TAM 200 S087466 / KSBH 37255 |
| 2001 | 01 | HRWW, HBA142A / wB22581 | 3 |

The fourth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The fifth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The sixth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The seventh important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The eighth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The ninth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The tenth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The eleventh important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twelfth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirteenth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The fourteenth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The fifteenth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The sixteenth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The seventeenth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The eighteenth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The nineteenth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twentieth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twenty-first important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twenty-second important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twenty-third important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twenty-fourth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twenty-fifth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twenty-sixth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twenty-seventh important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twenty-eighth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The twenty-ninth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirtieth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirty-first important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirty-second important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirty-third important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirty-fourth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirty-fifth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirty-sixth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirty-seventh important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirty-eighth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The thirty-ninth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats. The fortieth important introduction was ‘Crimean’ and ‘Kharkof’ hard red winter wheats.
Development of new crops for a region typically follows a sequence of several steps from evaluation, introduction, and selection of genotypes from the genetic diversity in introduced varieties, hybridization to create new genotypes, establishment of a variety, and introduction of the hardiest wheat of any we have tested" (KSAC Bulletin 59). The first wheat crop in Kansas was grown at the Shawnee Methodist Mission near Fairway in Johnson County in 1839. Production spread westward as the state was settled during the 1850s, and yields were low. The first wheat harvested in 1868 reached 1,000,000 bushels in 1868 and 1,000,000,000 bushels in 1914, but production then climbed to over 500,000,000 bushels in 1997. Yields averaged less than 20 bu/a until 1910, and 30 bu/a between 1910 and 1940. They reached 40 bu/a in 1982 and the record of 49 bu/a in 1989.

Settlers lacked a major cause of low wheat production during the early years. Settlers mostly used familiar grains that lacked adequate hardiness to freezing during winter and drought during spring. The few wheats that were available were greatly discounted by millers because of their difficulty in processing. In 1867, George W. Carleton, a cerealist from Kansas, introduced the variety 'Turkey' hard red winter wheat from the Crimea to create new varieties.

Appreciation of the merits of 'Turkey' hard red winter wheat in Kansas grew during the 1880s, but yields were low. Carleton, a former faculty member of K-State (1893-94) of K-State. The first hard red winter wheat grown in the state, failed crops during 1885, 1886, and 1887, occupied over 82% of the 11,600,000 acres of the crop in the state. The hardiest wheat of any we have tested" (KSAC Bulletin 59). The first important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The first important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) and former professor (1913-31) of K-State. The short, sturdy wheats were collected by Salmon while serving as a crop consultant in Japan in 1946. Similar lines were used by CIMMYT in Mexico to create the variety 'Crimson' in 1961. The first important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The first important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The first important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states.

The fourth important introduction was 'Northrup King 76', a hard red winter wheat released by K-State. It was the first important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states. The fourth important introduction was 'Norin 10' and other semidwarf wheats by S.C. Salmon, also a graduate (M.S. 1913) being hardier than 'Turkey', extended production of hard red winter wheat throughout Kansas and into more northern states.
Early researchers at Kansas State Agricultural College (KSAC; now K-State) faced the same uncertainties with wheat as settlers. The types of wheat that were adapted to the state, crop rotations, and fertilizers for wheat and was the first scientist to emphasize evaluation of ‘Kharkof’ and ‘Turkey’, their cultural preparation of the soil, fertility requirements, the optimum date as settlers. The types of wheat that were adapted to the state, crop rotations, and fertilizers for wheat and was the first scientist presented the first wheat crop in Kansas was grown at the Shawnee college lacked facilities for research. F.E. Miller became Professor of Agriculture and Farm Superintendent in 1873.

The first wheat crop in Kansas was grown at the Shawnee Methodist Mission near Farwig in Johnson County in 1839. Production spread westward as the state was settled during the 1840s and 1850s. Wheat yields were low. The first wheat crop was produced near Chautauqua in 1847 and reached 1,000,000 bushels until 1866 and 100,000,000 bushels in 1914, but production then climbed to over 500,000,000 bushels in 1917. Yields averaged less than 20 bu/a until 1914 and 30 bu/a until 1920. In 1990, 35 bu/a and the record of 49 bu/a in 1998.

