

Dominant Design: How The Ferguson System Revolutionized Mechanized Agriculture

By

Scott Marshaus

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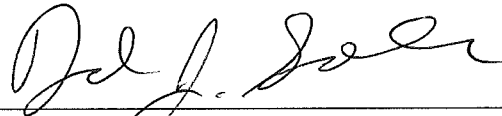
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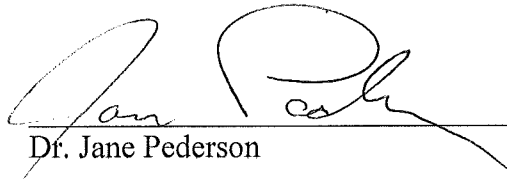
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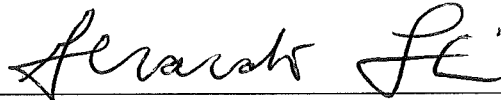
Scott Marshaus Presented December 4th, 2015



Dr. David Soll, Chair



Dr. Jane Pederson

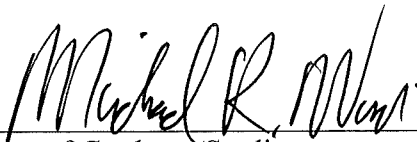


Dr. Gerardo Licon



Dr. Donna Lehmkuhl

APPROVED:



Dean of Graduate Studies

Dominant Design: How The Ferguson System Revolutionized Mechanized Agriculture

By

Scott Marshaus

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Under the Supervision of Dr. David Soll

This thesis examines the development of the three-point hitch system utilized on farm tractors, invented by Harry Ferguson of Ireland. Harry Ferguson partnered with Henry Ford to mass produce the farm tractor's first dominant design which prominently featured the Ferguson System, also called the three-point hitch. First introduced to farmers in 1939, the three-point hitch was the innovation that allowed farmers to upgrade from animal power to machine power. The Ferguson System revolutionized mechanized agriculture because it allowed farmers to increase productivity far beyond the capabilities of their traditional animal power.

It took decades for farmers to adopt the Ferguson System. To understand these adoption rates, this thesis will use Everett Rogers' principle of the diffusion of innovations. This is an idea pioneered by economists, but it is also relevant for other disciplines to understand the larger social context of adoption rates for new innovations. Farmers were still using animal power well into the 1950s because mechanization was not economically viable for small farmers. The diffusion of innovations is a way to tell the story of the three-point hitch as it progressed through the five stages of adoption. The Ferguson System was not simply a tool for the wealthiest, but rather a system for farming

that would reach all five stages of adoption classes. To better understand these classes the diffusion of innovations is consulted to learn the reasons for adopting. The Ferguson System was a fundamental change in farming ideas and established the mechanized agriculture's dominant design. The tractor's dominant design revolutionized mechanized agriculture by ushering in an unprecedented era of productivity for American farmers.

Dal J. Jell

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Dedicated to my mother:

During our brief moment together in this universe
you gifted me an enduring force, your love.

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Chapter I: Historiography of Agricultural Mechanization

A tractor on its own is worthless. A plough on its own is worthless. Put the two together and you have a system of farming. – Harry Ferguson¹

Introduction

The United States of America underwent an unprecedented growth in agricultural productivity and production during the twentieth century. In 1900 forty percent of the country's 76 million citizens lived, worked, and had families on farms.² By 1990 less than two percent of the country's population lived or worked in agriculture.³ This drastic change during the last century is not the cause of a single process or event, but rather the result of the collection of innovations that occurred in four key disciplines of agriculture: replacement of manpower/animal power with mechanization, increased production from hybrid crops, elimination of cultivation and fertilization with the advent of chemical farming, and the progress of environmental management practices.

At the center of the American farmer's desire to increase productivity was the displacement of animal power and rise of mechanization. The Ferguson System was the innovation that allowed the farm tractor to become more productive than traditional animal power. Before the Ferguson System, many farmers who did mechanize would still need to keep their horses for their versatility. Most early tractors were too large for tasks that required precision, and too great of an investment in a machine that could only use the same implements as the horse did. Other impactful innovations such as hybrid seeds

¹ Ian M. Johnston, "Harry Ferguson – And Me!," *The Australian Cotton Grower*, August/September 2005, 58.

² Bruce L. Gardner, *American Agriculture in the Twentieth Century: How It Flourished and What It Cost*. (Cambridge: Harvard University Press, 2002), 92.

³ Carolyn Dimitri and Anne Effland and Neilson Conklin, "The 20th Century Transformation of U.S. Agriculture and Farm Policy," *USDA Economic Information Bulletin*, Number 3 2005, 2.

and chemical additives did contribute to the rapid increase of agricultural production, but all of these advances would need to be distributed mechanically. The Ferguson System was the innovation that allowed for the most productive application system for hybrid seeds, pesticides, herbicides, and fertilizer. The system of delivery for these chemicals were implements designed for the three-point hitch, and without a proper system for farming in place these innovations would be under-applied on farms.

Farmers had been introduced to mechanization just before the start of the twentieth-century, but full market diffusion did not occur until the 1960s. The first tractors used during the late nineteenth-century were heavy cumbersome monsters of the prairie that could cost up to three times an average farmer's yearly income. Mass production of the tractor in the 1920s and 30s helped introduce mechanization on a larger scale but did not replace the productivity animal power could provide on most farms. It was not until the 1940s when tractors were manufactured with the revolutionary three-point hitch system, which brought hydraulics to mass-produced farm tractors. This was the Ferguson System, a coupling mechanism that joined the tractor and farming implement together harmoniously. The coupling mechanism is an important part of the farm tractor as it is the only unit that turns the engine's power into effective tools for most aspects of farming. Large engines for powering through muddy fields and rubber tires for traction were important advancements, but none of them increased the possibilities like the Ferguson System did. The farm tractor was no longer just used as a plow, seeder, or disc, but now it could be utilized to plow snow, split logs, elevate bales of hay, and even pick cotton.

The coupling is called the three-point hitch as there are two bottom armatures with a top centered single armature. The hitch is raised and lowered into the soil by powerful hydraulics. The hydraulics within the Ferguson System introduced the farming world to depth control, a means to control an implement's depth in the soil. Before the three-point hitch there was no way to regulate the depth of an implement within the soil. Implements were attached to wheels, acting as clumsy trailers; wheel-drawn implements were designed to be dragged behind animal power. The results of using these wheel-drawn implements on tractors with a single point hitch were life threatening as early tractors utilizing a single-point hitch could flip over, which often had fatal consequences. Depth control was not only a safety issue, but it was also an issue of functionality as it allowed the farmer to utilize previously unworkable land. The efficiency of the tractor and implement together allowed the farmer to utilize uneven, hard, or overgrown land. The constant depth of a plow forced energy downward carving the soil evenly, whereas plows on wheels could not generate the same down force, thus forming uneven furrows.⁴ This would be beneficial to those wanting to plow virgin soil or cultivate crops with safety and accuracy. The Ferguson System's success established itself as the dominant design for the farm tractor in 1939 and is still the dominant design for farm tractors built around the world.

Dominant design was a concept first outlined by James M. Utterback and William J. Abernathy in a co-written 1975 article. They define dominant design as the standard or *de facto* in the industry. It is the idea that wins over the competitors and forces them to

⁴ A furrow is the cut that the plow makes as it moves through the dirt. The sod gets turned over and creates a ditch for seeds. That turn over and the cut are what make up the furrow.

adopt to newer technology as the industry standard.⁵ This thesis will examine the farm tractor’s diffusion using Everett Rogers’ economic theory, the diffusion of innovations. The diffusion of innovations explains how new technologies diffuse across diverse social groups. There are five social groups in his model and each make up a percentage of the total population, innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%) and laggards (16%).⁶

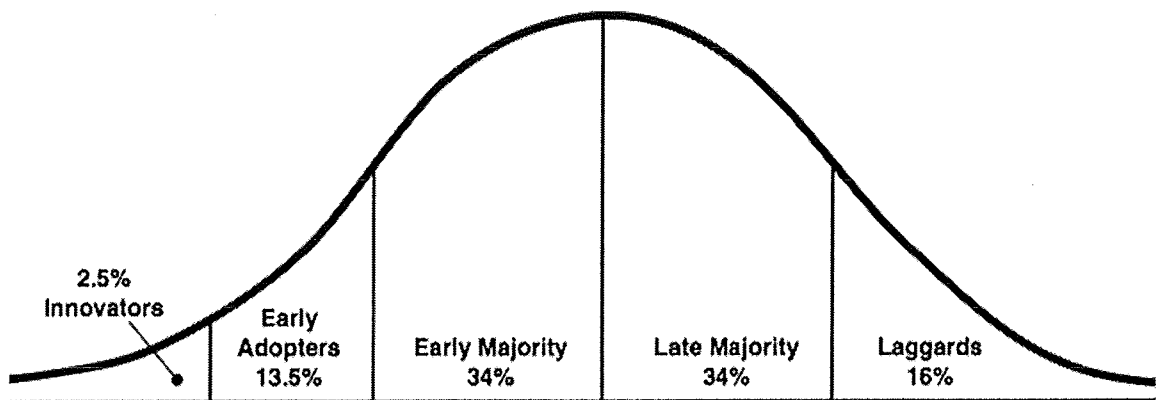


Figure 1 – Source: *The Diffusion of Innovations 5th Ed.*, 281.

Prior to the three-point hitch in 1939, the farm tractor was used across the country by innovators, early adopters and some members of the early majority, but failed to reach the final fifty percent of consumers that make up the late majority and laggards. There are many reasons why this was the case: flaws in the existing technology, economic hardships, and technological skepticism to name a few. The five categories that Rogers outlines represent different social classes among the American farmer. The innovators and early adopters were financially well-off and enjoyed taking risks on promising new technologies. The early majority farmers were ones who need to see the progress of

⁵ James M. Utterback and William J. Abernathy, “A Dynamic Model of Process and Product Innovation,” *OMEGA The International Journal of Management Science*, Vol. 3 No. 6 1975, 640-656.

⁶ Everett M. Rogers, *Diffusion of Innovations 5th Ed.* (New York: Free Press, 2003), 281.

others before making a change. The inconsistency of early tractors did not persuade these farmers to make the change quickly. Finally, the late majority and laggards within the farming community are highly skeptical of new innovations and any technology changes on the farm. For economists, a new innovation is considered a great success when the first three groups adopt, as it is unrealistic for some ideas to reach the late majority and laggards. The American farm tractor was able to diffuse across all five categories thanks in large part to the Ferguson System.

Another important innovation was International Harvester's power take-off (PTO). This breakthrough allowed tractors the ability to power implements through an auxiliary power source located above the rear hitch. This innovation opened the door to increased possibilities for implements. Tractor manufacturers rapidly adopted the PTO, as it became an industry standard. The benefits it provided farmers allowed the tractor to diffuse into the early majority of adopters. However, it was the Ferguson System that allowed the tractor to diffuse across both majorities and laggards. The success of the PTO was expanded upon with the introduction of the Ferguson System; the two bonded together forming the three-point hitch system. To this day the Ferguson System is still the dominant design of the tractor industry and it was the key that unlocked unprecedented opportunities for the PTO. The powerful duo forced the last technological adopters to recognize that the three-point hitch system was the final innovation that perfected the farm tractor.

Each of these social groups had specific needs and expectations when it came to accepting and adopting the farm tractor. It took the farm tractor around sixty years to diffuse throughout the five stages of innovation adopters; this thesis will argue that a

majority of farmers failed to adopt because the farm tractor was without its dominant design until 1939. This failed adoption had long-term effects on American agricultural production following the First World War and would last until the conclusion of the Second World War. American farmers wanted to adapt to mechanization much quicker than they did, but the farm tractor, until 1939, was not as effective as animal power. This inefficiency led to farmers holding onto their horses much longer, thus forcing farmers to allocate farm-land to feed their animal power. The three-point hitch was the solution for hesitant adopters and has led to the substantial growth of the American agricultural industry. As an innovation the three-point hitch has met the challenge of time and continues to be the industry standard across the world. Its ubiquitous nature has allowed for the spread of a universal implement system which is found working in fields worldwide.

The Ferguson System did not only transform mechanized agriculture; its contributions are far-reaching across modern industrial life. The three-point hitch is the means by which humans are able to effectively and efficiently produce energy to fuel human progress. In the twenty-first century there is not a single American that is not affected by the three-point hitch. Most of the world's food is harvested and cultivated by tractors which utilize the three-point hitch. The Ferguson System was an innovation that exemplified the progress and advancement of the human race, and the three-point hitch has contributed to the unprecedented advances in agricultural yields and productivity of the twentieth-century.

Historiography

Inventor and Pioneer

When discussing a piece of technological innovation it is important to discuss the inventor responsible. Colin Fraser undertook a biography that aimed to capture the story and spirit of Harry Ferguson. Ferguson was an agricultural pioneer, businessman, and inventor of the three-point hitch with draft control which he dubbed the Ferguson System. Fraser's book covers Ferguson's early life on the farm in Northern Ireland and his business ventures into agriculture as a young man. Fraser explores Ferguson's partnership with Ford and the rise of Ferguson's own tractor business in the 1940s. The book also explores Ferguson's downfall and depression following the split with Ford and the merger with the Massey Harris tractor company. Ferguson exited the tractor business when he sold his company, Ferguson Inc., in a merger with the Canada's Massey Harris in 1953.⁷

The biography takes a narrative perspective on Ferguson's life. It is very one-sided as the book aims to magnify and celebrate Ferguson's greatest achievements. The Ferguson System is an innovation he invented, but the book does not give adequate credit to the engineers on his staff for developing the invention. This is discussed more in Chapter 3 when a Ford engineer close to the development team admits that it was Ferguson's employee, William Sands, who took the Ferguson System from blueprint to a functional proto-type. The most valuable information gathered from Fraser's book are the interpersonal relationships of Ferguson. These stories build an image of Ferguson's thought-process behind the bold and innovative decisions he was known for. His research

⁷ Colin Fraser, *Harry Ferguson: Inventor & Pioneer*. (Ipswich, UK: Old Pond Publishing, 1972), 235.

in the book is much appreciated and adds depth to important events, most specifically like the “handshake agreement” with Henry Ford. The “handshake agreement” with Ford started the agricultural revolution that brought affordable and efficient mechanization to the farm. The handshake formed an agreement between the two men that agreed to produce Ford tractors with Ferguson’s three-point hitch. This was the first opportunity for the world to use the Ferguson System, and it injected innovation into the Ford tractor business. Fraser’s biography is a cornerstone work for any research into Harry Ferguson, and the twentieth-century tractor industry.

It is unclear whether or not Colin Fraser had access to the information that now exists regarding the history of the Ferguson System. Fraser’s book is a well written biography that does an excellent job of highlighting Ferguson’s brilliant ideas. The book is quite biased to the home-country hero and fails to address some of the more negative aspects of Ferguson’s career in the tractor business. Fraser himself comes from a background in academic agricultural lecturing and seventeen years of work as leader for the United Nations’ Food and Agricultural Organization. Fraser regards Ferguson as a legend for his contributions to global agriculture, but does not allow his position to cause a bias in his research.

Fordson, Farmall, and Poppin’ Johnny

Robert C. Williams’ work is a secondary source that gives an overall view of the major tractor manufacturers of the early to mid twentieth-century. His book *Fordson, Farmall, and Poppin’ Johnny* is the most comprehensive history of the early development of the farm tractor and how the American farmer was changing with new innovations. Williams recounts the tractor industry and early mechanization efforts of the

first half of the twentieth century in a chronological order. He covers the tractor business starting with steam power and expanding into mass-produced gasoline tractors. Williams comes across as being objective in his narrative on agricultural mechanization history.

Williams takes an in-depth look into the operations of the early tractor market and how the technology was accepted and then adopted by competitors. *Fordson, Farmall, and Poppin' Johnny* had one of the best interpretations of the 1920s battle over farm tractor market supremacy between the Ford Motor Company (Ford or Ford Motor) and International Harvester Corporation (IH or International Harvester). Williams makes the case that the wealthier Ford could bully competitors out of the market, but the smaller International Harvester, incorporated new innovations to gain a technological advantage. The advantage IH gained was so great that it forced Ford to withdraw from the North American market as the company lost money on every tractor produced.⁸ However Ford Motor learned from the failure and rebounded in 1939 by regaining market share with the dominant design of the farm tractor being introduced by means of the Ferguson System.

This book is a core research tool within the discipline of agricultural history. It has a well-written recounting and interpretation of the most influential early tractor manufacturers. The book's statistical information on tractor production by manufacturer is invaluable. Williams spends one-third of the book exploring the philosophical changes taking place within farming life as the fall of animal power gave rise to mechanization. It covers a wide range of social issues linked to the increased mechanization of American farms. The book is an excellent social history that does not subscribe to the fallacy of

⁸ Robert C. Williams, *Fordson, Farmall, and Poppin' Johnny*. (Chicago: University of Illinois Press, 1987), 123.

technological determinism, which is the idea that technology drives human changes. Very much to the contrary, humans drive changes in technology to suit their needs.

Twentieth Century American Agriculture

Bruce L. Gardner's 2002 work applies an economic element to the discipline of agricultural history. This work is more an economic study of agricultural progress than a social history of the American farmer. The strength that *American Agriculture in the Twentieth Century* brings to this thesis is its collection of economic figures that can be correlated to the social conditions facing the farmer. Written in the twenty-first century, this book has excellent perspective and coverage of the entire farming industry during the twentieth century. The book examines key areas of agricultural business: commodity and trade policies, government regulation and involvement, but most importantly technology and the family farm. His research is presented by explaining the development of each area, such as hybrid seeds and tractors separately. At the conclusion of his work these innovations are brought together to create a big picture of the overall increases in agriculture throughout the century. His conclusion is that it was not one single discipline or innovation but rather the contributions of each that led to the explosion of productivity. Gardner's research is important because it provides evidence of sharp increases in productivity during the 1940s, which supports my thesis about the diffusion of tractors among farmers.

