Gas Engines on the Farm:
The Forgotten Transition

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The transition on the farm from horses to tractors has claimed the attention of academics for many decades. But by repeatedly returning to the question of tractors replacing horses for fieldwork, researchers have given the false impression that farmers had little demand for power beyond fieldwork and that there were no gas engines on farms before the tractor arrived. In fact, long before tractors arrived on farms in significant numbers, hundreds of thousands of gas engines were already at work there. These stationary (or portable) engines were the first step in the technology adoption, even preceding the automobile. This paper presents evidence from a detailed study of the farm diaries and ledgers of a northern Illinois farm to illustrate the early steps in the transition to farm power based on the gas engine, and it presents literature from the early 1900s that describes why farmers needed gas engines for stationary power.

For well over half a century, academics interested in the history of agriculture have been intrigued – indeed obsessed -- by the transition from horses to tractors on the farm. The replacement of horses by tractors for draft power, which began in earnest during World War I, transformed the agricultural sector. In 1914 available power on the farm still exceeded available power in the manufacturing sector; and horses and mules provided 60 percent of farm power.[1] As farmers swapped their horses for tractors, by 1960 they had released almost 90 million acres that had produced fodder for horses into crop production, and discharged 1.7 million farm workers into the urban labor force, significantly accelerating overall economic growth. Sales of tractors overtook sales of all other kinds of farm implements.[2] But since World War II, little mention has been made by academics of the fact that hundreds of thousands of farmers used internal combustion engines for stationary "belt power" long before they purchased tractors. This earlier transition – part of the same process of diffusion of technological change -- has been largely forgotten.

It's not surprising that between 1920 and 1950 scholars were so concerned with "gas tractors" and their impact on the farm economy that they neglected the stationary "gas engine."[3] Tractors provided both belt power and draft power, and they were transforming the agricultural sector.

Many scholars since the 1950s have briefly mentioned the use of gasoline engines in studies focused on either the automobile or the tractor. Robert Williams devoted at least a full paragraph to the gasoline engine in his 1987 book on the history of the farm tractor.[4] Several scholars of automobile history have recognized that many farmers were already familiar with stationary

gasoline engines before they began to buy automobiles.[5] Farm diaries and advertisements in farm magazines have protected the memory of these early engines; so have collectors of the gas engines that survived the years. Those researchers that engage in narrative analysis and study old journals and diaries have verified their existence, even if they have not quantified their impact. But social scientists have yet to shine a spotlight on the gas engine. I have been unable to uncover a single scholarly journal article focused on its use on the farm since 1935.

By repeatedly returning to the question of tractors replacing horses for fieldwork, researchers have given the impression that farmers had little demand for power beyond fieldwork and that there were no gas engines on farms before the tractor arrived. But this has been very misleading.

The Need for Stationary Power

The need for stationary power on the farm was not trivial, and draft power was needed on the roads as well as in the field. C.D. Kinsman, in a 1925 study for the U.S. Department of Agriculture, estimated that stationary work represented more than 29 percent of total power utilized on the average U.S. farm at that time.[6] Table 1 below, drawn from that report, shows the various types of work that required power on U.S. farms. Just before 1900, gas engines began to fill the need for stationary power on farms. Within a few years the numbers of gas engines on farms were growing rapidly.

A number of books were published on the farm gas engine in its heyday in 1912 and 1913 that help to clarify the early demand for stationary power on the farm. Some of these books were written to help sell the engines, such as that by H.R. Brate, 1912, who wrote for the Gas Engine Publishing Company.[7] Xeno W. Putnam used a even more colorful and exuberant writing style in his 1913, *The Gasoline Engine on the Farm: A Practical, Comprehensive Treatise on the Construction, Repair, Management and Use of this Great Farm Power as Applied to All Farm Machinery and the Farmer's Work Indoors and Out*.[8] Others were more even-handed accounts written by engineering professors. Andrey A. Potter, from Kansas State Agricultural College wrote the textbook *Farm Motors* in 1913 and published a 2nd Edition with McGraw-Hill in 1917.[9] C.F. Hirshfeld and T.C. Ulbricht, two "Power Engineering" professors from Cornell, published *Farm Gas Engines* in 1913 to provide a guide for farmers trying to decide among the hundreds of gas engines available for purchase.[10]

These sources and others confirm that the demand for internal combustion engines on the farm began with the need for better stationary power. Horses, after all, were an excellent, flexible source of draft power and nearly every farmer had them; but horses were awkward at best for stationary power. The steam engine also had many disadvantages for the kinds of stationary power that farmers needed. It required a skilled operator and constant attention while in use and could take more than an hour to get up enough steam to begin work. Extra hands would be needed to provide fuel and water, which were bulky and inconvenient.[11] Moreover, with a steam engine, the danger of fire was ever present. Windmills were reliable for pumping water for livestock, but windmills were certainly not portable and were of little use in calm weather. Watermills were not portable either, farmers often hauled their feed long distances to the mill to have it ground.

