ID-278

Cooperative Extension Service

The Role of Phosphorus in Kentucky Agricultural Development:

A Story of the Haves and the Have–Nots

Central Kentucky soils frequently contain hundreds of pounds of plant-available phosphorus per acre, compared to five to seven pounds per acre for the soils of most counties in other parts of the state. This richness of the Central Kentucky soils is due to the unusually high phosphorus content of the parent material, known as the Lexington Limestone. This rock unit forms the bedrock in Central Kentucky above a geologic structure called the Cincinnati Arch (see Appendix 1), and it has made these Central Kentucky counties the "haves," in regard to soils inherently rich in plant-available phosphorus.

Natural phosphatic minerals in the limestone weather into the high phosphorus soils of Central Kentucky. These soils were originally so rich in phosphorus that rock phosphate was mined in Woodford County near Wallace Station from 1905 to 1937. In 1878, W. J. Davie, Kentucky's first commissioner of agriculture, stated, "The extraordinary fertility of a very large portion of the Kentucky Bluegrass region, based on the blue limestone formation, will compare favorably with the richest land on the face of the earth…" He also went further to establish a link between strong bones in Thoroughbreds and this part of the state, saying, "The water and also the grain raised on these lands, so acts on the animal economy as to produce the firmest, hardest, and most solid bones, and the toughest and most elastic muscles… [which] make the 'Bluegrass Stock' the finest in the world." He added that the region produced the "best milk, butter, and cheese on the continent."

The soils in most Kentucky counties outside of Central Kentucky, the "have-not" counties, were seriously deficient in plant-available phosphorus, and historical corn yields in these counties were only half as much as in Central Kentucky counties. This situation persisted from the pioneer days of Daniel Boone, famous for his exploration and settlement of Kentucky, until about 1940, when superphosphate fertilizers became more available and accessible. The dynamic changes in individual corn yields from 1931 to 2020 are illustrated in animated graphics that were created using ArcGIS Online, which can be accessed at the following links: (https://publications.ca.uky.edu/sites/publications.ca.uky.edu/files/id278-1.gif and https://publications.ca.uky.edu/sites/publications.ca.uky.edu/files/id278-2.gif). Interactive maps showing annual county-level corn yields in Kentucky can also be accessed at (https://uky-edu.maps.arcgis.com/apps/mapviewer/index.html?webmap=c9745df9632947e58a5556ef2ccc6a1a or https://uky-edu.maps.arcgis.com/apps/mapviewer/index.html?webmap=5639bb06fc2743c09477e70a9fad8137).

This phosphorus richness was confirmed by the results of soil fertility trials, conducted principally on high-phosphorus soils on the campus of the University of Kentucky (UK) Agriculture Experiment Station Farm, where Bluegrass and Maury silt loams locate on top of a high-phosphorus limestone bedrock. As reported by George Roberts (the UK Agronomy Department's first head), A. E. Ewan, and E. J. Kinney, the trials showed that none of the various fertilizer or lime treatments tested gave a profitable return on the investments. The average corn yields were about 55 to 60 bushels per acre, regardless of fertilizer or lime treatments.

In 1926, the Kentucky General Assembly made a special appropriation dedicated to investigating why crop yields were so low everywhere in the state except in the Bluegrass counties. This appropriation funded long-term soil fertility plots in Campbellsville, Greenville, Mayfield, Berea, London, and two locations at the Princeton Substation (now the UK Research and Education Center). One of the Princeton plots was on sandstone parent material (Tilsit soil series) and the other was on limestone parent material (Crider soil series). Yields were taken from 1921 through 1940. Except for the Crider limestone-derived soil at Princeton, applying either superphosphate or finely ground rock phosphate routinely doubled corn yield from 25 to 50 bushels per acre. Kentucky Agricultural Experiment Station Bulletin 663 by P. E. Karraker and H. F. Miller also summarized the soil fertility research collected from 1915 to 1951 and listed 14 additional bulletins, which inform the similar results for many locations.