Gardner introduces a productivity study comparison throughout the twentieth-century between farm business and non-farm business. He takes the raw data and interprets it in a way that illuminates agricultural history. The US Department of Commerce keeps track of productivity by calculating the output per hour of workers. In

1930 nonfarm business productivity was 9.9 times more productive than farm productivity. Farm productivity would close the gap and overtake nonfarm business in 1949.⁹ Gardner's analysis points at an upward trend starting in 1939 and continuing upward until the end of the twentieth-century, and contributes excellent work within the discipline as to when farming started to compete with nonfarm business in terms of productivity.

Most of Gardner's statistics were published by the United States Department of Agriculture (USDA). While using a base set of data from government statistics he also uses the work of other economists and historians in the field of agriculture to understand the statistics in a larger context. The amount of detailed statistical data gathered in *American Agriculture in the Twentieth Century* makes it one of the standard works on the agricultural systems of the twentieth century.

Diffusion of Innovations

Currently in its fifth edition, Everett M. Rogers' theory on the diffusion of innovations is the gold standard in economic innovation diffusion theory. Not a work of history, but rather an economics book that introduced an interdisciplinary idea, the diffusion of innovations. Innovations are new technological products that enter into the free market and compete for market diffusion.¹⁰ An early twenty-first century example of this principle can be observed while inspecting the 2006-2008 battle over high definition optical disc format supremacy. In 2006 HD DVD was backed primarily by Toshiba and aimed to gain control of a massive market that would overtake conventional DVDs. The only thing blocking their path was the Sony-backed Blu-Ray format type. Each of these

⁹ Gardner, 33.

¹⁰ Diffusion of Innovations

new formats took a special player to read the discs, and these machines cost thousands of dollars. The tipping point for Sony's victory was the PlayStation 3's ability to play a Blu-Ray disc for half the price of specialized players, a key factor because gaming system was already the second most popular gaming systems in American homes. The added distribution method gave the Blu-Ray disc an edge in diffusing their innovation across the majority of users.

It is Rogers' theory on the diffusion of innovations that gives historians a lens on how to view innovation diffusion across social demographics. The sociological elements help to explain the mindset of the farmer, and what mechanization meant to them. Some farmers jumped at the chance to take tractors to the field while many more held back. It is *The Diffusion of Innovations* that empowers historians of technology to understand the social and economic reasons for adoption to take place within a discipline. Rogers covers each social group's reasons for adopting new innovations, as well as why adoption did not transpire.

N-News Magazine

Edited by Rob Rinaldi, *The N-News Magazine* is a quarterly newsletter that is supported by fans, farmers, and hobbyists that own Ford tractors. There are articles written by tractor historians and people like Harold Brock, lead designer of the Ford 9N tractor. Reader submissions are accepted from those who have stories of how the N-Series Ford tractor affected their lives on the farm. Educated authors also pose new perspectives on the early Ford tractors which helped to understand the Ferguson System's diffusion. It is more than a newsletter for tractor junkies; this is a network of history lovers who reached out and started conversations with authors Harold Brock and Robert

Pripps. *The N-News Magazine* connects with a niche audience of hobby farmers and tractor enthusiasts to create a community to share ideas. That tradition is apparent as the newsletter receives quality opinion articles by amateur historians and those with challenging perspectives. Without the success of the N-Series tractors there would obviously be no newsletter, but without the Ferguson System the 9N might have been the only model made.

An example of the publication's respect within the community was exhibited when the editor, Rob Rinaldi, interviewed Harold Brock on his time designing the Ford 9N tractor. Brock shared lots of memories of working with Harry Ferguson and holds strong opinions of him. It is clear that he is not objective on some of his feelings, but it was not his place to be objective. He does make some good arguments and has evidence to support them. However his tone and verbiage does confirm that the two men did have many issues with one another (Chapter 4). Highly regarded tractor historian, Robert Pripps shares his insight as a regular contributor for the newsletter.

This resource adds a historic perspective of these tractors that tell a story of loyalty and dedication. *The N-News Magazine* is a modern example of how this technology has continued to endure over the years and is on par with modern tractors. New improvements such as power steering, radios, diesel engines, and four-wheel drive are simply innovations that were diffused elsewhere and brought to tractor design. The Ferguson System was a fundamental restructuring of how the farm tractor is built and operates, and that is why this newsletter still has a dedicated following. These tractors are still economical, selling for around \$2,000, but they are still an optimal choice for any

garden or small acre farmer. Their inexpensive price is perfect for new hobbyists which increases the network of N-Series users and aficionados.

Chapter II: The Mechanization Problem

The use of domesticated animals for agricultural needs sparked a revolution 8,000 years ago; the animal power revolution would remain exclusive until the nineteenth-century. Domesticated horses, mules and oxen were found on early American farms performing the intense labor required for successful farming. Farming is back-breaking work from start to finish: clearing the land, tilling the soil, seeding, cultivating crops, harvesting, and transporting the harvest to market. Each of these tasks requires a specialized tool commonly referred to as an implement. Implements are tools pulled behind the animal, such as a harrow, or disc. All farmers needed to plow the top soil, and create furrows for their seeds to grow in. Implements such as a cultivator or rake would utilize the horse's size and strength to be as efficient as possible. John Deere's steel plow and Cyrus McCormick's reaper revolutionized horse-drawn agriculture in the nineteenth century. Their ideas made life easier for American farmers, and ushered in a new era of productivity. In 1847 John Deere started producing his steel plows that provided a high level of cutting power through hard ground. The strength of the steel plow was crucial as most of the country had never been worked, meaning the soil was especially dense. Cyrus McCormick patented the first horse-drawn reaper to harvest grains in 1834, and six years later he started to manufacture them. Soon the reaper diffused across all American farms as a staple in horse-drawn mechanization. Deere and McCormick's inventions established the dominant design for horse-drawn agricultural mechanization.

The horse reached its highest level of efficiency during the nineteenth century with new and innovative implements. Almost at the same time implements were being perfected for the horse on the farm, the steam power movement started to gain traction

and brought the growth of industrialization to quiet pastures. Steam power was first introduced to the farm in the form of large external combustion engines that were wheeled around to provide power for threshers and other equipment. Think of these as portable generators that took a team of horses to move around. A number of companies started to manufacture movable threshing engines during the 1850s. As a young man, Henry Ford worked on threshing crews that took advantage of portable steam power. Before this time, steam power was reserved for locomotives, ships at sea, and massive stationary boilers in factories, but these had wheels and could go anywhere. Ford later recalled, "I remember that engine, as though I had seen it only yesterday, for it was the only vehicle other than horse drawn I had ever seen... It was that engine that took me into automotive transportation."¹¹ Despite their crude and short life on the farm, movable threshing engines provided much needed mechanical power on the prairie.

Farming by the turn of the twentieth-century was starting to change with the advent of steam, but very few of the nation's millions of farmers had switched over to steam. The American labor system depended upon agriculture as over thirty percent of the nation's labor force worked in agriculture.¹² Most farm work still needed to be done by hand, such as the harvesting of cotton and corn. In 1910 one-third of America's total population of 92.2 million lived and worked on farms. The American agricultural system was big business, but it was executed on small farms. Fifty percent of the smallest farms controlled only thirteen percent of farm acres, while the largest twenty percent of farms

¹¹ Stewart H. Holbrook, *Machines Of Plenty: Pioneering in American Agriculture*. (New York: The Macmillan Company, 1955), 90.

¹² William J. White III, "Unsung Hero: The Farm Tractor's Contribution to Twentieth-Century United States Economic Growth." (PhD diss., Ohio State University, 2000), 13.

controlled sixty percent of farm land.¹³ The average farmer in 1909 had a gross yearly income of \$1,236.¹⁴ However, farming is unlike any other profession because success or failure depends on the volatility of climate conditions. This uncertainty makes farming returns unpredictable. The wide range of economic conditions makes many farmers reluctant to make large capital investments. Any type of mechanization would require the farmer to entail risk, but a steam traction engine was roughly twice a farmer's gross income for the year. In many cases the farmer was far better off keeping their animal power instead of mechanizing to steam. Large-scale farmers however, had greater labor requirements and harvested large acreage fields to make these monsters of the prairie a wise investment.

Farm Life Is Introduced To Steam Power

Thomas Minnis introduced the steam traction engine, called the Minnis Crawler, in 1867, which was sent to the prairies of Iowa and demonstrated to future farmers at the Iowa State Agricultural College.¹⁵ At the turn of the twentieth-century, more than thirty companies manufactured over 5,000 steam traction engines a year. One of the largest North American companies producing steam tractors was the J.I. Case Corporation out of Racine, Wisconsin. Mechanization now emphasized machines capable of powering large thrashers and plowing multiple furrows at one time, which meant larger steam engines,

¹³ Gardner, 67.

¹⁴ Oswald W. Knauth, "Farmer's Income," *Income in the United States, Its Amount and Distribution 1909-1919, Volume II: Detailed Report*, edited by Wesley Clair Mitchell, 298 – 313. Washington D.C.: National Bureau of Economic Research, 1922.

¹⁵ Norbeck, 28.

making these machines mammoths.¹⁶ Plowing virgin soil for a seeded crop was the most energy intensive part of all farming operations. At the time, one expert estimated that plowing consumed sixty percent of the total energy required to produce a crop of wheat.¹⁷

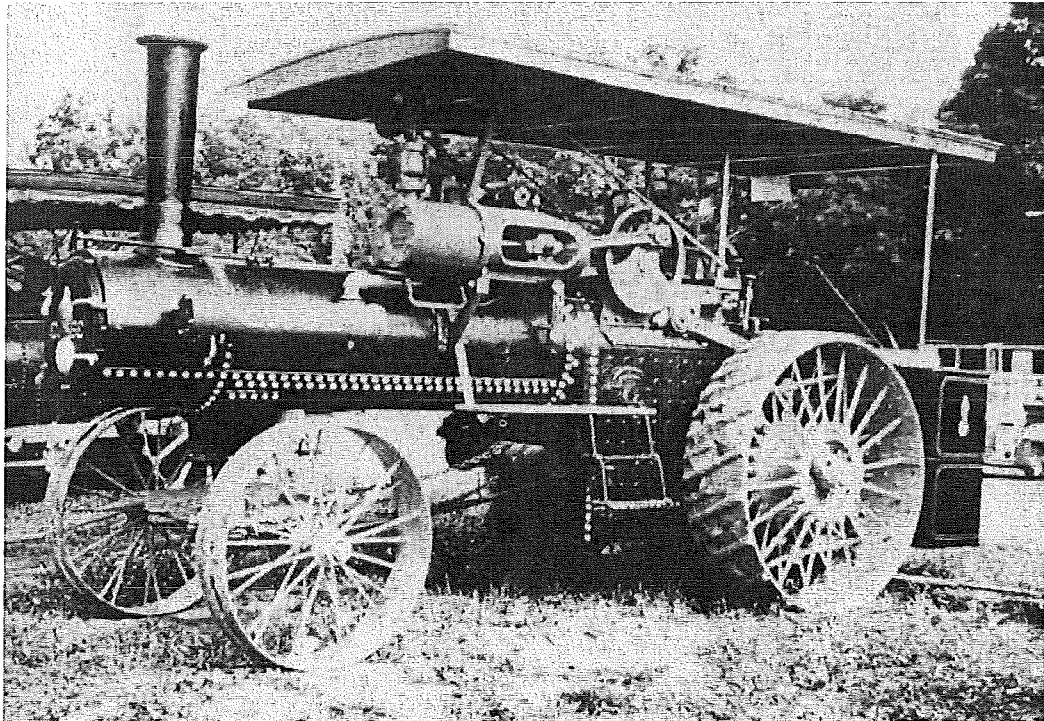


Figure 2 – Source: *Development of the Agricultural Tractor in the United States*, 97. 1907 45-H.P. Case steam traction engine, Mechanicsburg, PA

Many in agriculture knew that the steam traction engine could not displace the horse because so many farmers needed to keep their animals due to their versatility, something steam power lacked. Unlike horses, steam tractors had a difficult time working on uneven terrain and tight plots of land. If the soil conditions were anything other than dry the huge steel wheels would simply spin without traction in large mud pits. This made them impractical for farmers who lived in wet climates like Appalachia, the

¹⁶ John T. Schlebecker, *Whereby We Thrive: A History of American Farming, 1607-1972*, (Ames: Iowa State University Press, 1975), 199.

¹⁷ Bradford Brinton, "Some Suggestions for Tractor Plowman," *Threshermen's Review and Power Farming* (March 1914), 7.

Ozarks, and the Deep South. For this reason the majority of farmers who utilized the steam traction engine were those on the Great Plains and intermountain region.

Weighing over six tons on average and costing thousands of dollars, the steam traction engine was not the answer for small farms of less than 100 acres. The tractor was so large that it packed the soil on every pass and made it more difficult to plow properly. Its massive external combustion engine used large amounts of coal or wood as fuel, and the dangerous embers from the smokestack led to many prairie fires.¹⁸ Operators of steam equipment were skilled workers who understood the dangers and risks associated with steam technology. Most farmers were not skilled in the ways of using steam like a locomotive conductor or ship's engineer, and this caused problems in productivity. The new internal combustion engine developed in Europe was seen as the next step in advancing mechanized agriculture, but that does not mean the steam tractor was a failure for all farmers.

Agricultural co-operatives (co-ops) on the Great Plains would pool their money together and purchase a steam traction engine, or they would rent one for its sod-busting capability. Fertile land in Kansas already had vegetation growing on it, so this meant farmers needed an answer for the tough ground. The average farm size on the Great Plains was 300 acres. These farms dwarfed those operating back East, but they had a challenge finding manpower on the sparsely settled plains. This necessity drove the desire for an increase in affordable mechanization solutions. Big sod-busters may have been loud, dirty, and inefficient, but they shifted the burden off the farmer's animals. Douglas Hurt captures the effect steam power had on Great Plains' farmers, "Steam power came

¹⁸ Wayne D. Rasmussen, Ed. *Readings in the History of American Agriculture*. (Urbana: University of Illinois Press, 1960), 159.

into increasing use in the mid-1870s and by 1885 the traction steam engine was a success. Steam power enabled improved threshing efficiency, and considerable Dust Bowl land was broken with steam tractors and gang plows. Complete mechanization awaited the perfection of the gasoline tractor and with it the combine.”¹⁹

Steam power had an appeal to a small percentage in the farming community. Using the diffusion of innovations, this group of people would be categorized as the innovators. They only made up a small percentage of the total farming population at 2.5 percent, but their influence and enthusiasm was quite significant. Innovators are required to have two prerequisites according to Rogers, “Control of substantial financial resources is helpful in absorbing the possible losses from an unprofitable innovation.” And he continues by observing, “The ability to understand and apply complex technical knowledge is also needed. The innovator must be able to cope with a high degree of uncertainty about an innovation at the time he or she adopts.”²⁰ At the cutting edge of technology, these early mechanized farmers dreamed of all the new possibilities opened up to them. They knew that this was the first time in human history that farming could be accomplished using only mechanical power instead of the organic power of the past. This was a time when steam power and external combustion power was the only kind of mechanization possible. These innovators were well informed about how steam power pushed massive locomotives across the country and allowed ships to cross the Atlantic Ocean in record time. They were driven by prospects of large crop yields and increased productivity! The innovators are the ones who assumed the most amount of risk for their purchase. The good news for these farmers is that their investments paid off until a better

¹⁹ R. Douglas Hurt, *The Dust Bowl: An Agricultural and Social History*. (Chicago: Nelson-Hall, 1981), 23.

²⁰ Rogers, 282.

alternative presented itself. However, the average farmer had little use for a steam traction engine. The farmer has the power to influence the technology and vocalize needed changes. The reality was that the decline of steam power on the farm was because most farmers in the country were not willing to adopt an unproven technology when gasoline engines were seen as being the future of agricultural mechanization.

Seeing these early tractors on farms from 1900-1910 was uncommon, but they had a profound impact on the discipline of farming. Agriculture as a discipline had never seen such rapid changes since the Agricultural Revolution 8,000 years prior. Spreading across the countryside were machines that removed the organic component from planting and harvesting crops. There was a fundamental change in agriculture from that moment going forward. The farmer was now freed from the shackles of the farm and liberated by mechanization. An old farmer's wife recounted when their younger neighbors mechanized in the early 1920's: "Her husband's and my husband's parents gave their bodies to the making of that big farm. She and her husband do not have to do that. [Because of tractors and other machinery,] when they are forty, their steps will not drag and their shoulders round into a weary droop. The machines are saving them from that."²¹ Older generations of farmers felt that these machines were a threat to the integrity of farm life. They argued that farming was not supposed to be easy work, but instead very demanding. The notion that it took someone tough to be a farmer was a marker of pride for older generations. In contrast, the younger generations who would be classified as innovators and early adopters viewed mechanization as the emancipation of the farmer. The clash between these ideas in agricultural society was subtle, but quite noticeable when inspecting innovation adoption rates.

²¹ Williams, 131.

Gasoline Is The Future

The first gasoline tractor was built in 1892 by John Froelich of Iowa. Froelich simply took a gasoline engine made in Cincinnati and placed it on the rear-mounted traction frame. The tractor did hold up under adverse conditions, and performed basic farming tasks but was not manufactured for mass distribution. Froelich's tractor gained needed attention when *Farm Implement News* ran an article on the breakthrough. The article, compared steam and gasoline engines. "There is no danger of fire or explosion, no leaky flues, no boiler repairs, no water team."²² Those close to the tractor industry knew gasoline tractors were going to be the way of the future, but it would be three more decades before mass production was achieved.

By the end of 1917, America's first year in World War I, over 200 tractor manufacturers had produced 62,742 tractors. Eighty-five of those producers in the tractor market had started in 1917.²³ None of these manufacturers were mass producing these units, so the price for each tractor was still too high for the average farmer. Even with the high manufacturing costs, there was a substantial increase in demand for mechanization. During World War I many farmers saw their income rise as they were able to sell their goods at a premium to war-torn European nations. The tractor industry needed a boost in manufacturing in order to keep up with domestic demand and the stress of losing so many horses for the continuing war efforts.

²² Rasmussen, 161.