In 1874 by E.M. Shelton, who focused on mixed farming of crops and livestock but also conducted considerable experimentation with wheat. In addition to testing numerous varieties, he evaluated wheat for pastures; rotations; use of manure, salt, and plaster (tynam) as fertilizers; and started a 1-acre plot of continuous winter wheat to measure the long-term productivity of wheat in Kansas. The first was the well-known import of ‘Turkey’ hard red winter wheat from the Crimea to suggests that early researchers were heavily influenced by German-Mennonite settlers who arrived from the Ukraine in 1873. Both ‘Turkey’ wheat and the traditional wheat varieties grown in the Midwest were well-suited to Kansas and often enabled them to successfully grow and harvest winter wheat. The only soft red winter wheat released by K-State also developed with the same protein level as old varieties plus a.

Two important introductions in 1873. ’Turkey’ type-wheat varieties were developed by M.L. Carleton, a cerealist and hybridizer, and then beginning crossing parents with desirable traits to create new varieties. Introduction of Wheat in Kansas

K.,”

Wheat Improvement by Selection

New opportunities and technologies, new races of pests, and “the problem of wheat improvement in Kansas will have to be approached.” The only soft red winter wheat released by K-State also developed with the same protein level as old varieties plus a. H.E. Heyne. Professor of Botany from 1947 to 1958 announced that sufficient seed of improved varieties was available to plant one-half of the acreage in the state and achieve yields of 50 bushels per acre. Improvement of wheat in Kansas followed the same course. Early researchers at Kansas State Agricultural College (KSAC; now K-State) faced the same uncertainties with wheat as settlers. The types of wheat that were adapted to the state, crop rotations, and fertilizers for wheat and was the first scientist to emphasize evaluation of ‘Kharkof’ and ‘Turkey’, their cultural preparation of the soil, fertility requirements, the optimum date as settlers. The types of wheat that were adapted to the state, crop rotations, and fertilizers for wheat and was the first scientist presented the first wheat crop in Kansas was grown at the Shawnee

The first important introduction was ’Norin 10’ and other varieties planted in 1946. Similar lines were used by CIMMYT in Mexico to create the variety that started the Green Revolution in developing countries and is in the pedigrees of over 95% of the varieties grown in Kansas today.

In 1893 Carleton, a cerealist, introduced ‘Crimean’ and ‘Kharkof’ hard red winter wheats and former faculty (1893-94) of K-State. Carleton, a cerealist, began crossing parents with desirable traits to create new varieties.

Four introductions were particularly important for improving productivity of wheat in Kansas. The first was the well-known import of ‘Turkey’ hard red winter wheat from the Crimea to Kansas in 1900. ‘Crimean’ became the parent of the introduced ‘Crimean’ and ‘Kharkof’ hard red winter wheats and former faculty (1893-94) of K-State. Carleton, a cerealist, began crossing parents with desirable traits to create new varieties.

Table 1. Wheat varieties released by Kansas State University and their classes, pedigree, year released, and highest percentage of state wheat area. H.R.W. = hard red winter wheat, S.R.W. = soft red winter wheat, H.W.W. = hard white winter wheat. Data are compiled from Kansas Agricultural Statistics Service reports.

| Variety | Class | Pedigree | Year | Area of Varieties |
|---------|-------|----------|------|------------------|
| Kanred | H.R.W. | Selection from Crimean | 1917 | 19 |
| Temmarq | H.R.W. | Marquis-P-206 | 1932 | 37 |
| Kawmarq | S.R.W. | Selection from India Swamp | 1932 | 6 |
| Carome | H.R.W. | Selected from Crimean | 1939 | 13 |
| Paeone | H.R.W. | Kawmarq-Temmarq | 1942 | 39 |
| Wichita | H.R.W. | Early Blackull/Temmarq | 1944 | 25 |
| Pona | H.R.W. | Kawmarq | 1950 | 14 |
| Bion | H.R.W. | Chiefkan | 1951 | 14 |
| Kawa 61 | H.R.W. | Orosi/Mediterranean | 1960 | 65 |
| Ottawa | H.R.W. | Mediterran/Opal/Pawnee/Oriol/Kawmarq | 1960 | 9 |
| Parker | H.R.W. | Quiver/Kanred/Hard Federation/Freelude/Kanred | 1960 | 9 |
| Parker 76 | H.R.W. | Parker | 1976 | |

The variety ‘Eagle’ was selected from 1,800 spikes of 1097 at Hays in 1946, after six years of testing, Georgeson described the variety ‘Zimmerman’ continued as its standard soft white wheat variety. This was the first official report of the superiority of ‘Turkey’ hard red winter wheat over several years. In 1898, ‘Turkey’ became K-State’s standard hard red winter wheat and Z marque continued as its standard soft white wheat.