To determine the broader applicability of Professors Roberts' and Karraker's findings on the soil fertility, this paper analyzed data provided by the Kentucky field office of the United States Department of Agriculture's (USDA) National Agricultural Statistics Service, in cooperation with the Kentucky Department of Agriculture. This dataset contains 10,680 data points, including estimated yields and acreages of major crops grown in all 120 counties in Kentucky from 1931 to the present (2024 for this report).

In those early years, corn yields in the Bluegrass counties were twice as high as those counties located outside the region, except for nine counties on the Ohio River. At that time, frequent flooding of that land would have deposited nutrient-rich topsoil, likely accounting for the high yields in those river counties. Very little commercial fertilizer was applied to Kentucky soils before 1931. This situation can confidently be assumed to have existed back to the pioneer period of Daniel Boone, beginning in 1775. Throughout this long period, farmers in Central Kentucky counties were gaining twice as much from their investment in land, labor, and capital. As a result, farmers in Central Kentucky were gaining wealth, while most other farms were reduced to subsistence farming. Families in the "have-not" counties survived by practicing frugality, cutting timber, digging coal, and working at off-farm employment.

The wealth accumulated in Central Kentucky was invested in building businesses, churches, universities, and stately homes. It can be reasonably argued that the early development of Lexington was a result of wealth generated from the area's unusually productive Maury silt loam and other phosphorus-rich soils. Once begun, the pace of development seems never to have slowed. Lexington has never stopped growing and probably never will. Each new development builds on the previous development, like capital grows when earning a compound interest rate.

In retrospect, why were the non-Bluegrass counties settled? Harrodsburg was the first permanent settlement in Kentucky, which probably means that the land in Central Kentucky and some of the river counties was settled first, and those who came later had to take what was left. This did not seem like a missed opportunity at first, because the land was reasonably fertile and covered with trees. When cleared, the new ground had a layer of organic matter, built up from the annual tree litter drop. The organic layer provided enough plant nutrients for reasonably good corn and wheat yields. But after four or five years, the store of nutrients was diminished to a point that these counties were probably only producing half as much from the same inputs as settlers in Central Kentucky. This caused more and more trees to be cleared in order to have a supply of "new ground" to grow corn and wheat. Ultimately, this caused all of the land level enough for cropping to be cleared, leaving all the cultivated fields very low in plant-available phosphorus and thus low yielding. This situation persisted until about 1950. By then, the Tennessee Valley Authority (TVA) had produced enough superphosphate and made it easily available to increase yields in the "have-not" counties. Once the inherent phosphorus problem was corrected, the greatly improved genetic potential of hybrid seed corn, changes in corn plant architecture, increased plant population, narrow row spacing, improved weed and pest control, and mechanization combined to cause yields to double and redouble. Kentucky's corn crop in 2024 was three times larger than in 1931 from less than half as many acres (see Appendix 2).

County agents, USDA Soil Conservation Service (now Natural Resources Conservation Service) technicians, Agricultural Stabilization and Conservation Service (now part of the Farm Service Agency) employees, and fertilizer manufacturers and retailers all helped erase the inherent phosphorus deficiency that existed everywhere except in the Central Kentucky counties.

Grain crops are presently yielding at a high level (184 bushels per acre in 2020) everywhere in the state, but comparable yields are not yet the case with pasture and forage crops. Research that taught farmers how to double and redouble grain crop yield was relatively easy to implement. The farmer knew how much the field yielded and could more easily determine which management practice to change if yield was disappointing. Livestock production and forage management research are far more complicated.

Correcting Chronic Phosphorus Deficiency in Kentucky

There must have been similar soil fertility trials at many land-grant colleges where widespread soil phosphorus deficiencies were discovered. Dr. Kenneth Wells, longtime agronomist with TVA and more recently soil fertility Extension professor in the UK Department of Plant and Soil Sciences, stated that "all 13 states of the Tennessee River Valley were inherently phosphorus deficient, much the same as Kentucky."