²³ Williams, 44.

The First Mass-Produced Farm Tractor

Henry Ford always had a fascination with producing farm tractors. Despite his enormous success, he always viewed himself as a man of the people coming from humble farming roots. He was an adamant supporter of mechanization and argued that “Man minus the machine is a slave, man plus the machine is a free man.”²⁴ This idea connected him to American farmers and was the driving force behind Ford’s goals to promote what he viewed as increased freedom. After the Model-T’s success he had the idea of converting it into an adaptable farm tractor. The idea was not a success, so the next idea was to create a light-weight utility tractor. Ford called it the “Fordson” and advertised for its release in 1915 at the price of \$200. Both of these figures overly optimistic; the tractor was not released until 1917 and ended up costing \$750. A major reason why the Fordson was pushed to be released in 1917 is because of increased diplomatic pressure from the United Kingdom, whose farmers had a severe shortage in horsepower.²⁵ Part of the Fordson manufacturing plan was to build a factory overseas in Cork in addition to their established plant with their Detroit area headquarters. By early 1918 Ford was producing eighty Fordson tractors every day. It only took two years for there to be an estimated 100,000 Fordsons on farms worldwide. That same year Ford executives claimed to have produced over half of the tractors in existence throughout America.²⁶ The astonishing success of the Fordson made it seem as if the Ford Motor Company would take control of farming mechanization the same way they did the automobile business. However, the Fordson was no Model-T. The Model-T was not the dominant design for the automobile,

²⁴ Reynold M. Wik, “Henry Ford’s Tractors and American Agriculture,” *Agricultural History*, Vol. 38, No. 2 (April 1964): 84.

²⁵ Williams, 48.

²⁶ Williams, 49.

but rather the process that made the Model-T was. Mass production became a technique that all industrial manufacturers needed to employ to be successful in the twentieth-century.

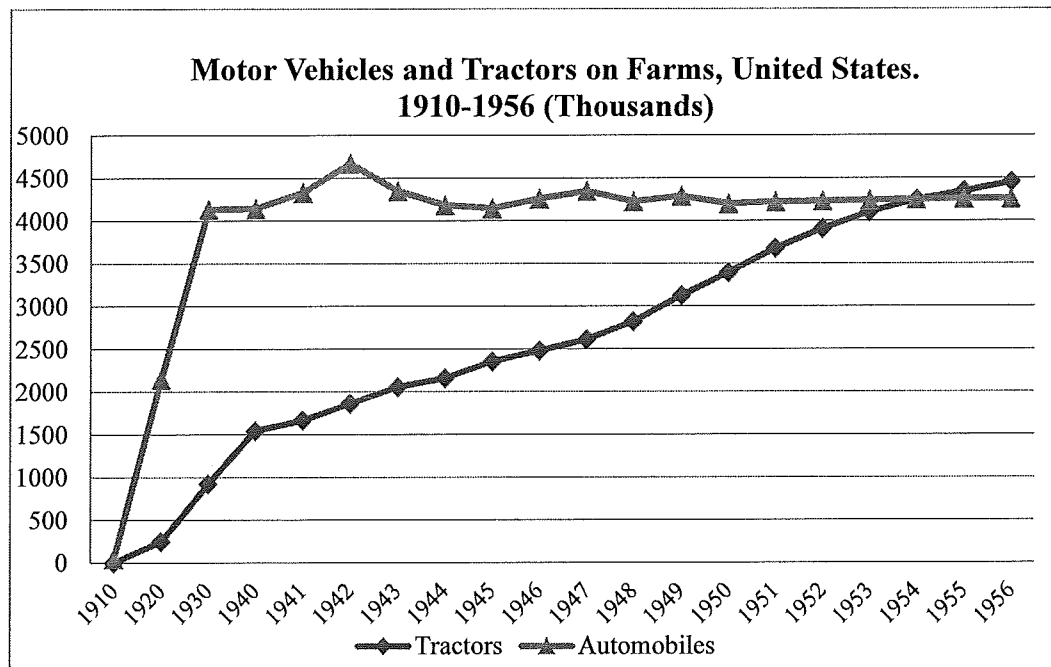


Figure 3 – Source: Data adapted from, *The Development of American Agriculture*, 198.

The numbers show that the automobile reached full market penetration in a short twenty-year period (fig. 3). There are many reasons why the automobile displaced the horse much quicker than the farming tractor did. The most important of these reasons was the technology for tractors was not at an appropriate level to meet all the demands of farmers. As already discussed, plowing the fields alone consumed sixty percent of the total energy needed to raise crops. The mechanical power and utility required to make the farm tractor a success were much greater than the automobile. The Model-T itself was not very impressive as car designs were concerned, but the manufacturing methods behind it had never been seen in human history. The Model-T was an adequate vehicle for the time and it met the people's requirements as a successor to the horse. The Ford

Motor Company saw the Fordson as the successor to the horse, but those who had the most influence, the farmers, disagreed with the notion.

The Fordson's diffusion had all the ingredients for success. American farmers received a boost from the demand for their crops during World War I and had more means to purchase Ford's tractor. Ford was able to match the tractor's demand with their expansive capital and mass production capabilities. The sky seemed the limit for mechanized agriculture, much like it did for automobiles. But there was one flaw that could not be overlooked, and that was the Fordson itself. The tractor had many engineering flaws that limited its effectiveness. Some of these engineering issues were created by Ford Motor Company's objective to keep the tractor as economical as possible.

An outcome of Ford's desire for an economy tractor can be seen in the tractor's ignition, as Ford used a flywheel magneto starting mechanism for the Fordson. This is a system where 10 magnets are clamped onto a flywheel, which rotates behind a stationary armature. The flywheel is cranked by the operator; the faster the motion the higher likelihood of there being a spark to engage engine ignition.²⁷ This technology is the precursor to the starter all tractors have now, but many small engines like lawnmowers and weed eaters still use the flywheel magneto rip cords. The flywheel magneto starter worked well on the Fordson in ideal starting conditions, that is, on a warm day and with new equipment. However, the Fordson was notorious for its tough starting as parts began to age. Older tractors and cold weather made starting the Fordson a challenge even for veteran operators. Ford would later add in the superior technology, the impulse magneto starter for its next tractor. The impulse magneto required a battery to spin the flywheel

²⁷ Williams, 296.

quicker and more efficiently than manual cranking. However, this method required a battery for operation and the Fordson was to be as economical as possible. Ford would later learn from these mistakes and always produce the most advanced technology on their tractors as the mechanization solution changed from quantity to quality.

The Fordson Flip

The Fordson's most damning engineering flaw was its tendency in some scenarios to rear up on its back, lifting the front, and flipping the tractor over backwards. These incidents were dangerous and often led to the operator being injured or killed. Determining the number of Fordson fatalities is difficult. The United States Department of Agriculture did not track statistics on farming related deaths in the 1920s, but tractor dealers would frequently take recordings. A 1920 August issue of *Pripp's Weekly* reported that there had been 136 injuries and deaths reported from the Fordson.²⁸ Ford Motor Company never openly admitted that the tractor had a tendency to cause a fatal flip. It did, however, admit a certain level of guilt by introducing solutions that treated the symptoms of the flip but not the root problem. By 1924 Ford started offering sturdy rear fenders as an optional product. "The fenders were low slung and heavy, also serving as guards against the tractor rearing up. If the front end rose too high, the fenders raised the rear wheels off the ground. This action allowed the operator enough time to release the clutch."²⁹ This solution was effective and helped farmers lower incident rates on the tractor. Farmers found solutions to these problems by using equipment and tools found in their barns. Some would add a tool box in the front-end and weigh it down with heavy

²⁸ James Dawson, "The Fordson Flip," *N-News Magazine*, Summer 2003.

²⁹ Dawson, "The Fordson Flip."

tools. Others would chain whatever they were pulling to the front axle and pull in reverse, but this resulted in lost traction to the rear wheels.

The root cause of the Fordson flip was the absence of depth control for implements. It is this flipping issue that started Harry Ferguson on a quest to treat the cause of the flip, not the symptoms. He viewed the problem as a matter of depth control, the operator's ability to regulate the depth of an implement. Most implements were designed with wheels that rolled independently behind a team of horses or a tractor and hooked to a single-point hitch. So if a plow hits a tree root or rock, an obstruction that forces the plow to a halt, the horses would stop because they were unable to move the plow forward. However on a tractor, when the plow hits a snag the tractor will continue to drive forward. The energy from the tractor is now transferred to the rear axle as the centripetal force wraps around it and forces the front of the tractor to rear up, dumping the tractor upside-down. The Fordson was notorious for this flip, but it also occurred on many other tractor models during this era of tractor engineering. It was this idea that led Ferguson to his groundbreaking idea of marrying the tractor to the implement. Farmers and engineers at the time saw the tractor as a bigger horse, but Ferguson saw this line of thinking as a fallacy. The single-point hitch focused the energy on one spot which had a fatal design that put thousands of farmers at serious risk. The Fordson's problems acted as the catalyst for Henry Ferguson to pursue a lifelong mission to make mechanized agriculture safe and accessible to all farmers.

Despite its many shortcomings, there were those who greatly benefited from the Fordson. The Fordson was the first mass-produced tractor and by 1928, the year North American production concluded, Ford had produced over 700,000 Fordsons in the United

States, and 6,000 in Cork.³⁰ This was easily the bestselling tractor of all time and tapped into the demand for small utility tractors. However, by 1928 Ford Motor Company was losing money on every tractor sold, and was locked into a fierce battle with the International Harvester Corporation. Ford Motor Company removed itself from the North American tractor market in 1928. This was a tough loss for Henry Ford to take, but he now had to focus on the next generation of automobiles as the Model-T had become outdated. It would be another eleven years before Ford would be willing to enter the tractor market again.

A Worthy Competitor Enters The Market

The grandson of the great inventor, also named Cyrus McCormick, was the CEO of International Harvester (IH) and looked to compete with Ford in the tractor market. IH was a farming implement company that turned its attention to increasing production of their light utility tractor division to compete with the Fordson. International Harvester had been making quality farming equipment for decades and had a strong brand loyalty among farmers. In competing with Ford they were the clear underdog in capital and production capabilities. The company had two tractors they would market to compete with Ford, the McCormick-Deering 15-30 released in 1921 and the McCormick-Deering 10-20 in 1923. These tractors were similar to the design of the Fordson in many ways. The single-point hitch that caused so many negative qualities on the Fordson was still present and hampered the overall dependability and reliability of these two McCormick-Deering tractors. None-the-less, International Harvesters' machines were the best mass-produced tractors on the market. The 10-20 and 15-30 were quite similar in design, and they had an innovative edge that gave them a technological advantage over any Ford

³⁰ Wik, "Henry Ford's Tractors and American Agriculture," 84.

tractor in production. These were the first tractors engineered with a separate power source that could supply power to an implement. They called this the power take-off (PTO).

The power take-off installed on the McCormick-Deering 10-20 and 15-30 provided an auxiliary power source located on the back of the tractor. Implements could now connect to a spinning shaft off the transmission on the rear of the tractor. An implement like a mower deck could be powered by connecting to the tractor's PTO. This allowed for the possibility to run complex implements that require an alternative power source, like a thrasher or harvester, with greater efficiency. "In earlier days when horses provided almost all farm power, implements such as binders or mowers drew their power from a bullwheel, a large wheel with cleats or lugs that was forced to turn as the implement ran over the ground. It was an awkward system at best."³¹ In other words, if the farmer bought a Fordson, they would still need to use this cumbersome system to supply energy to their complex implements. The technological importance of this innovation quickly became apparent almost immediately: "An engineer who reported on the new McCormick-Deering 15-30 for *Automotive Industries* praised the tractor, especially the novel power transmission feature. Farmers were equally impressed. The PTO soon became standard equipment on all tractors."³²

Edward A. Johnston was director for IH's experimental division, which was responsible for the design of the PTO. Johnston's department was well staffed with one

³¹ Williams, 62.

³² Williams, 64.

of the largest research and development teams in the industry.³³ The investments paid off as the introduction of the PTO was a huge step in the development of the farm tractor. The PTO and Ferguson System were developed independently of one another. Each innovation was a solution to separate problems and worked together well once used in tandem. The case could be made that the PTO was the most important innovation in agricultural mechanization, but the PTO without the Ferguson System is greatly limited. Although the PTO is what truly powers an implement, it is the hydraulics and unity between the implement and tractor that made the three-point hitch system so revolutionary. The PTO's impact on the tractor industry was demonstrated within its first year on the market as it was the muscle behind IH's market victory over Ford Motor.

Farmers as a whole have a tendency to be fiercely committed to their loyalties of a brand or company. International Harvester gained this loyalty from the McCormick reaper and a tradition of manufacturing farming implements. At the same time, International Harvester was run by farmers and had an American farming mentality for decades. Part of the argument as to why Ford failed to connect with farmers was because they were an automobile manufacturer and not a farming business. Even more proof of this mindset was highlighted when Ford refused to manufacture implements to complement the Fordson.³⁴ Not only was this a poor business decision, but it also gave a message to farmers that their problems were not being listened to. International Harvester explored this idea of brand loyalty and why tools connect with farmers. They listened when farmers said they needed an alternative to a bullwheel to generate additional energy, and this prompted the company to innovate mechanization. Even though

³³ Clarke, 40.

³⁴ Williams, 61.

International Harvester forced Ford to take a hiatus from the tractor business, the tractor was still not a viable means to replace animal power.

The importance of IH's victory over Ford Motor cannot be overstated. The company risked its very existence in order to compete with Ford's price cutting and unparalleled tractor production capabilities. International Harvester took its victory and continued to have great success controlling the tractor market until the 1970s. However, the real victor in this corporate feud was the American farmer. Farmers have great influence over the market, as they are the ultimate arbiters of every new innovation. IH invented the PTO for their tractors and farmers were enamored by this new external power source in the field. The farmers are the ones who push for innovations, and they will choose the brands that will best fit their farming needs. IH's victory demonstrated to the industry that in order to be successful, engineers and designers would need to listen to the farmer and their need for mechanization.

Not Yet Capable Of Displacing The Horse

The goal of the Ford Motor Company was to remove the horse from the field, much as it had removed horses from the roads. The Fordson was planned and marketed to accomplish this task but ultimately did not meet the demands from all farmers. International Harvester had the same goals in mind as Ford, but there was still a technological ceiling. Even early steam traction engine manufacturers thought their tractors would be the solution the same way the train was for mass transportation. Those who purchased a Fordson, McCormick-Deering or steam engine would still need to keep a majority of their animal power in tact because of their proven dependability. Horses and mules could do all the work on the farm that needed to be done. The average farmer

could not take the risk on investing in subpar technology, and the tractor industry was struggling to innovate. The July 1920 edition of the *Journal of Farm Economics* made the case for why farmers should hold on to their horses:

The displacement of the horse to any full extent depends upon the adaptability of the tractor to all kinds of farm work. The horse is a flexible source of farm power, useful singly or in teams of two or more, and dependable under almost all conditions that the farm demands. The tractor, while its performance has been almost unbelievable, has not proved its superiority to the horse as an all-around farm power. But, as necessity is the mother of invention, if there is an economic justification we may expect rapid strides in this direction.³⁵

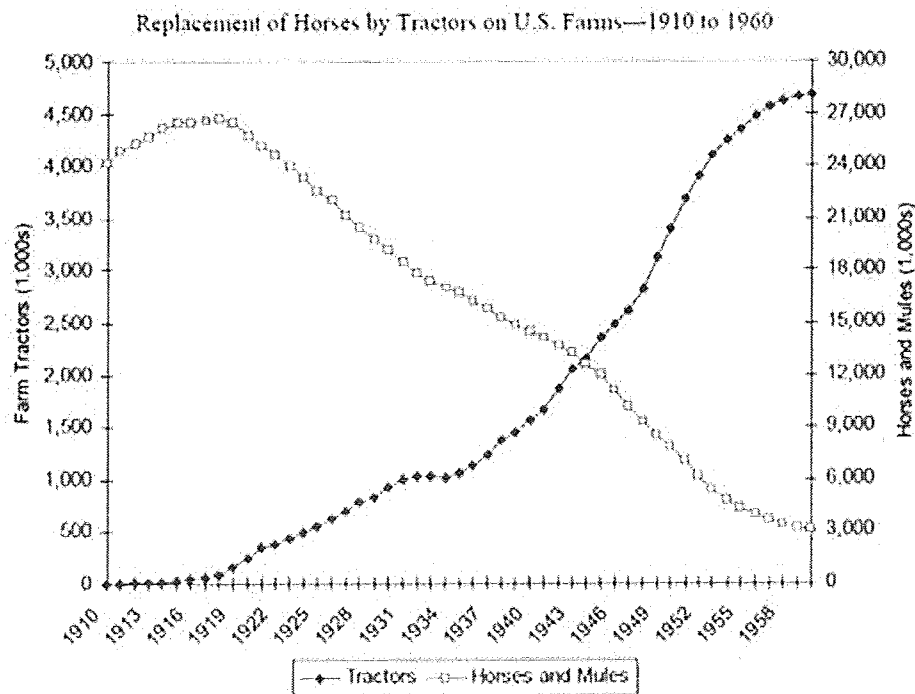


Figure 4 – Source: *American Agriculture in the Twentieth Century*, 12.

The number of horses on farms peaked in 1920, before starting a downward trend past the mid-twentieth century. The reason for the peak in 1920 is because the horse is quickly being displaced from cities and towns. The horse would eventually be displaced

³⁵ D. S. Fox, "The Horse and the Farm Tractor," *Journal of Farm Economics*, Vol. 2, No. 3 (1920): 171.

on farms but not for another half-century past the full displacement in cities.³⁶ That flooded the market with available animal power, and many would expand their animal power. From 1900-1910 the tractor was not effective enough to displace animal power, and that worried many farmers. A question millions of Americans asked was, “How can I justify buying a very expensive tractor while I would still need to keep my animal power with their dedicated food acres?” In some cases farmers would keep their horses for a few seasons after purchasing a tractor because of their hesitation about embracing full mechanization. The most labor-intensive part of farming was plowing, so farmers would routinely keep two extra horses for this difficult task.