Table 1 **Use of Power on U.S. Farms**

Type of Operation	Estimated power used annually	Percent of total
Draft work:	Million HP hours	
Road hauling	2,400	15.0
Farm hauling	1,200	7.5
Plowing and listing	2,500	15.6
Fitting ground	1,000	6.3
Planting and seeding	400	2.5
Cultivating	1,000	6.3
Harvesting	800	5.0
Haying	900	5.6
Miscellaneous field work1	1,100	6.8
Total draft work	11,300	70.6
Stationary work:		
Threshing	1,200	7.5
Pumping (irrigation and drainage)	1,000	6.3
Pumping (domestic)	600	3.7
Operating isolated electric plants	150	1.0
Grinding feed	200	1.3
Baling hay	100	0.6
Shredding feed	100	0.6
Sawing wood	100	0.6
Shelling corn	80	0.5
Cutting silage	50	0.3
Miscellaneous2	1,120	7.0
Total stationary work	4,700	29.4
Total draft and stationary work	16,000	100.0

[1]Includes primarily ditching, land leveling, and grading

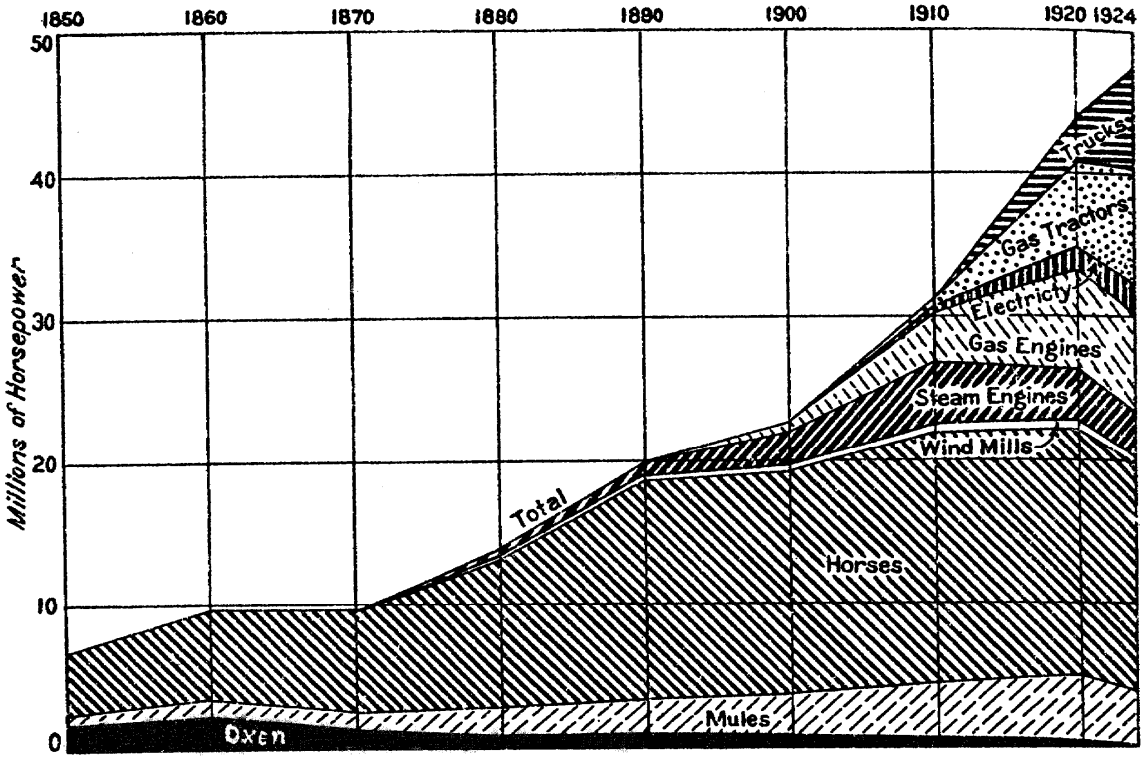
[2]Includes primarily stone crushing, cane mills, cotton gins, spraying machinery, milking machines, cream separators, churns, grain elevators, seed cleaners and graders, hay hoists, tool grinders, washing machines, and household appliances.

Source: C.D. Kinsman, An Appraisal of Power on Farms in the United States, U.S. Department of Agriculture, Bulletin No. 1348 (Washington, D.C.: USDA, 1925).

On the other hand, according to Putnam, the gas engine was “the ideal farm power.” He explained,

> Much of the farmer's work is done in short runs and at many different places. His ideal power must be ready at a moment's notice and must not cost anything to maintain except while in use. It must be safe, reliable, easy to operate and portable; not easily disturbed by weather conditions; available at any place, indoors or out. Electricity might avail for all of this excepting portability, were it more generally to be obtained upon the farm. It usually is not . . . . The gasoline engine is the only power at the present time that has answered all of these various demands. It is a wonderfully flexible power, adapting itself to all conditions. . . .The operator needs no greater mechanical training than should be considered necessary to properly run a binder. If power is needed in the kitchen to operate the washing machine two men can pick the engine up and take it there. If wanted in the farthest corner of the wood lot it can be set on the farm wagon and conveyed there without the necessity of a second or third trip for water tank and fuel; neither is there a trail of feed-wires to erect….nor does it break away from its moorings in the fiercest wind. It can be obtained in ¼ horse power sizes if required, while five thousand horse power engines are in successful operation.[12]

This explains why the portable gas engines caught on so quickly on farms. Already by 1914, according to Kinsman's estimates,[13] these portable stationary gas engines were providing more power for farmers than steam engines were, even though steam engines had been in use in farming communities – primarily for hire – since the Civil War.