TVA was established in 1931 to cope with the chronic flooding of the river and to generate hydroelectric power to help develop the depressed economies of the 13 valley states. A strong emphasis on fertilizer development and manufacturing was included in TVA's mandate. From its beginnings, TVA cooperated closely with land-grant university agronomy departments and Extension services in the 13 valley states. TVA produced and helped distribute large amounts of phosphorus fertilizer across these states. President Franklin Roosevelt's New Deal administration made superphosphate available to farmers at little to no cost through the USDA's Agricultural Stabilization and Conservation Service. At the same time, the UK Agronomy Department regularly published recommendations for fertilizer rates, crop varieties, seeding rates, and pest control materials. Generally, these recommendations were followed by government and commercial agricultural advisory services. The combined efforts of these services with the availability of phosphorus fertilizer erased the inherent problem of low phosphorus availability, along with other limitations to grain crop yield that plagued all counties except those in Central Kentucky. By interpreting the corn yield data from 1931 to 2020, in light of George Roberts' and P. E. Karraker's early soil fertility research, it seems undeniable that available soil phosphorus was the key to the differences in corn yields between the Bluegrass region and the rest of Kentucky.

Historical Guidance

Historical evidence in support of these conclusions was found in two University of Kentucky Press books by Dr. Thomas D. Clark: *Agrarian Kentucky* and *Kentucky: Land of Contrast*. This evidence is briefly reviewed in Appendix 3.

Acknowledgments

Ed Reeves, retired professor from Morehead State University, converted the data to Excel format. Stephen Greb of the Kentucky Geologic Survey provided comments and citations on the mining of rock phosphate in Woodford County, near Wallace Station. From the results of geologic samplings, he also reported that phosphatic limestone has been found in Franklin, Fayette, Jessamine, and Clark counties. Data was retrieved from Quick Statistics provided by the Kentucky field office of the USDA National Agricultural Statistics Service, available at https://quickstats.nass.usda.gov/.

References

Clark, T. D., 1977. *Agrarian Kentucky*. The University Press of Kentucky, Lexington, KY.

Clark, T. D., 1968. *Kentucky: Land of Contrast* [First edition]. ed, Regions of America. Harper & Row, New York, NY.

Davie, W. J., 1878. Kentucky: its resources and present condition. The first annual report. Kentucky. Bureau of Agriculture, Horticulture and Statistics., Frankfort, KY.

Karraker, P. E., and Miller, H. F., 1958. A summary of Kentucky soil fertility experiments. Kentucky Agricultural Experiment Station; Bulletin No. 663. Kentucky Agricultural Experiment Station, University of Kentucky, Lexington, KY.

Kinney, E. J., and Roberts, G., 1921. Soybeans. Kentucky Agricultural Experiment Station; Bulletin No. 232. Kentucky Agricultural Experiment Station, University of Kentucky, Lexington, KY.

Levy, J. E. and Mizuta, K., 2025. Kentucky historic corn yields by counties, with a box symbology from 1930-2020. https://uky-edu.maps.arcgis.com/apps/mapviewer/index.html?webmap=c9745df9632947e58a5556ef2ccc6a1a or https://uky-edu.maps.arcgis.com/apps/mapviewer/index.html?webmap=5639bb06fc2743c09477e70a9fad8137 (Accessed on April 9, 2025)

Roberts, G., and Ewan, A. E., 1920. Report on soil experiment fields: Maintenance of fertility. Kentucky Agricultural Experiment Station; Bulletin No. 228. Kentucky Agricultural Experiment Station, University of Kentucky, Lexington, KY.

Roberts, G., and Kinney, E. J., 1932. Soils and fertilizer experiments, Experiment Station Farm, Lexington. Kentucky Agricultural Experiment Station; Bulletin No. 331. Kentucky Agricultural Experiment Station, University of Kentucky, Lexington, KY.