In 1917 Harry Ferguson had just finished a tour of the Irish countryside. His goal for this trip was to listen to the farmers and their problems with mechanization. After his trip he came to the groundbreaking discovery that many of the mechanization problems of the early twentieth century were linked back to one critical design flaw of the time, the single-point hitch. In Fraser’s biography on Harry Ferguson he explains the mechanization problem:

The effects of the single-point hitch on the tractor were disastrous, especially when an obstruction such as a tree root or rock was hit by the plough share. Firstly, whereas a horse team would immediately have come to a halt when the obstruction was hit, the situation which a tractor was quite different. For a tractor in motion has much stored energy in its rotating fly-wheel, and the heavier the fly-wheel the greater the stored energy. Therefore, when one of the monstrous tractors of those times was brought to a sudden halt (because one of the plough shares had struck against a rock or root) the stored energy still attempted to drive the tractor forward. But forward it could no longer go, anchored as it was by the plough fouled against an obstruction, and the only way the energy could be absorbed was by winding the tractor around its own back axle so that the front reared into the air.³⁷

³⁶ Clay McShane and Joel A. Tarr *The Horse in the City: Living Machines in the Nineteenth Century*, Johns Hopkins University Press: Baltimore, 2007.

³⁷ Fraser, 38-39.

The problem with the single-point hitch is also called longitudinal instability, the technical term for what farmers called the “Fordson Flip”. For years the tractor business tried to solve this problem. As one observer explained, “A flip-over can happen with any lightweight, short wheelbase, rear wheel drive tractor like the Fordson and any number of other tractors then and now.”³⁸ A lightweight tractor excludes any steam traction engine or large crawler of the time. The single-point hitch also identified another problem farmers had in this era, draft control. Draft control is the farmer’s ability to regulate the depth of their implement. The depth was regulated by the wheels on all implements of the time. This could be troublesome for farmers who were plowing soil with many rocks and roots to snag the plow. The draft control would allow the farmer to regulate the depth to avoid certain obstructions.

Ferguson was the first to invent and utilize implements that were wheel-less. An implement without wheels could now have its depth controlled by the farmer, and Ferguson worked to invent a system that could give the farmer this power. The single-point hitch greatly reduced the operator’s ability to control the work being done. British farmers recounted life before the three-point hitch: “There were tractors available, like the Fordson, but they were large and unwieldy. Dragging rather than controlling the implements, they were only useful for plowing large fields, on smaller farms the horse remained the only option.”³⁹ Even though Ferguson knew the eventual answer to the

³⁸ Dawson, “The Fordson Flip.”

³⁹ Jim Broadbent, *Perpetual Motion: The Ferguson TE 20 Tractor*, BBC Bristol, UK, Season 2, Episode 5, 1994, 04:25-04:30. <https://youtu.be/4qhi-V-Chbs>

mechanization problem in 1917, it took another decade until he could advance his ideas into production.

The Fordson and McCormick-Deering 10-20 and 15-30 were able to diffuse the farm tractor further into American life as the early adopters mechanized. Early adopters are described by Rogers in the *Diffusion of Innovations*, “Potential adopters look to early adopters for advice and information about innovation. The early adopter is considered by many to be “the individual to check with” before adopting a new idea.”⁴⁰ The Fordson was not perfect, but it was capable of completing enough farming tasks to make it economically viable for large farmers. Those farmers who did adopt the early generation of gasoline tractors were generally better off than those who did not, however problems crippled their eventual long-term success. Those early adopters who purchased a Fordson had mixed opinions of the tractor, and that is reflected in the numbers as Ford was forced to abandon North American production. As described, the early adopters are the ones who the majority of farmers seek advice from. When many of these farmers invested in a Fordson they were disappointed, and they relayed this disappointment to all those farmers who sought the early adopter’s advice. International Harvester would also tap into the innovative spirit of many early adopters by installing the PTO on the McCormick-Deering. The PTO offered low risk and high upside potentials within increased implement capabilities. That made the investment attractive for many farmers, and would diffuse to quickly become the dominant design for farm tractors. In less than a decade the PTO was an industry standard that challenged designers to create new implements that could take advantage of its incredible power.

⁴⁰ Rogers, 283.

Although the mechanization problem did not find its answer during the 1920s, other important advancements were made to improve the farm tractor: Towering steam tractors started to favor light utility tractors, gasoline displaced coal and kerosene as the preferred fuel, and the introduction of the PTO eradicated the bullwheel for good. Innovation was present in the farming industry and there were changes being made each year to help increase productivity. Improvements took place, but the versatility of traditional animal power could not be matched by current technology. The PTO would increase the favorability of the tractor over the horse but not until the PTO's fullest capabilities were explored during the next twenty years. Animal power would be the most popular source of power on farms because the tractor could not surpass the productivity of animal power. This inability to surpass the productivity of animal power was the heart of the mechanization problem.

Chapter III: The Ferguson Solution

By 1930 the United States of America and other major industrial nations entered a period of dramatic economic decline. The Great Depression put tremendous stress on American farmers, especially those on the drought stricken plains. The poor economic conditions limited the opportunities for innovations, which led to no notable advancements during this time. Tractor companies took great hesitation in research efforts and focused on consolidating resources to stay in business even if this meant producing tractors innovated in the 1920s. International Harvester would continue to lead the way with at the time, the most economically viable innovation, the Power Take Off. Other tractor manufacturers took note and would follow as this design quickly became an industry standard. The Ford Motor Company declined to adopt the PTO proceeding to halt domestic manufacturing of the tractor, with the final Fordson rolling off the line in 1928.⁴¹ Ford chose to not adopt the PTO in efforts to keep prices low, but the decision was costly as it forced Ford out of the North American market. This decade was yet to produce a viable option to succeeding the horse on American farms, and even saw a slight increase in the use of animal power for those facing the most hardship. Small agricultural communities took to the ballot box in a landmark election, prompting their government to provide much needed financial assistance. Franklin Roosevelt was elected by the American people in 1933 to lead the country out of the depression, and much of his legislation was aimed at helping struggling rural agricultural communities.

President Roosevelt signed the American Agricultural Act (AAA) during his famed first one hundred days in office. The AAA was established under the United States

⁴¹ Allan Nevins and Frank Ernest Hill. *Ford: Decline and Rebirth 1933-1962*. (New York: Charles Scribner's Sons, 1962), 124.

Department of Agriculture (USDA) and established government subsidies on seven popular crops. These seven crops had the ability to control the prices of other commodities, and had to be processed before consumption. This allowed for easy regulation of distribution and production.⁴² The AAA aimed to reduce economic uncertainty for farmers and tried to establish a base payment each season. The ability for farmers to gain a reliable source of income helped in three ways. First, payments for commodity were paid in cash by the government. Secondly, commodity prices would rise to tariff levels as surpluses reduced.⁴³ And finally the AAA would help improve the life of farmers as more income was achievable, which would help allow for investment into mechanization. This government program would help the farmer through this difficult decade, but the short-term assistance also forced the farmer to become increasingly dependent.⁴⁴ The Roosevelt Administration was able to create the Soil Conservation Service (SCS), also within the USDA. The SCS was started out of necessity to aid with the Dust Bowl, and to control the lands that were currently being blown away. Untilled land would be susceptible to long periods of dry conditions, and harsh prairie winds would strip the soil of nutrient-rich minerals. The SCS worked with state agriculture to promote conservation, such as in Kansas where they tried to plow as much land as possible. Farmers were given federal relief funds to help pay for fuel, hay for animals to help promote plowing, and to encourage them to planting more acres for conservation.⁴⁵

⁴² Hurt, *Problems of Plenty*, 69.

⁴³ Hurt, *Problems of Plenty*, 71.

⁴⁴ The AAA was ruled unconstitutional by the Supreme Court in 1936. The United States V. Butler was ruled in favor of Butler as the AAA violated the 10th amendment as it forced unconstitutional taxes upon citizens. The AAA was rewritten to accomplish similar goals and complies with the constitution.

⁴⁵ Hurt, *Dust Bowl*, 67-70.

The dry conditions on the Great Plains were combated by plowing as much soil as possible in hopes of reducing the amount of dirt being blown by the constant prairie winds. Ultimately the plan yielded decent successes, but it would have worked better if more farmers had tractors before the 1930s. This was in large part because the tractor was still not viable or economical for small farmers on the Great Plains. The thirsty plains were in desperate need of a mechanized solution.

A large majority of American farmers still relied upon their animal power to produce a living through the horrific Dust Bowl. In 1930 farmers reported low numbers of mechanization, with only 14.5 percent owning tractors.⁴⁶ The failure of banks did not help the farmer's ability to secure a loan for their farm. In most cases small farmers who mechanized during the depression would be doing themselves a great disservice. At the time horses were equally effective, if not more effective than most available farm tractors. Farmers were pinched by the economic conditions and had little disposable income for costly depreciating assets. When the government stepped in and stabilized farmers' incomes it provided marginal relief for some, but many would stay in dire financial conditions throughout the decade.

Mechanization for many was too risky of an investment, especially because the farmer needed to keep some animal power. In 1994, Sally H. Clark published a noteworthy study comparing the costs and benefits of animals and tractors in 1929. Through the study she establishes that the farmer was able to sell two horses for every

⁴⁶ Ladd Haystead and Gilbert C. Fite. *The Agricultural Regions of the United States*. (Normon, OK: University of Oklahoma Press, 1955), 94, 116, 154, 188. The 1930 average of farmers reporting tractors in the largest four agricultural regions. Wheat Belt: MT (36%), ND (43.8%), SD (37.2%), NE (29.3%), KS (35.6%), OK (11.4%), TX (6.4%). Corn-Soy Belt: OH (23.1%), IN (22.3%), IL (30.8%), IA (29.4%), MO (9.2%). Middle South: VA (5.4%), WV (3.2%), NC (3.9%) KY (2.8%) TN (2.7). Deep South: SC (2.0%), GA (2.1%), FL (7.4%), AL (1.7%), MS (1.5%), LA (2.4%), AR (1.8%).

farm tractor purchased. The study compared two groups of farmers located in the Midwestern Corn Belt: those farmers who had six horses and those who had four horses with a tractor. Clark compared both approaches using a calculation between fixed and variable farming expenses.⁴⁷ Fixed costs for the farmer would be equipment, depreciation and interest on machinery, tractor fuel, and feed for animal power. Examples of variable costs on the farm would be machine repairs, cost of labor per-acre, and the going rate of agricultural labor per hour for the operator's time. The finding established 100 acres as the threshold between tractors being more viable and horses being more viable. This study affirmed the largest farmers stood to benefit the most from mechanization in 1929. The country's largest farms were spread through the Midwest across the plains into large acre homestead land. Older farms in the Cotton Belt were on average much smaller and had fewer opportunities to increase arable land. Clark's findings help explain why Midwestern farmers, who tended to have larger holdings, mechanized much quicker than their Southern counterparts.

Following Ford's departure from the tractor market two years prior, the 1930s were controlled by one company, The International Harvester Corporation. The implement company was able to challenge the much-larger Ford Motor Company with innovativeness and by listening to the needs of the individual farmer. The PTO, which had first appeared on early McCormick-Deering models, was now a common feature of all tractor models. From 1910 to 1925, IH controlled eighteen percent market share compared to Ford's whopping forty-five percent. But during the 1930s Ford took a leave of absence from the tractor business, enabling while IH's market share to soar to 44.3

⁴⁷ Sally H. Clark, *Regulation and the Revolution in United States Farm Productivity*. (New York : Cambridge University Press, 1994), 91. The threshold calculation is $VC0/\text{acre} + FC0/X \text{ acre} + FC1/X \text{ acre}$.

percent; Allis-Chalmers commanded second with 12.6 percent.⁴⁸ However, the market plummeted with the onset of the Great Depression and Ford's exit; production of tractors dropped from two million units in 1929 to a ten year low of one million tractors in 1931.⁴⁹ It would take the market six years to rebound to the 1929 production levels, a reflection of the broader economic collapse.

During the Great Depression IH would continue to design and develop the most advanced tractors in the world. Their introduction of the tricycle based Farmall row-crop tractor was the start of a powerful agricultural brand. The row-crop clearance was an important development for farmers who planted row crops like corn or soy beans because the tractor would clear the plants and fit between the rows without crushing the plant. The tractor had four wheels but the front two were close together, giving the tractor a tricycle base. The Farmall was an important tractor because it sold well, and farmers adored its cultivating abilities. The Farmall had a large underbelly where a cultivator attached and combined with the tractor for weed control. This idea of combining tractor and implement produced positive results and allowed the tractor to maintain power and accuracy throughout cultivation. The tractor could squeeze between rows and cultivate soil with an implement. Some of those who bought a Fordson were now replacing it with the more productive Farmall. Throughout most of the decade however, farmers had lost property value and were hit by horrible droughts, which hampered their ability to generate capital. There were some farmers, however, who could sell off their animal power and mechanize with the Farmall because it met all their farming requirements. An attachable cultivator on the underbelly of the tractor reduced the labor required to remove

⁴⁸ White, 100.

⁴⁹ White, 102.

unwanted vegetation from the field. The Farmall was the best row-crop tractor for cultivating in a pre-herbicide era. The Farmall still utilized the single-point hitch to connect to implements and it lacked depth control. Despite that, Farmalls were built for a specific farming need and they worked at a high level in the field for those farmers. The tractor worked wonders for those farmers who needed row crop design. It sold well in corn and soy rich regions throughout the Midwest. By 1940 an average of 39.2 percent of farms reported owning tractors in states in the corn-soy belt.⁵⁰ The Farmall was a huge advancement for farmers who could maximize its potential, but its tricycle design and single-point hitch was not the answer for an all-purpose tractor.

A new approach to mechanized agriculture was needed for the tractor to achieve full market penetration. The Fordson and Farmall were not able to penetrate the early and late majority of farmers by 1930. The Farmall worked well for row-crop farmers, but still most farmers who could utilize the tractor could not afford one. The tractors that could displace the horse needed to be economical and highly productive. It would need to embody utilitarian principals that would benefit the most number of farmers. The answer to the mechanization problem would be found in the ideas of an Irishman, Henry Ferguson.

For King and Country

Henry “Harry” Ferguson was born into a hardworking Irish farming family in 1889. Ferguson at an early age was described as a tinkerer and loved to work with and understand machines. He was an avid fan of the new sport of race-car driving. As his interest grew in the sport he soon started to enter organized racing. In 1912 he competed

⁵⁰ Haystead and Fite, 154. Corn-Soy Belt: OH (35.6%), IN (37.1%), IL (51.8%), IA (55.3%), MO (16.4%).

in the French Grand Prix, in which some reporters say he topped out at a speed of ninety m.p.h.⁵¹ The finale of the race was a spectacular crash involving Ferguson and others, but luckily there were no critical injuries. The danger of race car driving almost equaled the risk of another hobby of Ferguson's. His love for speed expanded into the new transportation method of flying. On the tumultuous final day of December in 1909 Ferguson took to the skies to become the first in flight in Ireland. Ferguson was flying an airplane he had built, which marked the first time a Briton flew an airplane that was built by the pilot.⁵² In 1913 Harry Ferguson married Maureen Watson, and it was this moment that forced Ferguson to rethink his risky business of flying and auto racing. Harry had knowledge of farming from his family's farm, and had a keen interest in early mechanization efforts. As a young man he started his own business, and found success in the market selling plows. His new enterprise in implements would lead to his true calling, popularizing mechanized agriculture.

The United Kingdom had a dire need for mechanization ever since the start of the Great War. The manpower and horsepower of the small islands were pushed to their limits during the war. At the height of Germany's U-Boat assault, England was left with only a two-week supply of food until support arrived. In the final year of the war England imported Fordson tractors to help ease the shortfall in manpower. Henry Ford also started construction of a Fordson manufacturing facility in Cork, Ireland. The factory would not start production until a year after the war's conclusion. Ireland quickly needed an answer to the low productivity levels heading into the spring of 1917. The Irish Board of

⁵¹ Fraser, 27.

⁵² Fraser, 18.

Agriculture sought an answer in young Harry Ferguson, who was brought in to improve the efficiency of Irish farmer's tractors before plowing season.⁵³ Ferguson started his job in 1917 with a tour of farms across the Irish countryside. The goal of the trip was to see how mechanization was working for the Irish farmer. Ferguson and other officials went farm to farm listening to the farmers and their problems. The leading complaint from farmers was that the tractor itself was just too heavy to be effective. The weight affected the soil because it compacted the ground and made plowing and blading the field much more difficult. Ferguson's impression from the study was that the plows and tractors of the time were far too complex and cumbersome. It was this trip that led to Ferguson's conclusion that the root of the problem was the single-point hitch, as it led to instability, uncontrollable depth regulation and limited terrain versatility.

Ferguson's first idea to increase productivity throughout Ireland was to invent a more efficient plow. Ferguson and his team of engineers started to manufacture and sell a plow for a tractor called the Eros. The Eros was a conversion kit for the Model-T that made it capable of farming duties. There was a shortage of tractors in Ireland but an abundance of Model-T's, and this meant good sales for the Eros conversion kit. Ferguson's first plow was attached to the underbelly in front of the rear axle on the Eros. This allowed the tractor to pull in the line of draft and keep all four wheels on the ground. Ferguson's idea was groundbreaking, as one reporter commented. "A new wheel-less plow for which great claims are put forward has made its appearance in Ireland."⁵⁴ His first plow was a success and helped hundreds of Irish farmers maximize production. Sales

⁵³ Fraser, 35.

⁵⁴ Fraser, 44.

started strong but declined as the Eros would give way to the Fordson as the dominant tractor for the United Kingdom. However, Ferguson had discovered how to fix the problem of longitudinal instability on tractors, but only tested it on the failed Eros conversion. Now it was time to take credit for his idea and make it practical for manufacturing.