Estimated total primary horsepower available on U.S. farms, 1850-1924

Source: Kinsman, C.D. 1925. *An Appraisal of Power Used on Farms in the United States.* USDA Department Bulletin No. 1348. Washington, D.C.: U.S. Department of Agriculture.

Early Production of the Gas Engine

The modern internal combustion engine came into being when the German engineer, N. A. Otto, patented his four cycle engine in 1876. During the eighteenth century, engineers applied their efforts to the development and application of the steam engine. It wasn't until about 1860 that real progress was made on the gas engine. By then the steam engine had been in use for nearly a hundred years and was already being used experimentally for plowing on the earliest steam tractors.[14]

The broad coverage of the original Otto patents restricted the early manufacture and sale of the new engine, but when the patents expired in 1890, development and production of gas engines surged in the United States. C.H. Wendel, a devoted collector of gas engines, wrote an astonishing book in 1983 with many thousands of pictures of early gas engines produced (at least briefly) by over 2000 companies between 1890 and the early 1940s.[15] The vast majority of these companies produced gas engines before 1930, and most produced engines only briefly sometime between 1900 and 1915. The *Patent Office Gazette* was a primary source for Wendel, who assumed that production began with the filing date. He noted, "by the time the actual patent was awarded, some companies were already out of the business."[16] With rapid improvements in technology, the demands of the war, and the expanding use of automobiles, trucks, and gas tractors, a great many lines of engines were discontinued during World War I.

Other researchers have ignored the minor firms that produced gas engines and the firms who produced primarily something else. R.B. Gray notes that "In 1899 there were approximately 100 firms engaged in the manufacture of internal combustion engines in the United States; in 1911, 400 firms and in 1914, 549 (not including the automobile manufacturers)."[17] Lucke and Woodward writing in 1907 noted "some 300 manufacturers of importance" in the United States at that time.[18]

Data on the numbers of engines produced in these early years is more elusive than that on the number of manufacturers. Researchers of the day, like Lucke and Woodward mentioned above, learned about production by talking to the larger manufacturers. They explained, "The exact figures on the sales are not available and it is impossible to secure them because of the unwillingness of manufacturers to tell their business; but when a single manufacturer (as is the case) is selling 425 per day, and there are in the United States alone some 300 manufacturers of importance, there can be no doubt as to the popularity of these machines."[19] If the average "manufacturer of importance" were selling just a quarter of what this particular manufacturer was selling, the number of gas engines sold in 1907 by major manufacturers might have been on the order of ten million engines a year.

But some manufacturers left their competition in the dust. Fairbanks, Morse & Co. in Beloit, Wisconsin and International Harvester Co. of Chicago, Illinois were certainly among the manufacturers of importance. Fairbanks-Morse entered the gas engine business as a producer of windmills that were sold to railroads and to farmers. In 1893 Fairbanks-Morse was among the first U.S. companies to produce gas engines and gained an early and lasting edge on the competition by selling their gas engines to same clients that had bought their windmills. Fairbanks-Morse was also already selling equipment to the mining industry, a major consumer of

early gas engines. International Harvester produced most of its engines, in those early years, at the Milwaukee Works factory in Milwaukee, Wisconsin, after it bought the factory in 1902. Wendel has written another encyclopedic book on International Harvester farm equipment and devoted about 40 pages to pictures and descriptions of International Harvester stationary engines.[20] International Harvester produced the Famous, Mogul and Titan lines of engines – all of which were very popular with farmers in the early years of the 20th century. Wendel notes that "From the statistical viewpoint, these engines probably outsold anything on the market, and had few rivals in quality and dependability."[21] Production of all three of these lines ended during 1917 and 1918.

(Potential additional photo here -- Milwaukee Works factory, WHS Image ID 7607)

Other large manufacturers were scattered throughout the Midwest. They included the Stover Manufacturing and Engine Co. in Freeport, Illinois and the Waterloo Gasoline Engine Co. in Waterloo, Iowa. The latter began producing in 1893, the former in 1895. Beginning in 1907, Montgomery, Ward & Co. sold Bullseye engines built by Jacobson Manufacturing Company of Warren Pennsylvania. Sears Roebuck had been selling gas engines – including the Otto engine -- since the 1890s. In 1907 and 1908, Sears Roebuck was selling engines produced by the Charles A. Stickney Co. of St. Paul, Minnesota.[22] The Gray Motor Company of Detroit, Michigan and the Cushman Motor Works of Lincoln, Nebraska were among the many other companies that produced popular farm engines in the early years of the twentieth century.[23]