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Appendix 1

Cincinnati Arch

The Cincinnati Arch is a broad geologic structure that separates two other structures: the Illinois Basin to the west and the Appalachian Basin to the east (Figure 1). The basins were areas of greater geologic subsidence during the Paleozoic era. The arches between basins were areas of greater stability and less subsidence during the Paleozoic. Because the Illinois and Appalachian Basins subsided more with time, younger and thicker strata are preserved above the basins. In Kentucky, the oldest strata at the surface are late Ordovician-age rock units above the Cincinnati Arch, in the Bluegrass region. Rock units are progressively younger off the arch into the basins on either side of the arch (Figure 2A).

Comparing the surface bedrock map with a geologic cross section of the state can help with visualizing how the arches, basins, and faulting result in the surface distribution of rock layers (Figure 2B). For example, the Late Ordovician-age rocks at the surface in the Bluegrass region are more than 3,000 feet beneath the surface in the basins beneath Kentucky's two coalfield regions (eastern Appalachian Basin and western Illinois Basin).

The Cincinnati Arch itself has structural highs and lows. A structural high called the Jessamine Dome occurs along the arch in the southern Bluegrass region. The oldest rock strata in the state, from the late Ordovician period, are at the surface in this part of the arch. A structural low called the Cumberland Saddle occurs in south-central Kentucky along the arch, where younger Mississippian strata are at the surface.

Phosphates in bedrock on the Cincinnati Arch.

Rock units of different ages and compositions have different physical and chemical attributes, and they contribute to different soil types, hydrology, and surface geomorphology across the state. Relatively high (albeit variable) natural phosphate contents have been noted in some areas in the Upper Ordovician Lexington Limestone in Central Kentucky, a prominent carbonate formation that underlies much of central Kentucky and represents a shallow marine depositional environment. It is especially well developed in the Tanglewood Limestone Member, a distinct subunit of the Lexington Limestone. The Lexington Limestone is at the surface along the Jessamine Dome of the Cincinnati Arch in Central Kentucky (Figure 3), corresponding to the Inner Bluegrass physiographic region/ecoregion. The Lexington Limestone is beneath the surface in much of the rest of the state.

The Tanglewood Limestone Member of the Lexington Limestone is interpreted to have formed in shoals in the shallow seas that covered Kentucky during the Late Ordovician. Upwelling currents from deeper waters to the west contained phosphates. Phosphates were reworked and sometimes concentrated in the shallow-water shoals, leading to higher phosphates in some of the limestones of Central Kentucky.

Figure 1. Basins and arches in Kentucky and surrounding areas. The images are modified from maps on the Kentucky Geological Survey website, https://www.uky.edu/KGS/geoky/index.htm.