The Mechanization Problem's Solution

The solution to the disastrous effects of the single-point hitch was a system whose three-points formed a triangle. Instead of a draw bar, there would be two lower arms and a large adjustable middle armature. This would connect tractor and implement and establish consistent depth control for the first time. Harry Ferguson filed his draft control patent in both the United States and England in 1925:

Without a doubt this patent, which was entitled 'Apparatus for Coupling Agricultural Implements to Tractors and Automatically Regulating the Depth of Work' can be considered the master patent of the Ferguson System; and draft control is now so commonplace in farm mechanization that one can hardly imagine a time in which it had not been thought of.⁵⁵

The patent outlines a system for connecting implements to tractors to achieve draft control. For his patent he used a duplex hitch, which means a connector on the top and one on the bottom in a linear pattern. The duplex hitch idea later evolved into the three-point hitch with two armatures on the bottom sides and a single control point on top forming a triangle pattern. This was Ferguson's master patent, a patent that would bring the farm tractor to its dominant design once it could be manufactured correctly. For now, Ferguson simply had his ideas down on paper and into patent offices. Now that Ferguson had solved the crux of the mechanization problem, his next task was to find a willing manufacturer. He realized that the Ferguson System could not be simply applied to just a

⁵⁵ Fraser, 68.

plow or implement, but it had to be part of a complete makeover of the coupling mechanism and rear hydraulics.

Ferguson pitched his new idea to anyone within the tractor business willing to meet with him. Throughout the 1930s Ferguson pitched the new ideas to automobile manufactures and agricultural implement companies alike. During his pitch Ferguson would bring a model with him to help demonstrate how his design could make tractors safer. It showed off how the three-point hitch could fix issues of longitudinal instability, while the single-point hitch exacerbated the deadly problem. The ability to persuasively promote ideas was one of Ferguson's greatest gifts throughout life. He was now in possession of a superior idea and it was only a matter of finding the best manufacturer to produce his Ferguson System. His first sales pitch with a North American tractor manufacturer was in 1928 with the Allis-Chalmers Corporation. They rejected the Ferguson System because the technology to produce it did not exist. This is a fair statement to make, because Ferguson was an inventor, not an engineer. So this project would require a large amount of research and development before it could become profitable for Allis-Chalmers. The Rover Car Company showed some interest entering the tractor market and looked to the Ferguson System as a technological advantage. However Ferguson was so displeased with their design of the tractor that he could never imagine his system working with the blueprint. Another suitor listened to Ferguson's ideas, The Ransome Rapier Company, but the problem quickly became apparent that the company was critically underfunded and the new idea still needed to be engineered.⁵⁶

⁵⁶ Fraser, 78.

It started to become quite clear to Ferguson and his staff that there would be no opportunities to put the Ferguson System into mass production yet. So Ferguson and his close team of William Sands and John Charles started to build a prototype tractor. Sands first started working with Ferguson in the 1910s as a brilliant young engineer and designer. He was the man who took the raw ideas of Ferguson's and translated them into functional products. Charles was Ferguson's right-hand-man and would often go to meetings that Ferguson could not attend. The three men worked together to design a tractor largely using David Brown Manufacturing gears, transmission, and steering parts coupled with an American Hercules 18 horsepower engine. The tractor had the three-point hitch and the implements were controlled hydraulically using the Ferguson System. David Brown worked out an agreement with Ferguson and supplied limited manufacturing capabilities for their new tractor.

The Ferguson-Brown tractor was ready for sale in 1936 and sold for around \$1,200, about \$500 more than the Fordson.⁵⁷ The higher cost reflected the small-scale manufacturing expenses compared to the Fordson's mass production. This was a challenge for the Ferguson team to fight through. Many farmers in Northern Ireland were skeptical of the tractor and hardly had the funding to purchase a new Fordson. But it was exactly those farmers that Ferguson targeted for sales. He wrote articles and letters declaring, "The smaller the farm the less it can afford to keep a pair of horses, even if farmers are as loth to part with them as the army were with their spectacular cavalry regiments."⁵⁸ His assessment was that Northern Ireland needed to part with the horse just

⁵⁷ Fraser, 90.

⁵⁸ Fraser, 92-93.

as many American farmers had in the 1930s. The smaller farmer needed to sell as many crops as possible to turn profits, and feeding animal power took up large amounts of cropland. In 1939 there were forty-five million acres of land in the United States devoted exclusively to feeding animal power.⁵⁹ This was not a large percentage given the nation's vast land area, but the smaller acre farmer was affected more as land for feed consumed higher percentage of potential crop yields. Ferguson used this as a selling point to increase productivity and efficiency on the farm. It was still a goal of Ferguson's to market his system to a company that had the ability to mass produce his tractor for less overhead, which he saw as the only way to market it to the small farmer. Tractors on the market were still well over \$1,000 and this was beyond the average farmer's financial capabilities. A falling out took place between David Brown and Ferguson halting production of the tractor, but Ferguson now had a tractor that could show off his Ferguson System in action. In 1938 Ferguson's former partner in building plows, Eber Sherman, had a close business relationship with Henry Ford and arranged for a plowing demonstration of the Ferguson System in Dearborn, Michigan in the company of Mr. Ford.⁶⁰

The Handshake Agreement

Henry Ford had left the North American tractor market in 1928 when the infamous Fordson halted production. Ford had recently developed an interest in the tractor market. The American farmer was always a group that Henry Ford tried to connect with as he came from a family of farmers. His hopes of the Fordson being the-

⁵⁹ Earl O. Heady, "Extent and Conditions of Agricultural Mechanization in the United States." In J. L. Meij Editor. *Mechanization in Agriculture*. (Chicago: Quadrangle Books, 1960), 67.

⁶⁰ Fraser, 98.

answer to their power needs fell short. The need for tractors was still apparent nationwide as there was no solution for the mechanization problem. The market share loss to International Harvester and the negative cloud around the Fordson fueled Ford's desire to reenter the tractor market. However he learned from his defeat that mass production was no longer the sole factor, but rather which firm could manufacture better technological innovations. So Ford was looking for new innovations on his new tractor, and that was excellent news for the fiery Irishman.

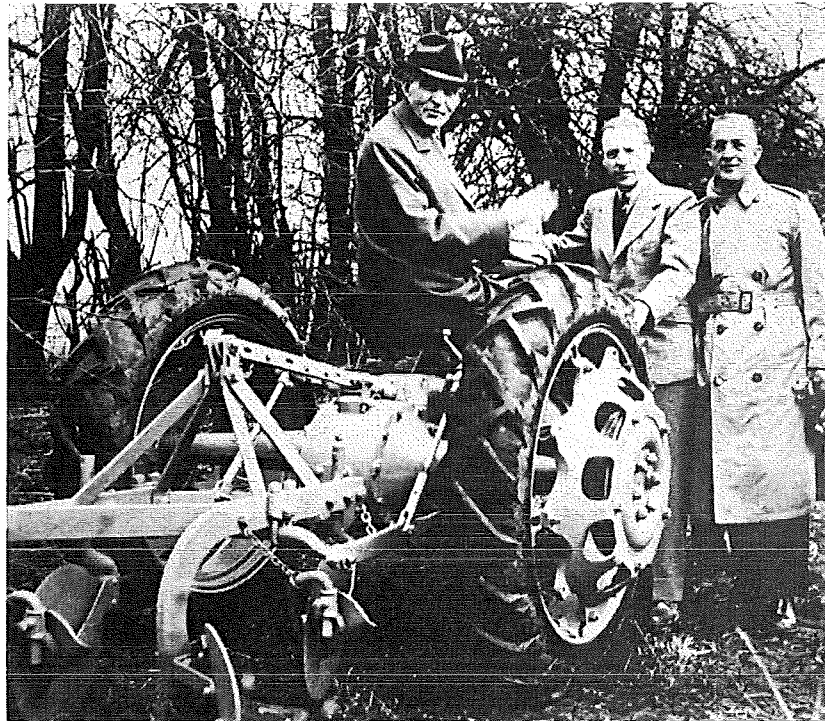


Figure 5 – Source: The Collections of Henry Ford (From left to right) Henry Ford, Harry Ferguson, and Eber Sherman.

William Sands and Henry Ferguson loaded their tractor onto a ship headed for Toronto. Once across the lake the team was treated to a cool Michigan fall day. Ferguson and Sands rolled out the Ferguson-Brown tractor onto Mrs. Ford's nursery garden. Ford was excited to meet with Ferguson and witness his claims of what the Ferguson System could do. On that morning the challenge was between an Allis-Chalmers model B, a

Fordson, and the Ferguson-Brown. Without question the Ferguson-Brown with the Ferguson System out-plowed the other tractors. Ford was absolutely enamored with Harry Ferguson and his innovation. Following the plowing success at the nursery, Ford insisted they go over to Deer Field, the largest on the Ford estate at 250 acres. The heavier soil was no problem for the Ferguson-Brown while the other tractors slipped all over the moist grass. The Ferguson-Brown tractor was not pretty to look at in the field or even as a blueprint, but it took Ferguson's ideas and showed them off. Of course the Ferguson-Brown tractor was not ideal for mass producing, but the goal was to lure Ford into a partnership for new tractors which utilized the Ferguson System. The two men talked for hours about tractors and different ideas, and Ford even wanted to try the Ferguson-Brown himself.

Once Ford was finished testing and asking questions about the Ferguson System he and Ferguson took a seat at a table set up in the field. Ferguson brought along his model to demonstrate the principles at work in the field. Henry Ford was excited to find his next big idea for new tractors. He first offered to purchase the patent rights from Ferguson outright, to which Ferguson responded by saying "You haven't got enough money, because they are not for sale at any price, to you or anybody else."⁶¹ Ford was bound and determined to go into business and proclaimed that they both needed each other and asked what Ferguson's suggestion would be. Ferguson proposed a gentleman's agreement with Henry Ford that would come to be referred to as "the handshake agreement":

Well, you're proposing to stake your reputation and your resources on this economic idea, even if a billion dollars is involved, and no agreement

⁶¹ Fraser, 105.

could protect you fully. I've spent my whole career thinking out this great economic idea and I've put everything I and my family have into it and I reckon my designs and inventions are worth more than your billion dollars, so I don't see how I can make an agreement. I'll trust you, if you'll trust me, and I'll put my services at your disposal for future designing, education and distribution. It'll have to be world education because there's a new world economy involved. For your part, you'll put all your resources, energy, fame, and reputation behind the equipment and manufacture it in volume, at low cost. I'll sell it.⁶²

Ford was pleased and responded by agreeing to those terms from the Irishman. The two men agreed to five terms in their deal. First, Ferguson was in charge of all design and engineering matters and had complete authority. Second, Ford would manufacture the tractor and with it assume all the risks in manufacturing. Third, Ferguson would distribute the tractors. Fourth, either party could revoke the arrangement at any time without the other's consent. And fifth, the Ford manufacturing plant in Britain would build the Ford-Ferguson tractor.⁶³ Once the two men agreed upon everything they stood tall and reached out their right hands for a firm handshake. Ford did not keep his word on the fifth issue, as the new Ford-Ferguson tractor was never built in the United Kingdom. The lead engineering designer for Ford at the time, Harold Brock, was on the field that day. He, like many within Ford Motor Company, was not thrilled with such a large business deal being done without paperwork. His views also come from someone who had to work under Ferguson because of the power Ford granted him in the verbal agreement. Brock recalled what he thought the motives of Ferguson were that day:

And of course he [Henry Ford] didn't ask any of the Ford management what they thought about the idea [The handshake agreement], and so it left Ferguson and Ford were at a table, which I have pictures of. And so none of the management knew much about what Ferguson and Ford agreed to,

⁶² Fraser, 105-106.

⁶³ Fraser, 106.

which put Ferguson in a position of almost dictating to Ford management what the agreement was and his responsibility.⁶⁴

One of the largest business deals in the tractor industry had no paperwork filed for a formal contract. Henry Ford despised lawyers and never kept them in his company.⁶⁵ He felt that they impeded businessmen from operating efficiently. Henry Ford was born on the farm and worked his entire childhood in agriculture. Harry Ferguson had a similar story; he was raised on the farm by hardworking Irish Catholic parents. Both men had brought their love for farming with them on that monumental day when they did something to help the American farmer improve their lives. Henry Ford and Harry Ferguson came from a time when one's word was binding contract, and in a sign of solidarity to that simpler time they both were pleased with a simple handshake.

The event received coverage from the press, most notable being *Time Magazine*. In the July 1939 edition they covered the prospects of this tractor revolutionizing agriculture. "This tractor is peculiarly Henry Ford's personal baby. It is his solution of his favorite problem: how to get people back to the farms."⁶⁶ The reporter continued as he explained how the new finger-tip hydraulics improved farming practices. "That a special, double linkage coupling will keep the plough it draws from pulling out of the ground-keep a plough full depth even in hard soil."⁶⁷ The reporter was right about the benefits of draft control, but it was three-points of linkage. Most importantly the issue of safety is

⁶⁴ Brock, Harold. 2010. An Interview with Harold Brock: Chief Designer of the Ford 9N Tractor. DVD. Directed by Rob Rinaldi. East Corinth, VT: N-News Magazine and Media 1, 00:47:21 - 00:47:53.

⁶⁵ Mr. Ford would only keep patent lawyers around after the infamous Selden patent suit in 1911. Automobile manufacturers had been paying royalties to George Selden because of a sketch drawing of an automobile he patented. Henry Ford won in court on the grounds that he had never secured a patent, thus removing any royalties paid to produce an automobile.

⁶⁶ *Time Magazine*. "Manufacturing". July 3, 1939.

⁶⁷ *Time Magazine*. Ibid.

covered and drives home the benefits of having tractor and implement as one fluid tool. “That when the plough hits a rock or stump the tractor will not tip over backward and fall on its driver like old time tractors-it slips its back-wheel drive when an obstruction is encountered, keeps its nose down by pulling with its front wheels only.”⁶⁸ For the first time a large audience of readers were given a taste of what the future of the tractor business had in store. So the danger of flipping a tractor still existed until late 1939, when the first Ford-Ferguson 9N tractors were introduced.



Figure 6 – Source: The Collection of Henry Ford. Henry Ferguson (sitting, left) is demonstrating a model of the Ferguson System for Henry Ford (sitting, right).

The handshake agreement offered the promise of gains for both Ferguson and Ford. Ferguson needed a strong name to ensure his new innovation could succeed, and Ford was desperate for a strong technological advantage for his second-run into the tractor market. The world’s farmers were the greatest benefactors of this. The Ferguson

⁶⁸ *Time Magazine*. Ibid.

System, when adequately produced, would help protect farmer's lives and increase productivity. The three-point hitch presented the opportunity to create implements that could do a wide range of tasks because of its universal design. This was the real selling point to not only those in farming, but those in industry as well. Now the tractor could be used to plow snow, split logs, and even operate in the South Pole.⁶⁹ What would soon become the standard for all mechanized agriculture was now the innovation that would attempt to re-launch Ford back into the tractor industry.

⁶⁹ The Ferguson TE-20 (discussed in greater detail in chapter 4) was used as part of Ernest Shackleton's expedition to the South Pole. The tractor was hauled on the ship and unloaded to help with the clearing of seaways and supply roads.

Chapter IV: The Rise to Dominant Design Status

Ford-Ferguson 9N

Following the handshake agreement, work started immediately on designing a Ford tractor with the Ferguson System integrated. Ford Motor Company's Chief Designer for the new tractor was Harold Brock, although he still needed to follow the orders Harry Ferguson. The design of the Ford 9N was a collaborative effort between Ford's top engineers and Harry Ferguson Incorporated's team of designers. The tractor would go from prototype to production in under six months, whereas most companies took years developing and testing before a prototype design. Henry Ford had two goals for the 9N, rapid manufacturing and low cost production. Harold Brock recalled a design meeting where he suggested using Ford car and truck parts on the new tractor.⁷⁰ Brock said this would accomplish both of Ford's goals since it allowed for quick production and would be cheaper than developing new components. The 9N shared the same rear axle, brakes, clutch, and half the engine with Ford trucks. He also suggested this idea would benefit Ford auto dealers as they would not need to expand their inventory for repairs on the new tractor as much. The unprecedented turn-around time was attributed to six months of hard work and creative solutions from both teams working together. Brock remembered Ford and Ferguson exchanging ideas, changing designs, altering features, and then finally settling on an acceptable adaptation of the Ferguson System onto a Ford engineered tractor.

The Ford-Ferguson 9N tractor rolled off the assembly line in the spring of 1939 and the tractor's performance was unparalleled. In a sit-down interview with the publisher of *The N-News Magazine*, Rob Rinaldi, spoke with Harold Brock. The

⁷⁰ Brock, 00:57:39.

interview was recorded in 2009 when Brock was ninety-four years of age; he passed away two years later. Brock had a long career in the tractor industry working for Ford's tractor division for twenty years and then another twenty years in tractor design with John Deere Inc. During their conversation, Brock and Rinaldi exchanged comments on how the 9N was ahead of its time when it first rolled off the assembly line at the Dearborn factory.



Figure 7 – Source: The Collection of Henry Ford.

Ron: Because I think one of the things that make the 9N really stand out, besides the hitch, which obviously puts it in a whole different category in terms of Agriculture...[Interrupted by Harold]

Harold: If you look at other tractors during that period you'll see they were very crude looking.

Ron: They are, and this tractor came off the assembly line looking finished and smooth, and though it was ready to work, it looked good.⁷¹

⁷¹ Brock, 00:59:34 - 01:00:02.

Ferguson never took formal classes in engineering or mechanical design, and this led to him being illiterate in the language of engineering. He never could read a blueprint, so throughout his career he had employees on his team who could read the blueprints and turn his ideas into functional metal patterns. Harold Brock made the claim that the actual design and engineering part of the Ferguson System was all done by his assistant, William Sands.⁷² From an engineering aspect Sands contributed much more than Ferguson did to the three-point hitch design. It can be easily asked why Ferguson received the credit for all of Sands' hard work. The answer is quite simple: Sands was an employee of Ferguson Inc. and held no control over the Ferguson System copyrights or patents. Ferguson did not conduct illegal activities, but was at fault for taking more credit than he deserved for the invention of the three-point hitch. Although Sands did carry Ferguson through the engineering requirements, Ferguson was the promoter that allowed the innovation to diffuse across the world. William Sands did not receive the credit he deserves for his contributions to the Ferguson System. However, this does not undermine the contributions that Ferguson was able to make through his gift of promotion. The Ferguson System was heavily promoted by Harry Ferguson, who had a remarkable ability to sell himself and his ideas to a range of parties: a potential business partner, engineers, agricultural educators, and above all else the small farmer. As a young man selling plows it was his charisma and salesmanship that proved to be his most powerful asset. Sometimes people have brilliant ideas and inventions, but generate little promotion thus failing as an economic success. The quintessential example would be Serbian-American Nikola Tesla, who worked for Thomas Edison, a personal friend of Henry Ford. Tesla was the inventive mastermind behind most of Edison's most famous innovations, but

⁷² Brock, 01:02:08.