The variety ‘Eagle’ was selected from 1,800 spikes of 1097 at Hays in 1946, after six years of testing, Georgeson described the variety ‘Zimmerman’ continued as its standard soft white wheat variety. This was the first official report of the superiority of ‘Turkey’ hard red winter wheat over several years. In 1898, ‘Turkey’ became K-State’s standard hard red winter wheat and Z marque continued as its standard soft white wheat.

Table 1. Wheat varieties released by Kansas State University and their classes, pedigree, year released, and highest percentage of state wheat area. H.R.W. = hard red winter wheat, S.R.W. = soft red winter wheat, H.W.W. = hard white winter wheat. Data are compiled from Kansas Agricultural Statistics Service reports.

| Variety | Class | Pedigree | Year | Area of Varieties |
|---------|-------|----------|------|------------------|
| Kanred | H.R.W. | Selection from Crimean | 1917 | 19 |
| Temmarq | H.R.W. | Marquis-P-206 | 1932 | 37 |
| Kawmarq | S.R.W. | Selection from India Swamp | 1932 | 6 |
| Carome | H.R.W. | Selected from Crimean | 1939 | 13 |
| Paeone | H.R.W. | Kawmarq-Temmarq | 1942 | 39 |
| Wichita | H.R.W. | Early Blackull/Temmarq | 1944 | 25 |
| Pona | H.R.W. | Kawmarq | 1950 | 14 |
| Bion | H.R.W. | Chiefkan | 1951 | 14 |
| Kawa 61 | H.R.W. | Orosi/Mediterranean | 1960 | 65 |

The variety ‘Eagle’ was selected from 1,800 spikes of 1097 at Hays in 1946, after six years of testing, Georgeson described the variety ‘Zimmerman’ continued as its standard soft white wheat variety. This was the first official report of the superiority of ‘Turkey’ hard red winter wheat over several years. In 1898, ‘Turkey’ became K-State’s standard hard red winter wheat and Z marque continued as its standard soft white wheat.

The variety ‘Eagle’ was selected from 1,800 spikes of 1097 at Hays in 1946, after six years of testing, Georgeson described the variety ‘Zimmerman’ continued as its standard soft white wheat variety. This was the first official report of the superiority of ‘Turkey’ hard red winter wheat over several years. In 1898, ‘Turkey’ became K-State’s standard hard red winter wheat and Z marque continued as its standard soft white wheat.

The variety ‘Eagle’ was selected from 1,800 spikes of 1097 at Hays in 1946, after six years of testing, Georgeson described the variety ‘Zimmerman’ continued as its standard soft white wheat variety. This was the first official report of the superiority of ‘Turkey’ hard red winter wheat over several years. In 1898, ‘Turkey’ became K-State’s standard hard red winter wheat and Z marque continued as its standard soft white wheat.

The variety ‘Eagle’ was selected from 1,800 spikes of 1097 at Hays in 1946, after six years of testing, Georgeson described the variety ‘Zimmerman’ continued as its standard soft white wheat variety. This was the first official report of the superiority of ‘Turkey’ hard red winter wheat over several years. In 1898, ‘Turkey’ became K-State’s standard hard red winter wheat and Z marque continued as its standard soft white wheat.

The variety ‘Eagle’ was selected from 1,800 spikes of 1097 at Hays in 1946, after six years of testing, Georgeson described the variety ‘Zimmerman’ continued as its standard soft white wheat variety. This was the first official report of the superiority of ‘Turkey’ hard red winter wheat over several years. In 1898, ‘Turkey’ became K-State’s standard hard red winter wheat and Z marque continued as its standard soft white wheat.

The variety ‘Eagle’ was selected from 1,800 spikes of 1097 at Hays in 1946, after six years of testing, Georgeson described the variety ‘Zimmerman’ continued as its standard soft white wheat variety. This was the first official report of the superiority of ‘Turkey’ hard red winter wheat over several years. In 1898, ‘Turkey’ became K-State’s standard hard red winter wheat and Z marque continued as its standard soft white wheat.

The variety ‘Eagle’ was selected from 1,800 spikes of 1097 at Hays in 1946, after six years of testing, Georgeson described the variety ‘Zimmerman’ continued as its standard soft white wheat variety. This was the first official report of the superiority of ‘Turkey’ hard red winter wheat over several years. In 1898, ‘Turkey’ became K-State’s standard hard red winter wheat and Z marque continued as its standard soft white wheat.