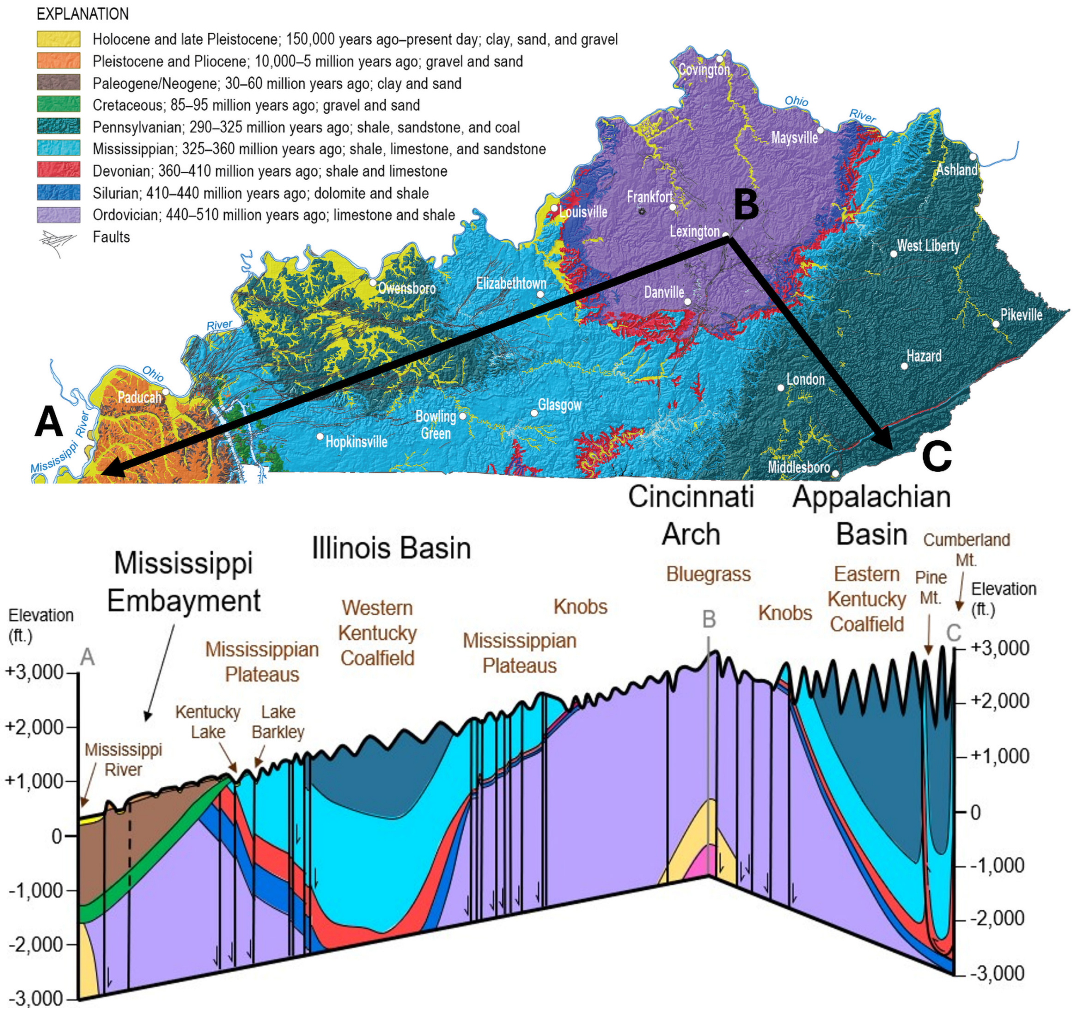

Figure 2. . Geologic map of Kentucky showing the locations of major basins and the Cincinnati Arch (2A) and generalized cross section across Kentucky and the Cincinnati Arch (2B). Image from Kentucky Geological Survey website, "Beneath the Surface," https://www.uky.edu/KGS/geoky/beneath.htm.