Tesla would suffer the same fate as William Sands. All of the three-point hitch patents were approved in 1927, each of them were in Harry Ferguson's name. At the end of the day Sands knew that his work was owned by Ferguson Inc. It came at no surprise that once the handshake agreement was confirmed William Sands terminated his relationship with Ferguson and returned home to England.

Harold Brock remembered employees at Ford being nervous when the temperamental Ferguson walked into the work shop. Ferguson demanded perfection in every aspect of design and development. Brock recalled a time when Ferguson spent hours on a mundane design detail of the 9N: "Ferguson would spend more time than the rest, but he would do it on all the little details. We had a little fuel valve that had a gallon of gas left, a reserve, it had a little knob and had little serrations and I think he spent a couple of hours with me on what those serrations should be."⁷³ The advantage Ferguson had working with the Ford brass was that he was in a partnership at the top of the corporate ladder with the founder of the company. Brock appreciated Ferguson as a salesman and for having the idea for the three-point hitch, but that is where his admiration stopped.

Promoting The Tractor

The handshake agreement stipulated that Ferguson would be responsible for the distribution and marketing for the new tractor. In order to incorporate such a large task, he turned to the assistance of Eber Sherman, whom joined with Ferguson Inc. Ferguson had the small farmer in mind when they first started talking business about building a tractor. The finished Ford-Ferguson 9N was introduced at \$585, which was a value considering the possibilities of its new technology. Marketing placed an emphasis on the

⁷³ Brock, 01:01:18 - 01:01:56.

tractor's implements as each implement let the tractor become a different tool. Hundreds of new implements were designed that could perform cumbersome tasks with ease. The three-point hitch was able to utilize impressive tools such as log splitters, post-hole drillers, backhoe buckets, mowing decks, and even an elevator conveyor belt for bales of hay. Tractors before this time only used wheel drawn implements attached to a single-point hitch and lacked the PTO for auxiliary power. The new implements did not require the rubber or steel for tires, thus lowering the cost of materials. A plow was included with the purchase of the tractor, which translated into an outstanding value for small farmers. The combination of 9N and three-point plow was promoted as the farming system to finally displace the horse from the field. In 1940, seventy-five percent of farmers who made over \$5,000 annually reported having a tractor.⁷⁴ Among those making \$1,000-\$1,999 annually, only 36.7 percent reported having tractors. The Ford 9N's primary marketed was not well-off farmers, but rather small farmers who needed mechanization. The Ferguson System impressed farmers and agricultural leaders alike, and their positive reviews helped small farmers feel confident before they incurred the risks of mechanization.

Ferguson used the 1939's World's Fair, held in New York City, as a grand stage to unveil the most advanced light utility tractor ever. Thousands were in attendance to witness the tractor plow perfect furrows on small plots of land. The World's Fair was the stage to showcase recent advancements, and the target audience was the working class in attendance. The audience was treated to watching Ford Motor Company's President Edsel Ford cut the first furrow. Edsel was followed by Grover Whalen, World Fair

⁷⁴ Heady, 87.

president, who also utilized the tractor to plow a furrow. Ferguson was in his natural form while demonstrating and promoting his revolutionary system. Henry Ford regretted that he could not attend the event but spoke to the team about the importance of the new tractor as “the most revolutionary step that mechanized farming has taken.”⁷⁵



Figure 8 - Source: The Collection of Henry Ford. Local newspaper journalist, Nina Dean, reported on the newly introduced Ford 9N.

One of the more impressive impacts the tractor had during the fair was when a newspaper reporter, who had never operated a farming tractor, demonstrated the simplicity and ease of use the new Ford-Ferguson could provide. Nina Dean, a local reporter, was introduced to the new Ford 9N with a fully hydraulic implement system utilizing the Ferguson System. She was able to control the tractor with ease because of its battery that provided for electric starting, unlike the manual-crank starting of the Fordson. Located in the middle of the three-point hitch was the PTO, which could provide

⁷⁵ Fraser, 119.

auxiliary power to hundreds of unique implements. The 9-N emphasized simplicity and a quick learning curve, which was welcoming for first time tractor operators. Its finger-tip control system allowed for every member of the family to participate in mechanized agriculture.

Another successful avenue of promotion that Ferguson used was showcasing the tractor as an educational tool. The National Farm Youth Foundation was formed by Ferguson and Sherman with funding provided by The Ford Motor Company. The foundation awarded twenty-nine students with an agricultural scholarship. The scholarship was for a one-year course in farm management and engineering at an agricultural college closest to the recipient's home. But the winner also came to Dearborn for one month of training with the Ferguson staff on how to use the Ferguson System effectively.⁷⁶ The goal for the month would be to teach each of the students that the Ferguson System was the ultimate system for farming. Under the veil of charity, this plan was directly marketing the tractor to future farmers all across the country. The hope was that they returned home and spread the word of the Ferguson System and the advanced farming techniques they learned. The scholarship was a great opportunity for younger farmers to get a first-hand account of the Ferguson farming system from industry experts.⁷⁷ The idea was that the youth would be the ones who could sustain the tractor industry for the future, and creating brand loyalty at a young age was a bottom-up approach to marketing. This was a very small-scale program, but the idea was ahead of

⁷⁶ Fraser, 134.

⁷⁷ *Science*, 17 May 1940: 91.

its time. This type of promotion practice is now commonplace in corporate dealings with scholarships and education.

Advertising and marketing played an important role during the initial launch of the Ford-Ferguson 9N tractor. Ford Motor produced a promotional booklet that was pushing the advanced features offered on the new tractor. “Henry Ford and Harry Ferguson Revolutionize Farming” was first printed in the September 1939 issue of *Ford Field*. The promotional material stressed the simplistic operation of the tractor and emphasized the ease of switching between dozens of implements. Starting the tractor was easy with a simple push of a button by means of a mounted battery. The 9N tractor was promoted as a smaller alternative to the industry’s bulky models. Also included were pictures of the 9N in action and captions that describe the tractor’s benefits: “Keeping front wheels on ground makes safe hill-plowing; supreme test mobility. Plowing in a 20’ x 27’ enclosure and note how close to edges; this is how operator lifts implements and adjusts depth while running.”⁷⁸ In addition to the features of the tractor, both men have optimistic statements about the future of farming and their intentions. Henry Ford emphasized the noble work of farming:

The land! That is where our roots are. There is the basis of our physical life. The farther we get away from the land, the greater our insecurity. From the land comes everything that supports life, everything we use for the service of physical life. The land has not collapsed or shrunk in either expanse or productivity. It is there waiting to honor all the labor we are willing to invest in it, and able to tide us across any local dislocation of economic conditions. No unemployment insurance can be compared to an alliance between man and plot of land.⁷⁹

⁷⁸ Ford Motor Company, *Henry Ford and Harry Ferguson Revolutionize Farming*. (Milwaukee: Ford Field Magazine, 1939).

⁷⁹ Ford Motor Company, 3.

It is difficult to question Mr. Ford's motive for wanting to help the small farmer mechanize. Ford would routinely express his feelings on the American farmer being critical to the success of the nation. His actions would echo the same desire to offer a product that could help many who found themselves in dire-straits. He had sold the Fordson at a loss, and the same was true with the 9N. It seems that Mr. Ford did indeed have a soft spot for the farmer and wanted to make the idea of mechanization possible. He knew that the people would listen to him and his sales pitch for the new tractor. American consumers and farmers wanted to trust Henry Ford, and were willing to overlook some of his clumsy products of the past.

The three-point hitch system allowed for universal implements that could be interchanged quicker and easier than ever before. An overlooked benefit of the three-point hitch system was how it introduced mechanized accessibility for all members of the family. Switching between a plow, disc or cultivator was quick and effortless with the hydraulic lift to raise and lower the implement. Once the plow was attached, the tractor was equipped with draft control to maintain the plow's depth in the soil. This was a huge advance in tractor design and operator ease of use; just twenty-five years earlier the only mechanization options were humongous steam traction engines. In Mary Neth's book on women in farming she saw the introduction of large machinery as a way of excluding women from the field:

Another constraint on women farmers is the increased use of large machinery. While women are able to operate large, heavy machinery, several complained about the difficulty of hooking up the machinery and working with the hydraulic hoses. Women rarely trained to use this equipment, and often the machinery is designed to be operated by men. One woman changed the seat on her tractor because she could not reach the pedals. The distance from the seat to the controls is often too long,

especially for small women. As men buy more and larger machinery, women are less likely to operate it.⁸⁰

Women were always contributors to farming life, but the advent of steam and large machinery limited women's accessibility on the farm. This was an unfortunate side effect that sidelined women. However, the Ford 9N was compact enough for the pedals to be at a height where any size operator could reach them. The hydraulic implement system was ideal for maneuvering heavy loads. Granted, switching out implements designed for the three-point hitch still required some elbow grease, but it was far less complex than attaching bulky machinery to an early tractor. Every Ford 9N was equipped with a battery that rotated the flywheel within the starter at the push of a single button. This was a major upgrade from the crank start and steam engines which needed large chunks of wood loaded into a hot boiler to generate steam. The Ford-Ferguson 9N eliminated almost all of the mechanical exclusion of women in farming, and opened up new tools for the farmer. It was revolutionary for a tractor that small to have such an upside over steam tractors that were still being used on American farms. The engine was not large on the 9N but it used that horsepower most effectively as the implement was designed to flow as one with the tractor. To demonstrate this point, during Henry Ford's debut of the 9N he had a young boy plow a furrow. The tractor was operated with finesse and precision, not by brute strength. Any member of the family could use this tractor and not feel intimidated or technologically encumbered. Most homestead families had to rely upon internal-manpower so this meant every member of the family needed to contribute; the Ford 9N increased the contribution potential for the whole farm family. The tractor was no longer viewed as a clumsy replacement to the horse, but rather a unit that could be transformed

⁸⁰ Mary Neth, *Preserving the Family Farm: Women, Community, and the Foundations of Agribusiness in the Midwest, 1900-1940*, (Baltimore: John Hopkins Press, 1995), 116.

into hundreds of different industrial tools. The Ferguson System is the Swiss Army Knife of mechanized agriculture, and supported the small farmer's desire for independent operations.

The Gray Menace

With all his experience partnering with Ford Motor, the savvy salesman had no problems securing a new contract to start manufacturing his own tractor. Ferguson searched between the US and UK for a manufacturer to produce a tractor with his hitch; he was successful in late 1945. Standard Motor Company, an internationally recognized automobile manufacturer, agreed to produce Ferguson's tractor in the UK.⁸¹ At the time of the agreement, Ferguson was still in a partnership with Ford, but Ford had no problems with Harry Ferguson Incorporated's affairs. Ferguson would not be working with Ford for much longer, however not because of Ferguson's new agreement with Standard Motors.

The Ferguson TE-20 was a gray light utility tractor that had a 20-horsepower engine that utilized his trademark linkage, the Ferguson System. He started selling them in 1946 thanks to the manufacturing capabilities of England's Standard Motors. Ferguson's goal was to manufacture a tractor in Europe that used the Ferguson System; as Ford Motor did not fulfill the terms outlined during the handshake agreement, which called for the building of a factory in the UK that would manufacture the 9N. The TE-20 is a national treasure in the United Kingdom and was the ideal tractor to help rebuild following the destruction brought on by World War II. Peak production occurred in 1951 when over 74,000 Fergusons were produced and of those manufactured seventy percent

⁸¹ Fraser, 148.

of them were exported.⁸² The TE-20 was distributed across the globe to over one-hundred nations in large part to the United Kingdom's wide distribution network. The spread of this revolutionary system was the goal of Harry Ferguson and for that matter the goal of Henry Ford as well. The Ferguson TE-20 was able to spread across the world while Ford predominantly marketed their tractors to the North American farmer. There is little doubt that the global success of the TE-20 is a tribute to functionality of the three-point hitch. The TE-20 was only the second tractor model manufactured with the Ferguson System and just as with Ford, it produced unparalleled market penetration. The farm tractor was now diffusing across all social groups around the world, just as Ferguson had planned. Many former English colonies were importing tractors for the first time, and they lucked out as the TE-20 proved to be the farm tractor's dominant design.

When the Ford-Ferguson 9N and the Ferguson TE-20 were lined up next to one another, it was difficult to tell them apart. From Ferguson's time working with Ford it is only logical to think that the tractor would share some common features but not be a near-clone. Harold Brock had an explanation as to why the two tractors' designs were so similar. Brock remembers an interaction when Ferguson was approached by Charles Sorensen, Ford Production Manager, about 9N production costs. Sorensen wanted to talk with Ferguson because the tractor had to have its price raised because the company was losing money manufacturing the tractor. Ferguson would not stand for a price increase and he responded by telling Sorensen, "You can tell Mr. Ford you can't manufacture at this price."⁸³ Ferguson had the upper-hand as Sorensen would not dare question Mr. Ford, so he listened to Ferguson's idea. The plan was to bring in a consulting group to audit the

⁸² Jim Broadbent, 17:50-18:30.

⁸³ Brock, 01:11:50.

manufacturing processes and see if they could find areas to reduce cost. Harold Brock recounted a conversation he had with Ferguson in which Ferguson obtained the blueprints for manufacturing the 9N.

Ferguson says, now he was a schemer, he really wanted to get his name on that tractor originally, but now so he was a schemer and said to Sorensen that "I'll have Ford, Bacon and Davis [Auditors] whose experts in manufacturing look at the manufacturing operations of Ford and tell you how to reduce the cost." They [Sorensen and other management] agreed to that, and now of course Ford knew more about manufacturing than Ford, Bacon and Thomas, but anyway they agreed to it. So then Ferguson came to me and said "Well we don't have any drawings." And I said well we didn't think you'd need our drawings, they're our [Ford Motor Company] drawings. [Ferguson Says:] "Well this won't work with the experts without drawings." So I told management, okay give him the drawings. Then they came back and said we need the operating sheets too, how you manufacture these things [Ford 9N]. So they got the whole kit-and-caboodle, Ferguson had that in mind that he was going to do something on his own.⁸⁴

The tractors are so similar that some of the parts can be interchanged between the two. Brock's comments support a reason to suspect Harry Ferguson Incorporated of foul play when taking sole-credit of the design for the TE-20. Ford Motor did not bring any legal charges against Ferguson for theft or copyright infringement because there was enough of a difference that an infringement case could not meet the required legal threshold. This allowed Ferguson Incorporated to continue producing and marketing tractors. There were more Ferguson TE-20's produced than Ford 9N's, and the TE-20 was primarily distributed throughout the United States, United Kingdom and its Commonwealth of Nations. The TE-20 is affectionately known as the little gray Fergie

⁸⁴ Brock, 01:12:06 - 01:13:10.

by its owners and fans. This love for the Ferguson is demonstrated through a popular children's television program first airing in Norway entitled, "Little Grey Fergie".⁸⁵

The Ford-Ferguson 9N and the Fordson had many similarities, but there was one difference that changed the landscape, the three-point hitch. The Fordson, despite selling well, did not leave a positive impression of Ford's ability to create farm tractors. So there were many who were quite hesitant to try the latest Ford side-project. This hesitation forced Ford to market the tractor on the Ferguson System first with the Ford name promoted second. Brand name would be the first goal in most cases, but this was an interesting twist given the past failures on the company. It is the idea of John Ruff, *N-News Magazine* contributor, that the Ford 9N was only successful because of the Ferguson System which separated it from the Fordson. Ruff outlines his point, "The 9N was everything a tractor should not have been, according to the context of the times, it may have taken some time before farmers began to realize exactly what a big leap forward this compact little design was."⁸⁶ The real challenge was to overcome the bad roll-out of the first Ford tractors.

There were several factors that benefited Ford in their second attempt. The first, and always most important was the passage of time. With almost fifteen years passing between the final Fordson and the first 9N, the old adage that time heals all wounds rings true in this case. The second factor was that, the superior technology first introduced. The fifteen years away not only helped heal wounds with customers, but it also gave Ford a plan to come out with innovations that can compete. The sales of the Ferguson-Ford 9N did not break any records, but it did instill enough confidence in Ford to further perfect

⁸⁵ www.littlegreyfergie.com

⁸⁶ *N-News Magazine*, Volume 14 Num. 4, Autumn, 1999.

this idea. It was the Ferguson System that was most notable about the introduction of the 9N, but it was also the most important reason why this tractor did not become another massive failure.

A Withdrawn Partnership

The Ford-Ferguson 9N was a success and was welcomed into the tractor world. In 1942 the country was at war, and rationing forced the 2N tractor to be designed out of necessity rather than from true commitment. As the country prepared for manufacturing of military armaments and a rationing of precious resources, the engineers at Ford Motor were forced to make tough changes to the current 9N to continue production. During World War I and II, Henry Ford opposed intervention as a pacifist and protested the Department of Defense's demands to reduce production on non-essential products and cut back on resources. As warfare became imminent, Mr. Ford agreed to produce bombers and primitive Jeeps; the agreement let production on tractors continue but with a steep reduction in production and war-time materials. Rubber was in desperate need for the war so the 2N had steel wheels, and copper was removed from the starter as it was a precious material. The steel wheels caused the tractor to slip and slid in muddy soil. Minor changes can be seen on 2N tractors based on the materials on hand when production started. Some will have rubber tires, but most will not. The tractor was not ideal, but it was functional and helped farmers during this world crisis.