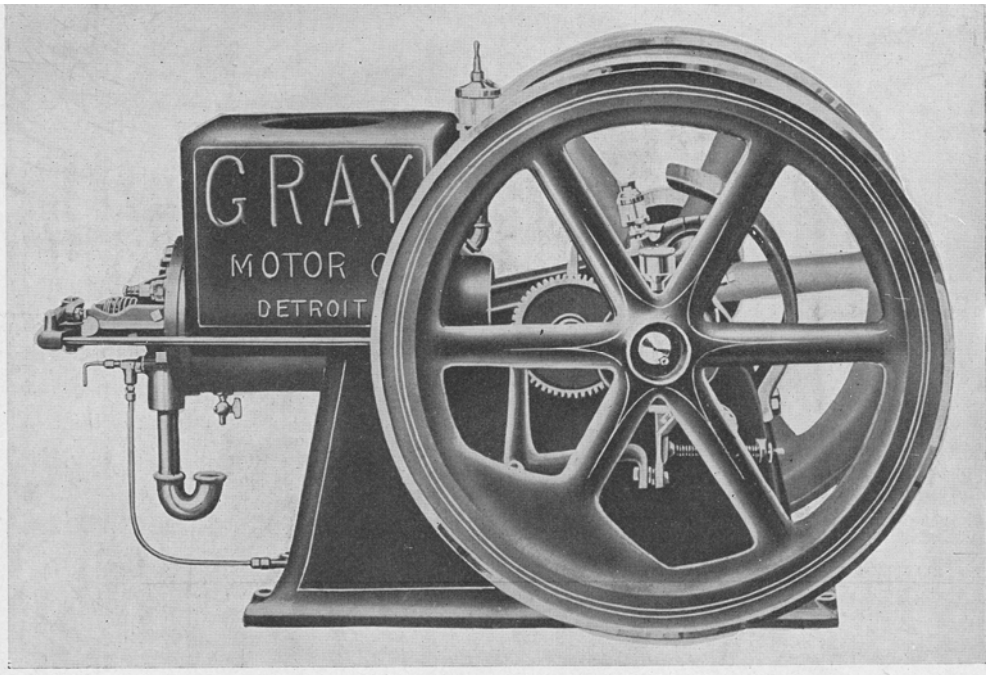


FIG. 126.

Each significant manufacturer had a variety of sizes and styles. Some were air cooled, most were water cooled. Larger farm engines were typically horizontal, it made them more stable for portability. Smaller engines, to be placed in the dairy for example, were often vertical; they

could run at higher speeds and also took up less space. The Gray Gasoline Engine pictured below came in four sizes in 1913: 1 ½ horsepower, 2 ½ horsepower, 4 horsepower, and 6 horsepower.[24] International Harvester's Titan tank-cooled portable engine was available in several different models with sizes ranging from 4 to 25 horsepower between 1905 and 1917.[25] The Titan engine was also available as a tractor beginning in 1910.

The Numbers of Gas Engines on Farms

Only a few experts of the time ventured estimates of the number of gas engines in use on farms in these early years. Philip S. Rose, an agricultural engineer and editor of the *American Thresherman*, estimated in 1914 that over one million gas engines were in use on farms at that time.[26] (There were less than 6.5 million U.S. farms in 1914.) Edward Rumeley had estimated there to be at least 600,000 gas engines on farms four years earlier.[27] The well regarded 1925 study by Kinsman corroborated those earlier figures in giving the previous graphical summary of the changes in available power on U.S. farms.

The Bureau of the Census did not begin to collect data on the use of stationary gas engines until 1930 when it had already become a moot point. By that time, tractors were already available for medium to heavy belt work on nearly 14 percent of farms. (See Table 2 below.)

Table 2 **Types of Power on U.S. Farms in 1920 and 1930**

	Number (thousands)	Farms Reporting (thousands)	Percent of all farms
1930			
Automobiles	4135	3650	58.0
Electric lights in homes	841	841	13.4
Electric motors for farm work	386	257	4.1
Tractors	920	851	13.5
Trucks	900	845	13.4
Stationary gas engines	1131	945	15.0
1920			
Automobiles	2146	1980	30.7
Electric or gas light	453	453	7.0
Tractors	246	229	3.6
Trucks	139	132	2.0

Source: Bureau of the Census, 1920, 1930

Moreover, 58 percent of all farms had at least one automobile; there were more than four million automobiles on farms. Ford's Model T was famous for its versatility on the farm. Reynold Wik explained, "farmers attached pulleys to the crankshaft, or bolted them to a rear wheel to utilize the 20-horsepower motor for grinding grain, sawing wood, filling silos, churning butter, shearing

sheep, pumping water, elevating grain, shelling corn, turning grindstones, and washing clothes."[28] Electric lights and motors were also an option on many farms. All of these options reduced the need for stationary gas engines, particularly for the larger ones. In 1914, according to Rose, the average size of a farm gas engine was five horsepower; but by 1930, according to Wendell, farm demand for gas engines of that size or larger was satisfied by tractors.[29] Smaller gasoline engines of one to two horsepower were still practical, however, for light work like pumping water and running milking machines.

Thus, in 1930 the Bureau of the Census found only 1,131,000 stationary gas engines on farms – little more than Rose estimated in 1914, and substantially less than the 2.5 million Kinsman had estimated in 1924 on the basis of "manufacturers' figures and assessors' reports from several states".[30]

In 1933, Hurst and Church updated the Kinsman USDA study and scaled back the earlier estimates of total power from gas engines to achieve a smoother alignment with the new census data.[31] Interestingly, the study made the unlikely assumption that the average horsepower of gas engines remained constant at three horsepower from 1900 to 1930, but still assumed (like Rumeley) that there were 600,000 gas engines on farms in 1910. Rose assumed that one million gas engines in 1914 averaged five horsepower for total available power from gas engines of five million horsepower. The Kinsman graphical summary reflects that same figure for 1914, and a figure of three million horsepower in 1910. The latter would be consistent with 600,000 gas engines of five horsepower each. Kinsman showed only the total horsepower – not the number of engines or their average horsepower. He assumed that total power from gas engines peaked in 1920 and then declined slightly, reporting 2.5 million gas engines in 1924, averaging 2.9 horsepower.[32] The analysis included estimates for each of the 48 states in 1924. The 1933 report by Hurst and Church assumed there were one million gas engines on farms in 1920 averaging three horsepower; and the census data for 1930 found the average horsepower of gas engines on farms to be 2.7.[33] In any case, neither report disputes the estimates of 600,000 gas engines on farms in 1910 and one million gas engines on farms in 1914.