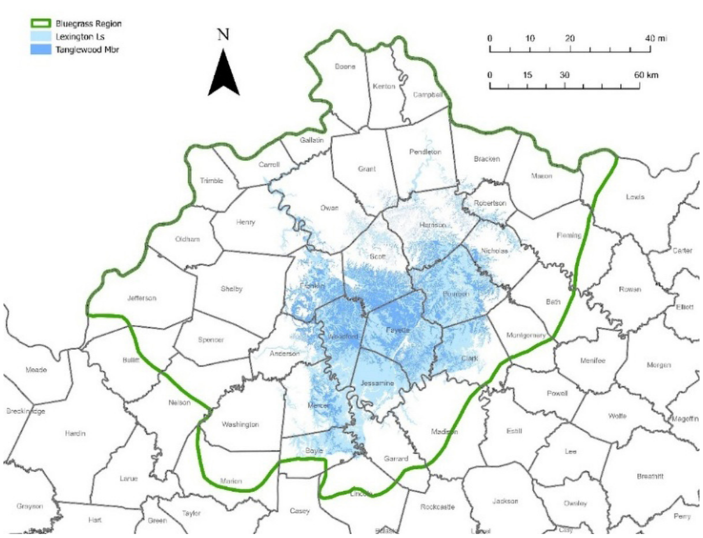

Figure 3. Map showing where the Lexington Limestone (light blue) and Tanglewood Limestone Member of the Lexington Limestone (dark blue) are at the surface in the Bluegrass region (outlined in green) of Central Kentucky. Data from Kentucky Geological Survey, University of Kentucky, courtesy of Tom Sparks, Kentucky Geological Survey.

References

Cressman, E. R., 1973. Lithostratigraphy and depositional environments of the Lexington Limestone (Ordovician) of central Kentucky (No. 768), Professional Paper. U.S. Government Printing Office. https://doi.org/10.3133/pp768

Ettensohn, F. R., 2010. Origin of Late Ordovician (mid-Mohawkian) temperate-water conditions on southeastern Laurentia: Glacial or tectonic?, in: Finney, S. C., Berry, W. B. N. (Eds.), *The Ordovician Earth System*. Geological Society of America. https://doi.org/10.1130/2010.2466(11)

Ettensohn, F. R., Barnett, S. F., 1992. Changing interpretations of Kentucky geology: layer-cake, facies, flexure, and eustacy, Miscellaneous report (Ohio. Division of Geological Survey). State of Ohio, Dept. of Natural Resources, Division of Geological Survey, Columbus, OH.

McFarlan, A. C., 1943. *Geology of Kentucky*. University of Kentucky, Lexington, KY.

Appendix 2

Changes in Kentucky Corn Yield (1931–2024)