The 1940s were not a good decade for the Ford Motor Company and its powerful family. Company President Edsel Ford was diagnosed with late stage cancer and quickly passed away in 1943 at the age of forty-nine. Edsel was Henry's only son and the loss was difficult on the aging Ford. In the company's moment of crisis, Henry Ford

reclaimed his duty as president through the end of World War II. Henry Ford had a difficult time managing because several strokes suffered in the late 1930s left him in a debilitated mental state.⁸⁷ For this reason, most of the company's major business decisions were made by a small group of top Ford Motor executives, most notably Mr. Ford's right hand man Charles Sorensen. A power struggle then ensued between high powered Ford executive Harry Bennet and the son of Edsel Ford, Henry Ford II.⁸⁸ The war came to a conclusion in 1945 and Henry Ford stepped down from his position. Despite attempts by Bennet to appeal to the mentally ill eighty-one-year-old, Mr. Ford placed the company he founded into the hands of his grandson.

The company was in poor financial shape when Henry Ford II was asked to lead Ford Motor Company back to prominence. During the war the company was losing \$10 million a month to keep up with production of military armaments. The Ford-Ferguson tractor was a success in the field but the tractor's production was losing the company \$20 million each year of manufacturing.⁸⁹ This led the new administration to question the validity of the handshake agreement and its financial outcomes. Ferguson was summoned to meet with Ford Motor executives to discuss a new deal. Original deals called for Ford Motor to have a majority share in Harry Ferguson Incorporated, Ferguson's business that distributed implements for the 9N. After negotiations between the two parties soured, Ford executives pushed back with a take-it or leave-it offer. One proposed agreement to keep the handshake agreement intact called for an exchange of seventy percent ownership in Harry Ferguson Inc. to Ford, and the removal of Ferguson's name from the tractor.

⁸⁷ Nevins and Hill, 289.

⁸⁸ Fraser, 173.

⁸⁹ Fraser, 174.

Ferguson was appalled with the conditions of these terms, so he was forced to terminate the partnership instead of losing control of his company. The two parties agreed to continue tractor production until the end of the six-month production cycle, which lasted until June 1947. However, Harry Ferguson Incorporated was stripped of its largest market to sell implements for the three-point hitch. Ford Motor Company created a subsidiary to replace Ferguson, Dearborn Motor Corporation, which took up promotion and distribution of the three-point hitch implements. The terms of the handshake agreement said that either party could terminate the deal at any time and retain their respective patents or copyrights.

The handshake agreement, reached over a decade ago was now the subject of a class action lawsuit because of the Ford Motor Company's infringement of Harry Ferguson Inc.'s patents. Ford Motor Company made substantial improvements to the 9N tractor design as production on the more powerful 8N started in 1947. The Ford 8N was a solo endeavor by the company, which emphasized improvement upon the 9N and 2N by: increasing the engine size, adding running boards, upgrading the transmission to a 4-speed, and improved hydraulics on a modified version of the Ferguson System. Since the handshake agreement was terminated without patent rights exchanged, Ferguson felt that he should be compensated by Ford Motor for royalties on every tractor sold, since they used patents in his name. The dollar amount Ferguson put on the patent infringement lawsuit was an optimistic \$251 million. Proceedings started in 1948 and both sides' litigators presented thousands of depositions and tens-of-thousands of documents for evidence.

On the eve of the impending court date against the Ford Motor Company, Ferguson remarked, "It'll be a grand fight".⁹⁰ The confident Irishman knew that he could extend a legitimate challenge to the larger and more powerful Ford over the illegal use of his ideas. Ferguson put an outrageous price tag of \$251 million in compensation for every Ferguson System on each individual tractor produced. Every top executive that worked with the Ferguson System for both Ford and Ferguson was questioned as part of the proceedings. The trial lasted four years and ended as the largest court settlement ever in the automotive and tractor industries. Ferguson did not need the money as much as he wanted to fight for his honor as an inventor. He was a very proud man and felt that Ford Motor should be brought to justice for their crimes.

Every aspect of the Ferguson System and the three-point hitch at large was examined. The most compelling testimony during the hearings was delivered by Ferguson's long-time engineer, William Sands. The proceedings revealed that he was in fact responsible for most of the system's engineering and functionality. The defense used Sands' testimony to discredit Ferguson and his contributions to the system. Years of deliberation dragged on, there were 80,000 depositions, over 1 million documents, and 200 lawyers when it was over. To avoid dragging the court case out any further, Ford Motor settled with Ferguson Inc. out of court for \$9.5 million. The patent infringements would need to be stopped at once; Ford was in violation of Ferguson's hydraulic pump control patent for the three-point hitch.⁹¹ This ruling was important not because of its cash exchange, but instead a message was sent to the tractor industry that they too could use the Ferguson System if they could slightly modify it to avoid patent laws. It did not

⁹⁰ *Time*, Vol. LIX No. 16, April 21, 1952.

⁹¹ Fraser, 203.

take long for the industry's best engineers and designers to start creating their own unique three-point hitch system.

Once the case was over, Harry Ferguson was left with a decent monetary victory. The Ferguson vs. Ford court case had one real winner, and that was the American farmer. Following the case, Ferguson's sole claim to the three-point hitch patents took a significant blow. Tractor manufacturers did not fear retribution for designing their own three-point hitch tractors because Ford did not lose the case, thus proving slight alterations to be sufficient enough to avoid patent infringement. Agricultural companies around the world would soon design their own unique three-point hitch tractor. Tractor companies decided to adopt the three-point hitch because of its overwhelming popularity across the world.

The Undiscovered Country

As the farm tractor and other forms of mechanized agriculture reached higher adoption levels, the amount of laborers on American farms would decrease. Many farmers living throughout the Great Plains had an abundant wave of mechanization that could allow them to depend less upon family help. The consistent downward trend of farm labor was part of a wide-spread consolidation of smaller farms. The elimination of entire families from farm life had a drastic impact on the labor shifts within the country. Most of those children off the farm would enter into city life and search for opportunities not available in rural farming communities. The number of laborers does stabilize in the 1990s as many of the hired laborers are working on southern fruit and produce farms. Many of these farms would hire migrant workers to perform the demanding task of harvesting citrus fruits, berries, and vegetables. Although mechanization has made its

precedence felt across these southern farms, the task of picking and cultivating is still most effectively done by hand for many types of crops.

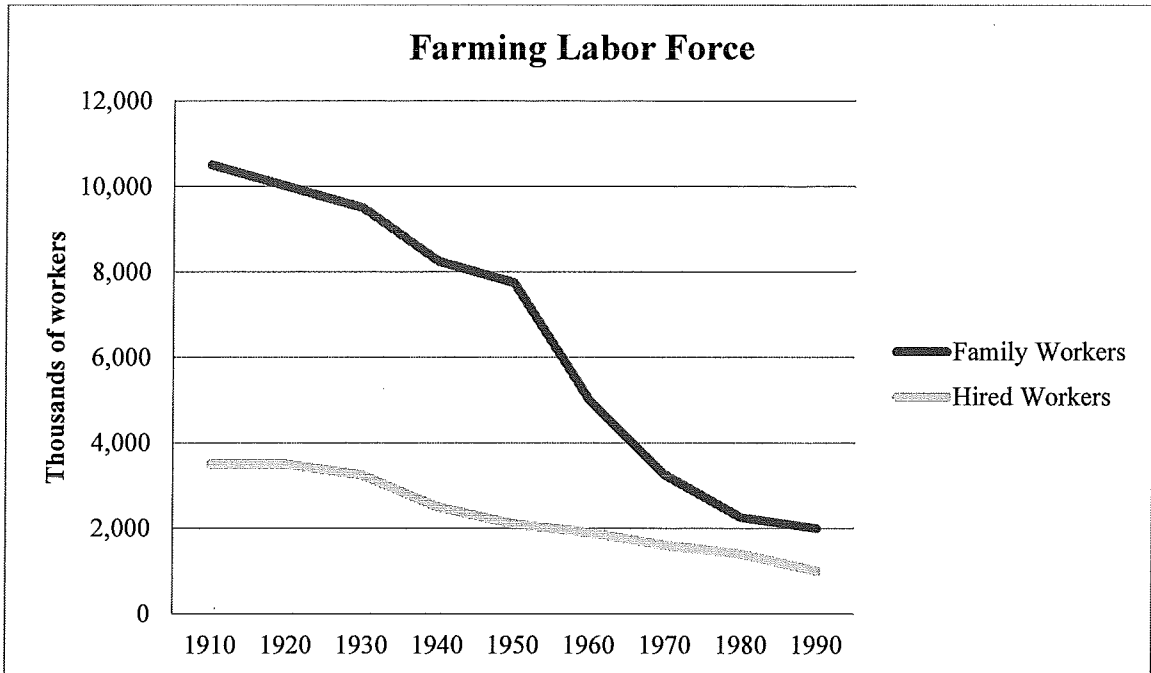


Figure 9 – Source: *American Agriculture in the Twentieth Century*, 172.

The quick adoption of the Ferguson System increased arable land across the world. Land increased for growing crops in two ways. First, the Ferguson System helped displace animal power, thus opening former animal feed land for cash crops. Second, the Ferguson System allowed for the use of new types of terrain that was previously not hospitable. Horses and oxen throughout America needed 59 million acres for food in 1933; the most popular feed crops were oats, hay, and alfalfa. By 1956 the land freed up by the fading of animal power was 50 million acres.⁹² Depending on a farmer's location, the amount of farmland gained by the three-point hitch varied. Crop lands that were uneven or muddy were now more easily accessed and safely cultivated. The land gained would vary from region to region and farm to farm, but every little bit counted when

⁹² Earl O. Heady, 67.

allocating lands for cash crops. The gained acres can only be calculated into total acreage information, as the amount gained would be debatable between each person asked. The amount added would not come close to the 50 million acres freed up by displacement of the horse, but it did provide a slight increase in workable crop lands.

Following World War II the United States entered into a time of unprecedented growth in all areas of modern life. Farm life was exposed to new methods and techniques for farming. The amount of crops being produced took a dramatic change upwards. Farmers growing corn around the turn of the nineteenth-century could expect to harvest about twenty-seven bushels (bu.) per acre. That same farmer could now grow 121 bu. of corn in 1990, using the very same plot.⁹³ This dramatic increase in crop yields were the result of several different factors, and each crop is unique to what technology benefited it most. An attempt was undertaken by G.F. Warren Jr., a former professor of horticulture at Purdue University, to rate the effectiveness of four key areas of innovation for nine popular American crops (Fig. 10). The lines between disciplines such as chemistry and biology are sometimes indistinguishable and are by no means perfect; however, this research does provide insight for the innovations responsible for greater yields. Not surprisingly, biology and hybrid seeds were the largest contributors to increased yields. Mechanization played a larger role for cotton and tomatoes as the harvesting of these crops required complex mechanical solutions. The benefits that mechanization provided had a threshold, while hybrid crops and genetically modified organisms have the potential to triple or quadruple crop yields in some cases. The mechanization threshold

⁹³ Don Paarlberg and Philip Paarlberg. *The Agricultural Revolution of the 20th Century*. Iowa State University Press, Ames, 2000. All measured in bu. 1900-1901 = (Corn, 27), (Wheat, 14.4), (Soybeans, NA), (Sorghum, NA). 1930-1939 = (Corn, 24), (Wheat, 13.3), (Soybeans, 16.1), (Sorghum, 12.7). 1950-1959 = (Corn, 44), (Wheat, 19.7), (Soybeans, 21.4), (Sorghum, 23.8). 1990-1997 = (Corn, 121), (Wheat, 37.6), (Soybeans, 36.5), (Sorghum, 65).

was the dominant design of the farm tractor, the Ferguson System. Mechanization's contribution to crop yields reached its peak for most crops in 1939 with the first introduction of the Ferguson System. Of the four major categories, chemical, biological, management, mechanization reached dominant design the quickest.⁹⁴ Effective and productive mechanization was mandatory for the increased advances in new technologies to increase crop yields.

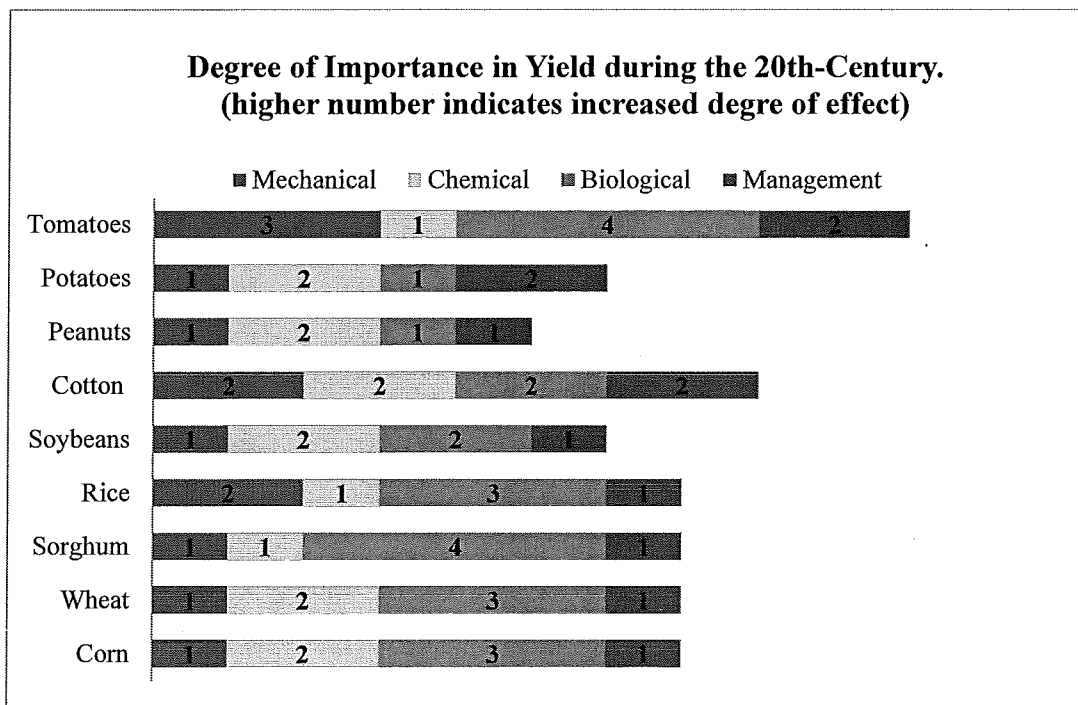


Figure 10 – Source: *The Agricultural Revolution of the 20th Century*, 64.

Diffusion by Region

Tractors sold in the 1940s were productive and reliable, thus allowing for the near complete diffusion of the farm tractor with the early majority of farmers by 1950. At the start of 1940, twenty-three percent farmers reported having a tractor on the farm and by

⁹⁴ Management would include all practices that control the stages of growth through techniques such as, irrigation, crop rotation, soil research, ext.

1950 this had increased to forty-six percent.⁹⁵ The early majority of farmers are the ones who needed to see the tractor's productivity in the field before they started to adopt:

The early majority adopt new ideas just before the average member of a system. The early majority interact frequently with their peers but seldom hold positions of opinion leadership in a system. The early majority's unique location between the very early and the relatively late to adopt makes them an important link in the diffusion process. They provide interconnectedness in the system's interpersonal networks. The early majority are one of the most numerous adopter categories, making up one third of all members of a system.⁹⁶

The American farmer entered the 1940s with reserved optimism and enthusiasm for agriculture's future mechanizing. The Ford-Ferguson found a market with smaller farmers and those early adopters who wanted to take a high-upside risk with the 9N. The early majority of adopters can also be described as those who do not want to be the first to try an innovation, but they certainly did not want to be the last. Their choice would prove to be wise if they mechanized before the onset of World War II.

The diffusion of the farm tractor was almost at the pinnacle in the 1950s as the late majority and laggards were on the cusp of fully adopting. The PTO, innovated by International Harvester, increased functionality for the tractor in the 1920s and had become an industry standard. The PTO was the catalyst which brought the tractor into the early majority of farmers. The Ferguson System was still being marketed by Ford Motor Company and in 1948 they would release a tractor, the 8N, aimed at the late majority of adopters. Agricultural production numbers could have been better throughout the 1940s if there had not been such a demand on military production. The market was opening up for an increase of tractor production, and heading into the 1950s the numbers were strong.

⁹⁵ White, 95.

⁹⁶ Rogers, 283-284.

Tractor production during the 1950s reached a record high that is still intact; in 1951 alone, 565,000 thousand tractors rolled off the assembly line. Production was at its highest level since 1940 and the lead up to World War II.⁹⁷ Farmers were seeing rapid change and growth, much different than the first fifty years of the twentieth-century, which saw worldwide war and depression. Ford Motor Company's 8N tractor, which caused so much controversy with Harry Ferguson, was the world's bestselling model of any tractor. The tractor was produced in Michigan from 1947 to 1952 and sold over 524,000 units.⁹⁸ Government programs that were implemented because of the economic downturn, such as the Agricultural Adjustment Agency and Rural Electrification Administration could now see widespread positive results. Both federal programs benefited rural farmers with economic stability and new opportunities with the introduction of electricity. The farms that had electricity would on average have a much higher income than those without electricity. Increased economic opportunities allowed farmers to have confidence in their purchase, and the Ford 8N tractor was the preferred choice by many.

The Ford 8N was the single best selling tractor unit of all time and kicked the door open for diffusion of the Ferguson System. The tractor's overwhelming popularity is a tribute to almost a decade of Ford engineering to perfect the Ferguson System and the tractor that utilizes it. The 8N's greatest improvements were: a more powerful engine, expanded transmission, and most importantly live-controlled hydraulics. On the 9N and 2N the operator would need to put the tractor in neutral in order to utilize the hydraulics.

⁹⁷ White, 72.

⁹⁸ Gibbard, 186.

The 8N could use its hydraulics while in gear and moving. This meant that a farmer could lower his plow into the soil while moving forward instead of coming to a complete stop like before. This was an industry first and an improvement upon the already industry dominant design.