Hurst and Church summarized the changing role of the stationary gas engine on the farm this way:

> The stationary gas engine came into use between 1890 and 1900, while electricity, the gas tractor, the motor truck, and the automobile began to be used for farm work between 1900 and 1910. The use of the stationary gas engine probably reached a peak between 1920 and 1930, but the use of electricity on the farm, the gas tractor, motor truck, and automobile continued to increase through 1930. Thus in general animal power on farms declined while mechanical power increased between 1918 and 1930. The gas tractor, motor truck and automobile displaced horses and the electric motor competed with the gas engine and windmill. While the automobile is not considered a source of power for farm work, probably 50 per cent of its operating time is directly associated with farm business. The potential horsepower of automobiles on farms in the United States probably exceeded the total available horsepower from all other sources in 1930.[34]

Research published in another USDA Bulletin later the same year, based on a survey in 1929-30 covering 736 farms in Iowa, Missouri, Illinois, Indiana and Michigan, found gas engines on 10 percent of the tractor farms and 12 percent of the horse farms. But only gas engines "which did work that horses or tractors could have done" were counted. The researchers also noted, "It is possible that some of the tractor farms could have gotten along without the gas engines, which were bought before the tractor."[35] In Iowa, gas engines were found on 33 percent of all horse farms and on 26 percent of all tractor farms. It's likely that many of the tractor farms previously had gas engines that had been sold for scrap iron – either during World War I, when demand for scrap iron was high, or during the 1920s, when many farmers went broke. The study also noted that nearly all farms surveyed hired power at least occasionally.

The Davis Case Study of Farm Gas Engines

A compelling case study of the use gas engines on Midwestern farms can be found in a set of farm diaries and ledgers of a rather typical farm in northern Illinois that belonged to Elmo Davis and his wife May.[36] It was an average-sized Illinois farm of 150 acres, just east of the city of Rockford, about 80 miles west of Chicago. May kept the diaries and meticulous ledgers, while Elmo did the farm work and bought the machinery. Davis bought his first gasoline engine in 1906 for $215.[37]

Northern Illinois was a prosperous farming area; it was among those areas -- also including southern Wisconsin, southern Minnesota, and all of Iowa -- where gas engines were found at highest densities in 1930.[38] The Corn Belt had heavy demands for stationary power, but did not need to power the super-size threshing machines of the plains and the west. Huge steam engines were common in these wheat areas, while the smaller gas engines were well suited for the Corn Belt.[39] Several important early manufacturers of gas engines were located in close proximity to Rockford including International Harvester, Fairbanks-Morse & Co., and Stover Manufacturing and Engine Co. Guilford Township, the community where Davis farmed, was a farming community at the forefront of technological change.

The engine that Davis bought in 1906 would have been about 5 to 6 horsepower. It was big enough to power his circular saw, and he used it for sawing wood primarily. In the first few years after he bought it, he earned income sawing wood in the wintertime for half a dozen neighbors each year. In 1907 and 1908, Davis earned $25.53 and $18.25 respectively in income from wood sawing. He also used the engine with a corn sheller bought in 1907 for $35 and a fanning mill bought in 1913 for $17 to clean grain. There are also indications that he used it to grind feed. His neighbor borrowed the gas engine to run an elevator in the barn in 1909. Davis also borrowed other gas engines in the neighborhood for specific jobs. For example, the stationary hay baler demanded more power than his engine offered, but other neighbors had gas engines big enough to run the baler. When Davis built a silo in 1913, a neighbor brought up a cement mixer and engine to run it. At least six other gas engines (of various sizes) in the neighborhood were mentioned between 1906 and 1916.

(Potential additional photo here -- gas engine with wood saw, WHS Image ID 9572)

Previously the work done by these gas engines would have demanded either the use of a horsepower or a steam engine – both worked with a belt and pulley system. Records in 1898 and 1899 indicate that Davis used a sweep-style horsepower (where several teams of horses walked around in a circle) to power his circular saw and corn sheller. (Treadmill-type horsepowers in a variety of sizes were also available.) On other occasions, however, he would hire a local steam engine to come out and provide the power.

Davis was also part of a group of six farmers that together bought a large gasoline engine in 1914. His share of the cost was $200. This engine was powerful enough to run the threshing machine that the group also owned, as well as their corn shredder and their silo filler. They used this "big engine" at least through 1929 for stationary work. By 1929, every farmer in the group had his own tractor. Tractors began to appear rapidly in the neighborhood in 1919, and Davis finally bought a tractor in 1926. (Nine percent of Illinois farms had a tractor in 1920, and 31 percent had at least one tractor in 1930.[40]) But the old gas engine was more powerful than the new tractors and better suited for the belt work, so the men continued to use it after they bought tractors. There is no indication in the Davis diaries of anyone purchasing an engine of five horsepower or higher after tractors appeared on the scene.