Year	Yield	Total Harvested	Total Yield	Total Revenue	Corn Price
	Bushel/ Acre	Acres	Millions Bushels	$Millions	$/Bushel
1931	27	2,836,000	76.57	26.03	0.34
1932	23	2,750,000	63.25	24.67	0.39
1933	24.5	2,764,000	67.72	39.28	0.58
1934	22	2,790,000	61.38	49.72	0.81
1935	21.5	2,604,000	55.99	47.59	0.85
1936	17	2,780,000	47.26	52.46	1.11
1937	25.5	2,637,000	67.24	39	0.58
1938	26.5	2,484,000	65.83	36.86	0.56
1939	24.6	2,553,000	62.8	43.33	0.69
1940	24.5	2,553,000	62.55	45.66	0.73
1941	28.5	2,527,000	72.02	62.66	0.87
1942	31	2,507,000	77.72	87.04	1.12
1943	28	2,457,000	68.8	91.5	1.33
1944	24.7	2,449,000	60.49	79.24	1.31
1945	32	2,118,000	67.78	105.73	1.56
1946	36	2,194,000	78.98	142.17	1.8
1947	35	2,127,000	74.45	158.57	2.13
1948	40	2,381,000	95.24	125.72	1.32
1949	35.5	2,303,000	81.76	105.47	1.29
1950	37	2,080,000	76.96	127.75	1.66
1951	37.5	2,104,000	78.9	141.23	1.79
1952	28	2,003,000	56.08	93.66	1.67
1953	35.5	1,894,000	67.24	100.86	1.5
1954	31	1,976,000	61.26	89.43	1.46
1955	41	1,876,000	76.92	99.99	1.3
1956	46	1,782,000	81.97	108.2	1.32
1957	41	1,459,000	59.82	77.17	1.29
1958	47	1,421,000	66.79	80.14	1.2
1959	45	1,689,000	76.01	83.61	1.1
1960	48	1,529,000	73.39	80	1.09
1961	55	1,116,000	61.38	70.59	1.15
1962	58	1,116,000	64.73	74.44	1.15
1963	66	1,094,000	72.2	85.2	1.18
1964	56	1,039,000	58.18	73.31	1.26
1965	69	1,049,000	72.38	90.48	1.25
1966	59	1,102,000	65.02	88.42	1.36
1967	80	1,168,000	93.44	104.65	1.12
1968	66	1,027,000	67.78	79.3	1.17
1969	77	945,000	72.77	94.59	1.3
1970	50	939,000	46.95	71.36	1.52
1971	77	1,183,000	91.09	102.93	1.13
1972	86	968,000	83.25	143.19	1.72
1973	85	1,010,000	85.85	227.5	2.65
1974	82	1,075,000	88.15	271.5	3.08
1975	77	1,140,000	87.78	225.59	2.57
1976	102	1,360,000	138.72	307.96	2.22
1977	90	1,470,000	132.3	289.74	2.19
1978	85	1,410,000	119.85	287.64	2.4
1979	102	1,300,000	132.6	360.67	2.72
1980	70	1,480,000	103.6	347.06	3.35
1981	98	1,490,000	146.02	375.27	2.57
1982	103	1,490,000	153.47	391.35	2.55
1983	48	960,000	46.08	163.12	3.54
1984	100	1,460,000	146	411.72	2.82
1985	102	1,560,000	159.12	377.11	2.37
1986	92	1,520,000	139.84	236.33	1.69
1987	104	1,140,000	118.56	239.49	2.02
1988	73	1,100,000	80.3	221.63	2.76
1989	116	1,180,000	136.88	347.68	2.54
1990	100	1,200,000	120	297.6	2.48
1991	89	1,250,000	111.25	287.03	2.58
1992	132	1,300,000	171.6	382.67	2.23
1993	104	1,220,000	126.88	327.35	2.58
1994	128	1,220,000	156.16	371.66	2.38
1995	108	1,140,000	123.12	402.6	3.27
1996	124	1,200,000	148.8	446.4	3
1997	103	1,150,000	118.45	310.34	2.62
1998	115	1,180,000	135.7	294.47	2.17
1999	105	1,180,000	123.9	261.43	2.11
2000	130	1,230,000	159.9	330.99	2.07
2001	142	1,100,000	156.2	324.9	2.08
2002	104	1,070,000	111.28	287.1	2.58
2003	137	1,080,000	147.96	374.34	2.53
2004	152	1,140,000	173.28	388.15	2.24
2005	132	1,180,000	155.76	344.23	2.21
2006	146	1,040,000	151.84	482.85	3.18
2007	128	1,340,000	171.52	710.09	4.14
2008	136	1,120,000	152.32	664.12	4.36
2009	165	1,150,000	189.75	709.67	3.74
2010	124	1,230,000	152.52	785.48	5.15
2011	139	1,300,000	180.7	1138.41	6.3
2012	68	1,530,000	104.04	724.12	6.96
2013	170	1,430,000	243.1	1135.28	4.67
2014	158	1,430,000	225.94	890.2	3.94
2015	172	1,310,000	225.32	874.24	3.88
2016	159	1,400,000	222.6	832.52	3.74
2017	178	1,220,000	217.16	801.32	3.69
2018	175	1,220,000	213.5	819.84	3.84
2019	169	1,450,000	245.05	960.6	3.92
2020	184	1,360,000	250.24	1131.08	4.52
2021	192	1,420,000	272.64	1578.59	5.79
2022	156	1,330,000	207.48	1394.27	6.72
2023	187	1,500,000	280.5	1374.45	4.9
2024	186	1,280,000	238.08		

References

Levy, J. E. and Mizuta, K., 2025. Kentucky historic corn yields by counties, with a box symbology from 1930-2020. https://uky-edu.maps.arcgis.com/apps/mapviewer/index.html?webmap=c9745df9632947e58a5556ef2ccc6a1a or https://uky-edu.maps.arcgis.com/apps/mapviewer/index.html?webmap=5639bb06fc2743c09477e70a9fad8137 (Accessed on April 9, 2025)