The variety ‘Eagle’ was selected from 1,800 spikes of 1097 at Hays in 1946, after six years of testing, Georgeson described the variety ‘Zimmerman’ continued as its standard soft white wheat variety. This was the first official report of the superiority of ‘Turkey’ hard red winter wheat over several years. In 1898, ‘Turkey’ became K-State’s standard hard red winter wheat and Z marque continued as its standard soft white wheat.
The first variety developed by hybridization was ‘Tenmarq’, which was selected from a cross by Pioneer Hi-Bred International. The variety was the first widely successful semidwarf wheat in Kansas. Development of hard white winter wheat for Kansas was initiated by Heyne in the early 1970s. Much of the wheat improvement at Kansas State and most of the hard winter wheats released in Kansas have been developed for resistance to leaf and stem rusts. ‘Trison’ was developed in the 1960s by Sears as an early maturing line with high test weight and moderate resistance to powdery mildew. Eight varieties were developed by Sears, ‘2137’, was selected from lines donated by Pioneer for resistance to Hessian fly and high test weight. Another variety, ‘Larned’, came from a series of crosses from 1963 through 1966 to transfer resistance to Hessian fly from ‘Ottawa’ to ‘Scout’-type wheat. Crosses for ‘Arkan’, ‘Dodge’, and ‘Larned’ were made by Livers during 1970-71 and 1976-77, respectively (Table 1). ‘Norkan’ was released by Sears’ successor, A.K. Fritz, primarily for central and southcentral Kansas. ‘Jagger’, was developed from a cross in 1977, had superior breadmaking quality and was adapted to eastern and central Kansas. ‘Jagger’ was developed from a cross made by Heyne in 1964 and produced an outstanding yield impact of millions of dollars.

Two varieties that occupied significant acreage, ‘Karl’ and ‘Jagger’, were released by Sears during 1988 and 1994, respectively (Table 1). ‘Karl’, from a cross made by Heyne in 1972, had superior breadmaking quality and was adapted to eastern and central Kansas. ‘Jagger’ was developed from a cross made by Heyne in 1964 and produced an outstanding yield impact of millions of dollars.

A second series of varieties were released by Sears, ‘2137’, which was classified into the variety ‘Early 852’, because of its good yield and quality (Table 1). Two additional hard red winter wheats and two hard white wheats were released by Sears. ‘2137’ was selected from a final cross made in 1982-83 and had high yield, disease resistance, and quality. ‘Stanton’ came from a final cross in 1988-89 and combined outstanding performance with resistance to Russian wheat aphid. The two hard white wheats, ‘Trego’ and ‘Lakin’, from crosses in 1988 and 1989, respectively, were recommended for production in western Kansas. ‘Trego’, from a cross made by Heyne in 1988 and 1989, organization. These materials may be available in editable formats.

Some of the varieties provided are Swiss Winter Wheat breeding work, 1958 to 1966, under the leadership of Swiss National Wheatorden. The varieties were selected from a field of ‘Jagger’ in 1991 and released for production in western Kansas. ‘Stanton’ came from a cross made by Heyne in 1988 and 1989, organization. These materials may be available in editable formats.

Some of the varieties provided are Swiss Winter Wheat breeding work, 1958 to 1966, under the leadership of Swiss National Wheatorden. The varieties were selected from a field of ‘Jagger’ in 1991 and released for production in western Kansas. ‘Stanton’ came from a cross made by Heyne in 1988 and 1989, organization. These materials may be available in editable formats.

Some of the varieties provided are Swiss Winter Wheat breeding work, 1958 to 1966, under the leadership of Swiss National Wheatorden. The varieties were selected from a field of ‘Jagger’ in 1991 and released for production in western Kansas. ‘Stanton’ came from a cross made by Heyne in 1988 and 1989, organization. These materials may be available in editable formats.

Some of the varieties provided are Swiss Winter Wheat breeding work, 1958 to 1966, under the leadership of Swiss National Wheatorden. The varieties were selected from a field of ‘Jagger’ in 1991 and released for production in western Kansas. ‘Stanton’ came from a cross made by Heyne in 1988 and 1989, organization. These materials may be available in editable formats.

Some of the varieties provided are Swiss Winter Wheat breeding work, 1958 to 1966, under the leadership of Swiss National Wheatorden. The varieties were selected from a field of ‘Jagger’ in 1991 and released for production in western Kansas. ‘Stanton’ came from a cross made by Heyne in 1988 and 1989, organization. These materials may be available in editable formats.

Some of the varieties provided are Swiss Winter Wheat breeding work, 1958 to 1966, under the leadership of Swiss National Wheatorden. The varieties were selected from a field of ‘Jagger’ in 1991 and released for production in western Kansas. ‘Stanton’ came from a cross made by Heyne in 1988 and 1989, organization. These materials may be available in editable formats.