Davis used his 1906 gas engine at least through 1919, when he loaned it to his younger cousin for a couple of weeks. Thereafter in the early 1920s, the engine seemed to be acting up; Davis borrowed the tractors of family and neighbors for some stationary power jobs such as grinding feed and sawing wood that he could have done with his own engine had it been working.

May's ledgers confirm two other purchases of stationary gas engines for farm work over the course of 44 years of farm records. Davis bought a small gas engine to use to pump water in 1922 (for $25) and another (also for $25) in 1937.

The Decision to Purchase a Farm Gas Engine in 1913-15

Farmers, like those in the Davis group, faced a confusing choice deciding which engine to buy in 1914. Hirshfeld and Ulbricht stress the enormous variety of engines in use at the time; in writing their book the authors reviewed "several hundred American engines of the agricultural types." They state, "Engines of the agricultural type are still in the process of development and no one type has yet proved its superiority." Moreover they found "extraordinary variations in prices . . . the price of a 4 ½-horsepower engine, for instance, may vary between about $21 and $40 per horse power."[41] According to their analysis, however, the 4 ½ horsepower size was a relatively efficient size to buy in 1913, and they expected prices of all gas engines to fall in the future.

All three of the other books mentioned above suggest that the decision of which engine to buy could be facilitated by buying two engines. For one thing, it was important to have the right size. According to Potter, "A gas engine should be selected large enough to do the required work, as it will stand but little overload. . . . On the other hand, an engine too large for the work it has to do will give poor fuel economy." Thus, two engines were recommended: "the larger engine of 6 to 10 hp. can be used for the heavier work, such as feed grinding, threshing, wood sawing, etc., and a small engine of about 2 hp for the many small tasks, about the house, dairy, and barn, which

require but little power."[42] Brate and Putnam, who were both intent on selling engines, each suggested that the larger engine might be a tractor because a tractor could do everything the large engine could do and plow as well.[43] Brate, however, who wrote in 1912, also praised the practicality of the "portable outfit. . . . mounted on trucks, so that it can be hauled from place to place . . . so as to furnish power for sawing wood, grinding feed, pumping water, etc." He admitted that the "cost of an outfit of this kind is very much less than a tractor . . . and makes a very serviceable and handy arrangement. It takes the place of the gas tractor for the small farmer."[44]

Putnam (1913) argues more strongly for the gas tractor and makes "A Plea for the Small Engine" to relieve the farmer and his family of the drudgery – the work that would otherwise be done by hand.[45] One wonders whether a brief lull might have developed in the break-neck pace of the gas engine market. The gas tractor market was getting more interesting. As Williams noted, "In 1913, the Bull Tractor Company unveiled a new tractor that rattled the industry." The "Bull with a Pull" was much smaller than the earliest gas tractors, and it was much less expensive – under $800 as opposed to $3000.[46] Gas tractors had yet to prove themselves, however, and the Bull did not prove to be a good tractor. Earlier tractors had also disappointed: a 1915 Department of Agriculture study concluded that more than 400 farmers who used tractors before 1912, recommended horses as the better alternative.[47] In 1910 there were over 600,000 gas engines on farms and only 1000 tractors.[48] But farmers knew that tractors were the wave of the future, and many farmers yearned for one. By 1913, some farmers were thinking they'd hold off on a gas engine and buy a tractor when the price/value combinations for tractors improved. In the meantime they could borrow the neighbor's engine or make do with the Model T.

By 1913 more than 250,000 farmers already owned an automobile.[49] Automobiles began to appear in Guilford within a few years after Davis bought his first gas engine. The first automobile was mentioned in the diaries in 1909. Davis first bought an automobile in 1911 – a Maxwell Touring Car. He traded it for a new Buick in 1915. The Davis diaries specifically mention at least 17 automobiles owned by farm families in their immediate neighborhood by 1915. (Six of these were mentioned before the end of 1910). There were approximately 144 farms in the east side of Guilford Township during this time. But the automobiles mentioned belonged primarily to close friends and family members of Davis and his wife; perhaps half the neighborhood or more had cars by 1915. (No one could be identified as having bought a tractor without first buying an automobile.) The 1920 census found that 53 percent of farms in Illinois and 73 percent of farms in Iowa had at least one car in 1920, when only 9 percent of farms in each state had a tractor.[50]

In 1910, when there were over 600,000 gas engines on farms, there were only 458,000 automobiles registered in all of the United States. At least 50,000 of these automobiles were on farms.[51] But the numbers of automobiles were about to shoot up.

Henry Ford's Model T, which came out in 1908, was developed especially for farmers. It was reliable, durable, and, at $850, it was priced to appeal to the frugal though prosperous farmers of the golden age of agriculture.[52] It had four cylinders and 20 horsepower and was especially designed to handle rough country roads. Farmers loved it and demand soared. They had long distances to travel on a regular basis and needed to get to town more quickly. Farmers became

the most rapidly growing market for automobiles; by 1914 Ford had introduced his assembly line, was producing half the automobiles in the United States, and was selling them for $500.[53] By 1915, the number of automobiles on farms had increased to 472,000 and it continued to increase rapidly into the early 1920s, even while the agricultural economy soured. Several companies even developed kits to convert the Model T to a tractor.[54]

Conclusion

The progress of the gasoline engine on the farm between 1900 and 1924 was at least as interesting as it was in the next 25 years, even though the latter period has received intense scrutiny and former period, very little. Indeed already by 1924, according to Kinsman's graphical summary, available horsepower on the farm generated by gas engines, gas tractors, and trucks exceeded available horsepower from horses and mules. Moreover, in 1924 farmers owned over three million automobiles (per 6.5 million farms). In states like Illinois and Iowa, automobiles were becoming nearly universal on farms. One could argue that the most important phase of the technological transition was already complete in these states by 1924, when tractors (and trucks) were just taking off.