Appendix 3

Historic Confirmation of Central Kentucky as a "Garden of Eden"

In March of 1775, Daniel Boone led an exploration party of the Transylvania Company into the Bluegrass savanna. A member of the party wrote the following in his travel journal: "And as the cane ceased, they began to discover the pleasing and rapturous appearance of the plains of Kentucky. A new sky and strange earth seemed to be presented to our view. So rich a soil we had never seen before; covered with clover in full bloom, the woods were abounding with wild game—turkeys so numerous that it might be said they appeared as one flock, universally scattered in the woods. It appeared that nature, in the profusion of her bounty, had spread a feast for all that lives, both for the animals and rational world."

T. D. Clark described Kentucky's settlement and its remarkable productivity in his 1977 book, *Agrarian Kentucky*: "By 1787 Kentucky lands drew settlers like a mighty magnet draws filings. Jedediah Morse said, in his *American Geography*; The rapid growth of population of the Western Country has not only astonished America itself, but must amaze Europe, when they enter into the views and increase of this growing empire. He said Kentucky contained 100,000 souls in 1792. And upwards of 10,000 in one year and 4,000 to 10,000 in several other years. A more authoritative count indicates there were 73,677 in 1790, 220,995 in 1800, and more than half million in 1830. Immigrants came to establish farms and a fresh way of agrarian life. In a phenomenally short amount of time their annual harvests added to the mounting cargoes shipped by flatboats into the precarious Spanish-controlled market."

"The (Kentucky) boats (some 90 feet long and 30 feet wide) were loaded with corn in the shuck and in barrels, tobacco packed in 1,200 pound hogsheads, whiskey, brandy, and cider royal, hempen rope and bagging (burlap bags), salt pork, piggins (a wooden container with one stave left longer as a handle) of butter, hides, barrels of soap, and tons of flour," Clark wrote.

Clark continued: "The Kentucky Gazette regularly published commercial information. On 6 August 1802 it carried the report of the surveyor of the port of Louisville for the first six months of that year. Cargoes valued at $590,965 contained 841 barrels of apples; 7,971 gallons of cider, beer, and porter; 80 barrels of beef; 3,300 pounds of butter; 1,237 bushels of corn; 85,570 barrels of flour; 100 gallons of flaxseed oil; 272,222 pounds of hams and bacon; 42,048 pounds of hemp; 55,052 pounds of lead; 2,485 barrels of pork; 342 bushels of potatoes; 2,399 pounds of soap; 2,640 pounds of manufactured tobacco; 503,618 pounds of loose tobacco; and 13,666 feet of planking."

There were also annual drives of livestock down the Wilderness Trail to the port at Charleston, South Carolina. It was during this time period that Kentucky was called the "Breadbasket of the Nation." This is plausible because the Midwestern states were yet to be settled by farmers. Cincinnati was called "Porkopolis" because of all the pigs driven there from Central Kentucky counties.

Reaching the New Orleans and Natchez markets was precarious because the Spanish repeatedly closed or threatened to close the Mississippi to the flatboats moving the huge surplus of agricultural products down the river.

Henry Clay and John Breckinridge (Central Kentucky politicians) urged President Jefferson to take any actions necessary to keep the river open. President Jefferson solved the problem by purchasing the Louisiana Territory from France. The acquisition not only included the land that is now the state of Louisiana but also settlements up the west bank of the Mississippi River. Purchase of the Louisiana Territory added 828,000 square miles of land west of the Mississippi River to the United States. Thousands of people became U.S. citizens. The Central Kentucky region and the river counties of Kentucky and Tennessee applied much of the political pressure that led to the $15 million purchase.

References

Clark, T.D., 1977. *Agrarian Kentucky*. The University Press of Kentucky, Lexington, KY.

Collins, L., and Collins, R. H., 1878. *History of Kentucky*, 2nd ed., Set No. 128 of the thousand sets. Collins & Co, Covington, KY.

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