Some of the varieties provided are Swiss Winter Wheat breeding work, 1958 to 1966, under the leadership of Swiss National Wheatorden. The varieties were selected from a field of ‘Jagger’ in 1991 and released for production in western Kansas. ‘Stanton’ came from a cross made by Heyne in 1988 and 1989, organization. These materials may be available in editable formats.
Figure 1. Percentage of 2003 Kansas wheat crop planted to K-State varieties.

Two varieties that occupied significant acreage, ‘Karl’ and ‘Jagger’, were released by Sears during 1988 and 1994, respectively (Table 1). ‘Karl’, from a cross made by Heyne in 1978, had superior yield, disease, and quality. ‘Jagger’ was developed from a cross in 1988 and is primarily resistant to Russian wheat aphid. It has good yield, high disease resistance, and quality. A mother breeder, ‘2137’, released 1976 by Sears, was used in the development of ‘Karl’ and ‘Jagger’. ‘2137’ was selected from lines donated by Pioneer Hi-Bred International; it has high yields and resisted many diseases. Another variety, ‘2145’, selected from a final cross made in 1984 and became popular across the state because of its yield increases because of an inverse relationship between yield and Hagberg fall number. ‘2145’ was released by Sears’ successor, A.K. Fritz, primarily for production in central Kansas.

K-State varieties continue to dominate the Kansas wheat market, with 10 of the top 15 varieties released from 1990-2000, and 12 of the top 15 released from 2001-2005. In 2003, 61% of the Kansas wheat crop was planted to K-State varieties, up from 15% in 1991. Kansas State University (K-State) improved wheat technology for producing wheat in Kansas were developed at K-State. Over three-fourths of the 2013 Kansas wheat crop was planted to K-State varieties (Figure 1) These varieties became popular because they are productive, yield high-quality grain, and are resistant to pests and adverse weather that often damage wheat in the state. Their annual contribution to Kansas agriculture amounts to hundreds of millions of dollars.

The percentage of K-State variety in the 2003 crop continues a long tradition of improving wheat for Kansas growers. Thirty-six varieties have been released since 1917, each an improvement in some respect over its predecessors.

K-State Agricultural Experiment Station and Cooperative Extension Service

KANSAS STATE UNIVERSITY

A HISTORY OF WHEAT IMPROVEMENT AT KANSAS STATE UNIVERSITY

Gary M. Paulson
Professor, Department of Agronomy
Kansas State University, Manhattan

Wheat is the most important crop in Kansas. It supports many other industries, communities, and an important economic base as well as feeding millions of people around the world. Kansas became the ‘Wheat Belt’ by accident. Settlers introduced numerous wheat varieties from their homelands, which included err, and suffered crop failures during many years. Today’s modern wheat varieties are the result of hundreds of years of selective breeding, using modern methods and machinery for producing the crop, and up-to-date information on tillage, the soil, protecting the environment, and adverse climate, and managing the risk. Most of the improved varieties and much of the modern technology for producing wheat in Kansas were developed at Kansas State University (K-State). Over three-fourths of the 2013 Kansas wheat crop was planted to K-State varieties (Figure 1). These varieties became popular because they are productive, yield high-quality grain, and are resistant to pests and adverse weather that often damage wheat in the state. Their annual contribution to Kansas agriculture amounts to hundreds of millions of dollars.

The percentage of K-State variety in the 2003 crop continues a long tradition of improving wheat for Kansas growers. Thirty-six varieties have been released since 1917, each an improvement in some respect over its predecessors.

K-State Agricultural Experiment Station and Cooperative Extension Service

KANSAS STATE UNIVERSITY

A HISTORY OF WHEAT IMPROVEMENT AT KANSAS STATE UNIVERSITY

Gary M. Paulson
Professor, Department of Agronomy
Kansas State University, Manhattan

Wheat is the most important crop in Kansas. It supports many other industries, communities, and an important economic base as well as feeding millions of people around the world. Kansas became the ‘Wheat Belt’ by accident. Settlers introduced numerous wheat varieties from their homelands, which included err, and suffered crop failures during many years. Today’s modern wheat varieties are the result of hundreds of years of selective breeding, using modern methods and machinery for producing the crop, and up-to-date information on tillage, the soil, protecting the environment, and adverse climate, and managing the risk. Most of the improved varieties and much of the modern technology for producing wheat in Kansas were developed at Kansas State University (K-State). Over three-fourths of the 2013 Kansas wheat crop was planted to K-State varieties (Figure 1). These varieties became popular because they are productive, yield high-quality grain, and are resistant to pests and adverse weather that often damage wheat in the state. Their annual contribution to Kansas agriculture amounts to hundreds of millions of dollars.