Because the heyday of the stationary gas engine on the farm was so short and overshadowed by both the automobile and tractor, it has been overlooked by economic and agricultural historians. This portable gas engine was used for heavy stationary farm work for less than thirty years, beginning just before the turn of the century. Steam engines and horsepowers served for much longer. Steam engines were in use for farm power for nearly 100 years – beginning in about 1850 and disappearing completely after World War II. Horsepowers dated back to about 1830 and were still found in catalogues as late as World War I.[55] During the same period that stationary gas engines were rapidly adopted on farms, automobiles and tractors were stealing the spotlight. Numerous magazines appeared around the turn of the century to provide extensive coverage of the automobile to fascinated readers. Cross-country reliability tours attracted nationwide attention.[56] Large gas tractors were competing against steam engines at exhibitions and attracting popular attention and favorable press coverage.[57]

Stationary gasoline engines were somewhat dull though dependable in the first decade of the 20th century, relative to their automotive cousins. But the role of early stationary gas engines in the diffusion of the technology on the farm should not be forgotten.

The demand for gas engines on most farms was driven by a demand for better stationary power. Neither horse power, nor steam power, nor wind power, nor water power could effectively provide the stationary power that farmers needed. But gas engines could and did on hundreds of thousands of farms beginning in about 1900. Even when the tractor finally reached farms, its role as a source for stationary belt power was critical to the decision to adopt. And farmers were already familiar with the workings of the gas engine.

Endnotes

[1] See Department of Commerce, *Statistical Abstract of the United States, 1922* (Washington, D.C.: Government Printing Office, 1923), 197; "The Farmer's Power-Plant," *Literary Digest* (November 27, 1915), 1219-20.
[2] Alan L. Olmstead and Paul W. Rhode, "Reshaping the Landscape: the Impact and Diffusion of the Tractor in American Agriculture, 1910-1960," *Journal of Economic History* 61:3 (September 2001): 665-68), William J. White, "An Unsung Hero: The Farm Tractor's Contribution to Twentieth Century United States Economic Growth," (Ohio State University: Economics Ph.D. Dissertation, 2000).
[3] The term "gas engine" was applied to all internal combustion engines, whether they ran on gasoline, kerosene, or oil.
[4] Robert C. Williams, *Fordson, Farmall, and Poppin' Johnny: A History of the Farm Tractor and Its Impact on America* (Urbana, IL: University of Illinois Press, 1987), 35-36; John T. Schlebecker, *Whereby We Thrive: A History of American Farming, 1607-1972* (Ames, Iowa: The Iowa State University Press, 1975), 194-95 also mentions that stationary gas engines were beginning to replace the steam engine as early as 1900.
[5] James J. Flink, *The Automobile Age* (Cambridge: The MIT Press, 1988), Ronald R. Kline, *Consumers in the Country: Technology and Social Change in Rural America* (Baltimore: The Johns Hopkins University Press, 2000), and Reynold M. Wik, *Henry Ford and Grass-roots America* (Ann Arbor: The University of Michigan Press, 1972).
[6] C. D. Kinsman, *An Appraisal of Power Used on Farms in the United States*, USDA Department Bulletin 1348 (Washington, DC: Government Printing Office, 1925).
[7] H. R. Brate, *Farm Gas Engines*, (Cincinatti, Ohio: The Gas Engine Publishing Company, 1912.)
[8] Xeno W. Putnam, *The Gasoline Engine on the Farm: A Practical, Comprehensive Treatise on the Construction, Repair, Management and Use of this Great Farm Power as Applied to All Farm Machinery and the Farmer's Work Indoors and Out*, (New York: The Norman W. Henley Publishing Company, 1913).
[9] Andrey A. Potter, *Farm Motors: Steam and Gas Engines, Hydraulic and Electric Motors, Traction Engines, Automobiles, Animal Motors, Windmills* 2nd Edition (New York: McGraw-Hill Book Co., Inc., 1917. 1st edition published in 1913.
[10] Hirshfeld and Ulbricht, *Farm Gas Engines*.
[11] See Kinsman, *An Appraisal of Power Used on Farms*, 46-47 on advantages and disadvantages of various power sources.
[12] Putnam, *The Gasoline Engine on the Farm*, 36-37.
[13] C. D. Kinsman, *An Appraisal of Power Used on Farms in the United States*, Fig. 5. See also Carroll R. Daugherty, "Horsepower Equipment in the United States, 1869-1929" *American Economic Review* 23: 3, September, 1933, 428-44. Daugherty, 431, refers to Kinsman as "a sound and trustworthy piece of work."
[14] R.B. Gray, *The Development of the Tractor in the United States*. USDA Information Series No. 107. (Beltsville, MD: USDA, 1954). Fred R. Jones, *Farm Gas Engines and Tractors*. (New York: McGraw-Hill Book Company, Inc., 1932), 17-18. Eugene G. McKibben and R. Austin Griffin, *Changes in Farm Power and Equipment: Tractors, Trucks, and Automobiles*, WPA, National Research Project Report No. A-9, (Philadephia: WPA, 1938).
[15] C.H. Wendel, *American Gasoline Engines Since 1872*, (Sarasota, Florida: Crestline Publishing Co., 1983).
[16] Wendel, *American Gasoline Engines Since 1872*, 4.
[17] R.B. Gray, *The Development of the Tractor in the United States*, 11.
[18] Charles E. Lucke and S. M. Woodward, *The Use of Alcohol and Gasoline in Farm Engines*, USDA Farmers Bulletin No. 277, (Washington, D.C.: Government Printing Office, 1907), 12.
[19] Ibid.
[20] C. H. Wendel, *150 Years of International Harvester* (Iola, WI: Krause Publications, 1981).
[21] Ibid., 113.
[22] Wendel, *American Gasoline Engines Since 1872*, 315, 454, 489, 532.
[23] See C. F. Hirshfeld and T.C. Ulbricht, *Farm Gas Engines* (New York: John Wiley & Sons, Inc., 1913), 174-179, 204-210.
[24] Ibid., 174.
[25] Wendel, *150 Years of International Harvester,* 116.
[26] "The Farmer's Power-Plant", 1220.
[27] Edward A. Rumeley, "The Passing of the Man with the Hoe" *The World's Work* 20: 4 (August, 1910): 13246-58.
[28] Wik, *Henry Ford and Grass-roots America*, 32-33.
[29] "The Farmers Power Plant", 1220; Wendel, *150 Years of International Harvester,* 113-14.

[30] Kinsman, *An Appraisal of Power Used on Farms*, (appendix table 1).
[31] W.M. Hurst and L.M. Church, *Power and Machinery in Agriculture*, USDA Miscellaneous Publication No. 157. (Washington, D.C.: U.S. Government Printing Office, April 1933).
[32] Kinsman, *An Appraisal of Power Used on Farms*, 8.
[33] Hurst and Church, *Power and Machinery in Agriculture*, Table 8.
[34] Ibid., 13.
[35] L.A. Reynoldson, W.R. Humphries, S.R. Speelman, E.W. McComas, and W.H. Youngman, *Utilization and Cost of Power on Corn Belt Farms*, USDA Technical Bulletin No 384, (Washington, D.C.:, U.S. Government Printing Office, October 1993), 4-6
[36] See Carrie A. Meyer, *Days on the Family Farm: From the Golden Age through the Great Depression* (Minneapolis: University of Minnesota Press, 2007).
[37] The prices in this paper are in nominal terms.
[38] Hurst and Church, *Power and Machinery in Agriculture*, Figure 6.
[39] Kinsman, *An Appraisal of Power Used on Farms* (appendix table 1) estimated that Iowa had more gas engines in 1924 than any other state: 215,000. Illinois came in second with 155,000. See Thomas D. Isern, *Bull Threshers and Bindlestiffs: Harvesting and Threshing on the North American Plains* (Lawrence: University Press of Kansas, 1990) on threshing.
[40] U.S. Bureau of the Census, 1920, 1930.
[41] Hirshfeld and Ulbricht, *Farm Gas Engines*, 35, 156, 158.
[42] Potter, *Farm Motors*, 111-12.
[43] Brate, *Farm Gas Engines*, 155; Putnam, *The Gasoline Engine on the Farm*, 248.
[44] Brate, *Farm Gas Engines*, 136-37.
[45] Putnam, *The Gasoline Engine on the Farm*, 247.
[46] Williams, *Fordson Farmall, and Poppin' Johnny*, 23-24.
[47] Williams, *Fordson Farmall, and Poppin' Johnny*, 20 cites Arnold P. Yerkes and H. H. Mowry "Farm Experiences with the Tractor" *Bulletin* No. 174, Washington, D.C.: USDA, April 14, 1915.
[48] The figure for tractors comes from U.S. Bureau of the Census, *Historical Statistics* (Washington, DC: U.S. Bureau of the Census, 19750, series K184.
[49] *Historical Statistics*, series K 186
[50] U.S. Bureau of the Census, 1920.
[51] *Historical Statistics*, series Q153 and K186. The USDA estimated automobiles on farms to be 50 percent higher in 1910. See US Dept of Agriculture, Income Parity for Agriculture, Part II Expenses of Agricultural Production, (Washington, D.C.: US Dept of Agriculture, 1940), table 10.
[52] See Meyer, *Days on the Family Farm*, 48-49; and James J. Flink, *America Adopts the Automobile, 1895-1910* (Cambridge: The MIT Press, 1970), 66-74.
[53] John B. Rae, *The American Automobile Industry* (Boston: Twayne Publishers, 1984), 37-38, 180.
[54] See Wik, *Henry Ford and Grassroots America*, 33.
[55] Schlebecker, *Whereby We Thrive*, 192; C.H. Wendel, *Encyclopedia of American Farm Implements & Antiques* (Iola, WI: Krause Publications, 1997), 210-213.
[56] See Flink, *The Automobile Age*, 29-33.
[57] Williams, *Fordson Farmall, and Poppin' Johnny*, 21-23.