The benefit of the tractor's diffusion to the majority of farmers was starting to pay in economic terms but also in warding off natural disasters. As of 1950 over 72.5 percent of farmers reported having tractors who lived in Great Plain states.⁹⁹ When the Dust of Bowl of the 1930s struck farmers, it added insult to injury as economic depression was in full swing. The cause was from multiple years of drought that would dry the plains and then high winds would kick up dust and have damaging effects. There were health warnings for those who attempted to go out in such dust storms. Acclaimed historian of the Dust Bowl, Douglas Hurt interviewed Alf Landon, the Governor of Kansas during the Dust Bowl. Hurt asked Landon about the differences between the dust storms of the 1930s and those of the 1950s:

We've had high winds and we've had drought since then, but the technology is different. Big machinery breaks up the soil deeper. The deeper plowed, it doesn't blow. In 1933 it was still the horse. Horses instead of tractors. Tractors were just in their infancy in the early thirties. All farm machinery basically was still horse drawn and, of course, that's all changing now. You know the difference that makes [with] quicker cultivation and harvesting and so forth. So farming has changed; processes have changed as much in farming as they have in industry.¹⁰⁰

To be clear, the successes of the 1950s more had to do with the number of dominant design tractors on Great Plains farms rather than the size of the machinery. As

⁹⁹ Haystead and Fite, 188. This statistic is an average between seven Wheat Belt States reporting tractors in 1950. MT (77.7%) ND (89.3%) SD (84.8%) NE (81.7%) KS (75.3%) OK (50.4%) TX (49.1%).

¹⁰⁰ R. Douglas Hurt, *American Farms: Exploring Their History*. (Malabar, FL: Krieger Publishing Company, 1996), 48-49.

of 1930 the same states reported having an average of just 28.5 percent of farmers owning tractors.¹⁰¹ That is an increase of forty-four percent in a twenty year period from 1930 to 1950, and the added diffusion was a major contributor to the drought of the 1950s not becoming the Second Dust Bowl.

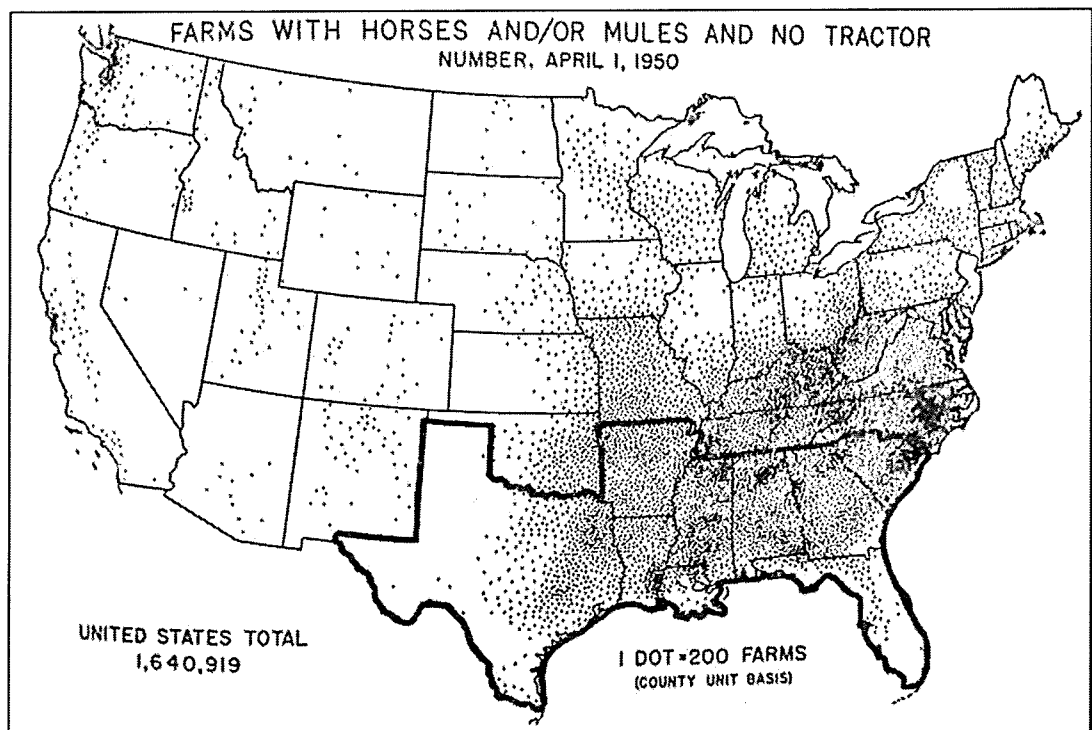


Figure 11 – Source: *The Agricultural Regions of the United States*, 117.

By 1950 the tractor market was booming with 46 percent reported having a tractor, an increase of twenty-three percent since 1940. However, diffusion of the tractor across the United States took much longer in some regions in comparison to others. The slowest region to adopt was the thirteen states in the Middle South and Deep South.¹⁰² Southern agriculture was plagued by a legacy of slavery; sharecropping and tenant farming still left many in bondage. In 1900, thirty-three percent of all white farmers and

¹⁰¹ Haystead and Fite, 188. This statistic is an average between seven Wheat Belt States reporting tractors in 1930. MT (36%) ND (43.8%) SD (37.2%) NE (29.3%) KS (35.6%) OK (11.4%) TX (6.4%).

¹⁰² Middle South and Deep States categorized by Haystead and Fite.

seventy-five percent of all black farmers were either sharecropping or tenant farming.¹⁰³ In the North those numbers were much lower. These poor sharecropping farmers did not have the means to mechanize or the will to do so. Slow adoption of the farm tractor for southern states is not unique to the tractor; the automobile also lagged in diffusion across southern states. In 1920 fourteen percent the residents of southern states reported having automobiles, up to just sixty-seven percent in 1959, while Northern states adopted much quicker from forty-eight percent to ninety percent, respectively.¹⁰⁴ Cotton was the king of cash crops in the South, and it was relentless with its maintenance to produce. The only way that large plantation owners could make money on the crop was by having cheap labor. The harvesting of cotton was still done by hand and required cheap labor. In 1950, only 20.4 percent of farmers owned tractors in the Deep South and Middle South.¹⁰⁵

A large reason for reduced numbers is due to sharecropping, but mainly because there was no point to mechanize. The tractor had been aimed towards soy, corn, and wheat farmers out on the prairies up until the 1950s. The job that the South needed done by machine was picking of the cotton, which was picked by hand until the mid-1950s. Government assistance did not help poor sharecroppers as much as it did for land-owning farmers. Farmers who took advantage of the Homestead Act were able to live the “American Dream”, but those in the South were still under economic bondage.

Southern states benefited the most with the introduction of the 8N. Most of the late majority and laggards lived in the South and were at the mercy of the cotton industry.

¹⁰³ Hurt, *Problems of Plenty*, 6.

¹⁰⁴ Gardner, 299.

¹⁰⁵ Haystead and Fite, 94. 1950 average farmers reporting tractors. Middle South: VA (24.2%), WV (14.2%), NC (21.7%) KY (22.6%) TN (21.9%). Deep South: SC (16.8%), GA (24.4%), FL (26.9%), AL (17.9%), MS (13.3%), LA (18.9%), AR (22.7%).

Cotton was one of the last crops that did not have an effective mechanized harvesting implement. Until the 1950s and 1960s cotton was still picked by hand, and this was labor-intensive work. The Ford 8N was reasonably priced at \$1,404 and offered an implement that could harvest cotton. The tractor market was starting to become saturated in the Corn-Soy Belt, but the cotton industry, for the most part, was still open for tractor marketing. Ford advertisements highlighted benefits such as increased production, time reduction, and increased profit. Their ideas spoke to farmers who were hesitant about mechanization, but needed to be convinced by other users to gain confidence before adopting.

It had become clear that the solution to the disastrous single-point hitch was the Ferguson System. Farmers across the world were starting to realize the potential of the farm tractor to do more than conventional farming had offered. It has been argued whether mechanization led to independence or bondage for farmers. The horse, with all its drawbacks, is an animal that is largely self-sufficient with its basic needs met. Heavy machinery on the other hand needs fuel, oil, but above all are the costly maintenance expenses. In terms of technical ability to solve machinery problems farmers would be beholden to local mechanics. The same could be said for animal power and the need for veterinarians their need on the farm. Veterinarians commonly visit modern farms but many early American farms had little access to medical care. This meant that families would need to provide care in-house or let mother-nature take her course for the animals. But for most small yeoman farmers the three-point hitch helped regain independent farming. Affordable mechanization was now possible for small farmers, the same as it had been for large farmers for decades. The tractor manufacturing of the 1940s would set

up the success of the three-point hitch into the 1950s and beyond. Mechanized agricultural industrial leaders would begin to accept that the dominant design for the farm tractor rested in the Ferguson System.

There Can Be Only One Dominant Design

The first non-Ford or Ferguson built tractor with a three-point hitch was the John Deere Model M in 1953.¹⁰⁶ The next to adapt to the dominant design would be the Oliver Farm Equipment Company in 1954 with their Super 77 model. Both of these tractors were released without protest from Ford/Ferguson and established an industry precedent. Farmers were thrilled with the sign of an industry standard developing. Implements for the three-point hitch had been around since 1939 and have a long life in the resale market. To this day hobby farmers still use these original implements built over half a century ago. When Oliver and John Deere adopted the three-point hitch, it was a major sign of respect for Harry Ferguson and the innovation that bears his name. John Deere and Oliver were companies with a rich agricultural history dating back more than a century, and they were now using an innovation from an Irishman and built by an auto-maker. It was clear that if an innovation is the best it does not matter who designed or adopted it, it will rise to the top and diffuse. The Ferguson System was a universal system for linkage, and that is exactly what the American farmer wanted. They wanted to buy implements that could work on all of their farm tractors. Farmers before this were forced into buying all of their products from one brand, and this did not allow enough options for farmers.

¹⁰⁶ Robert N. Pripps, *Standard Catalog of John Deere Tractors*, (Iola, WI: Krause Publications: 2011), 77.

The market share controller throughout the 1950s was still International Harvester, which sold slightly more than Ford Motor Company and their new 8N tractor. IH did not build tractors with the three-point hitch; instead they stuck with their market competitor, the two-point fast hitch. IH first started using the two-point fast hitch in 1951 with the introduction of the Farmall Super C. The two-point fast hitch is only the bottom two armatures forming a fixated drawbar. As the name would suggest, quick implement interchanging was the hitch's upside. This would help IH establish their industry standard that would be featured on all of their tractors and implements. The drawback to the two-point fast hitch was that it had a low pulling weight. For the small tractors of the time it was acceptable, but it became an important issue when the company started producing more powerful models in the 70s. A tractor pulling an implement with multiple plows would have difficult time as much of the pressure would fall upon the two-points of the hitch. The linkage was not able to withstand the pressure from the soil's resistance.

International Harvester introduced the two-point fast hitch because they felt their market control would be able to muscle its way to dominance, and because it was unclear how successful the three-point hitch would become. Before the Ford and Ferguson lawsuit the only tractors that had the three-point hitch were Ford's and Ferguson tractors. IH led most companies in market share so the two-point fast hitch was attached to the powerful agricultural brand. The marketing team at IH was behind this linkage system as well, but there was nothing that could be done to overcome mediocre technology. International Harvester was well known for its commitment to research and development and used their innovation as a way to separate from other competitors. Their victory over the Fordson in the 1920s is a prime example. The company was not producing superior

products, and that would be a trend that would continue until the 1970s. The two-point fast hitch was developed by IH and was featured exclusively on their tractors. For this reason, there was little chance that this system would prevail. IH had a strong market control for decades, but the Ferguson System was being used across the tractor industry by the late 1950s.

The settlement of the Ford *versus* Ferguson lawsuit weakened Ferguson's patent claims on the three-point hitch because a settlement was reached and not an official ruling. This meant that what Ford was doing was legal and did not infringe upon Ferguson's patents if they slightly altered their design. Other tractor companies quickly followed suit and introduced their own three-point hitches. The three-point system's legitimacy was solidified when other industry leaders started to adopt their own advanced linkage system. Tractor manufacturers know what the farmer wants, and it was clear that universal implements were a top priority. IH's two-point fast hitch was only available and used on their tractor while the Ferguson System was featured across multiple brands, and now featured on one of the top manufacturers, John Deere Company. The John Deere Company would design their own three-point hydraulic lift systems that did not use any of Ferguson's patents, but they did however use Ferguson's idea. The delay between the rest of the tractor industry and International Harvester to adopt the tractor's dominant design took almost two decades. There were many internal issues taking place within IH. They launched a campaign to enter the automobile industry by producing light-utility vehicles and trucks, which ended in failure. Chemicals introduced after World War II removed the requirement to cultivate weeds, thus rendering the Farmall less effective than it once was. The industry leader for decades was having a difficult time adapting to

the post-war tractor market. Finally in 1963, IH's Farmall 706 and 806 were available with an optional three-point hitch. The short lived linkage wars had come to an end as IH threw in the towel and adopted the superior three-point technology.

At last the tractor had reached all five social groups as the late majority and the laggards had finally adopted mechanization. The late majority of farmers were on the eve of adopting before the onset of World War II, so with plans changing adoption would need to wait until the late 1940s. Late majority farmers are those who are very skeptical and need to have overwhelming evidence to change their mind. These individuals adopt for many different reasons, but economic necessity and increased peer pressure contribute to the change. Rogers continues to expand, "Innovations are approached with a skeptical and cautious air, and the late majority do not adopt until most others in their system have already done so. The weight of system norms must definitely favor an innovation before the late majority are convinced to adopt. The pressure of peers is necessary to motivate adoption."¹⁰⁷ Tractors equipped with the Ferguson System were the most marketable tractors for manufactures, but also marketable through peer pressure. All of its advantages were difficult for the skeptics to continue to ignore. Many adopters needed to get their hands on a peer's tractor to demonstrate the potential upsides firsthand. Late majority adopters should not be blamed for a heightened level of skepticism. The early decades of mechanization were not appealing to those who could not see through the massive costs that would be incurred. The introduction of the Ford- Ferguson 9N did not have an immediate effect on this group because of the baggage associated with Ford and their less-than perfect Fordson. Once other industry leaders started to see the enormous benefits the skeptics now had little room to stand on for a defense. Laggards can be seen

¹⁰⁷ Rogers, 284.

as the simplest group, but also most complex for their reasoning for not adopting. They are marked by their stark commitment to traditional beliefs. Further explained by Rogers, “The point of reference for the laggard is the past. Decisions are often made in terms of what has been done previously, and these individuals interact primarily with others who also have relatively traditional values. Laggards tend to be suspicious of innovations and of change agents.”¹⁰⁸ Most marketers and economists are not too concerned with achieving adoption to laggards, since there are way too many variables in action. In the industry of mechanized agriculture the three-point hitch system is the only innovation that diffused across all social groups. The best way to convince laggards is to have the perfect product, and the three-point hitch system matched its lofty billing.

¹⁰⁸ Rogers, 284.

Conclusion

I think the major contribution of the TE-20 to farming has been [sic] that it has set the pattern for all tractors through its hydraulic system that virtually all implements now days controlled from the tractor seat. The interesting thing is [sic] the Ferguson System in some form or another is employed by every tractor maker in the world today.

– John Laughlin¹⁰⁹

The effects of the three-point hitch system are felt across the world to this day. The world's agricultural industry is now fully mechanized using specialized and technical equipment for every job. Endorsement from large tractor makers helped push the American Society of Agricultural Engineers (ASAE) into establishing a three-point hitch universal standard during the 1960s. They devised a system that had four different class sizes depending on the size of the tractor the hitch will be attached to. The CAT 0 is the smallest and CAT 4 is reserved for the largest tractors. These category sizes for the three-point hitch were adopted worldwide as part of the International Organization of Standardization in 1990. The three-point hitch is still recognized by farmers, the industry, and the ASAE as the dominant design of the farm tractor. Almost every large and small utility tractor built today utilizes the Ferguson System to link their implements. The world's complex food network is dependent upon the mechanization that allows for increased production and productivity.

When the Ferguson System was introduction in 1939 few could have anticipated the revolution that would ensue. Over the next two decades the Ferguson System would silence the competition and win the hearts of farmers across all diffusion groups. The revolution took several decades before its benefits could be enjoyed by all farmers. This innovation is more than the ball-hitch on the bumper of a pick-up truck. When the ball-hitch was invented it allowed the automobile to pull a trailer, which is something animal

¹⁰⁹ Jim Broadbent, 23:55 – 24:20

power could already accomplish. The three-point hitch system is more than a simple linkage mechanism; instead it is a fundamental change in how farm tractors conduct everyday operations. Revolution is changing the daily routine and adding new thinking into conventional ways. The Ferguson System brought hundreds of possibilities for implements that could be applied to more than the agricultural industry. Another sign of a revolution is when an idea or innovation transcends its specific use. The Ferguson System would absolutely qualify as a transcendent innovation as farm tractors were now seen off the farm performing industry demands. Without the increased tools provided by the Ferguson System it is highly unlikely the farm tractor would have any use off the farm as it had marginal use on the farm to start with.

The Ferguson System would have a much different story if it had the same creation and diffusion as the PTO. The PTO was introduced and within a short time all tractors would have an optional PTO installed. There were no competitors to challenge the PTO and the ideas of an auxiliary power source were presented decades prior, while the three-point hitch had one man (and his team) to promote and believe in the new idea. The three-point hitch is impossible to discuss without including Harry Ferguson in the discussion. For many years he was the only man who had faith in finding a solution to the mechanization problem. The man was a master promoter and would never stop networking to grow his business as the savior of mechanization. His connection with Ford was the epitome of two great men coming together at the right time to generate the product that mechanized agriculture needed desperately. Their deal would not be without its problems as the relationship would come to a messy legal ending, but Ford would never have succeeded without Ferguson and Ferguson needed Ford to take a shot on an

unproven idea. Their risk had worked as it proved to the world that the Ferguson System was more than a dream, but a functional idea that has the potential to transform the landscape.

The wide reaching effects of the Ferguson System are still making progress within the world of agriculture today. Almost every grocery store across the planet has crops that were grown on farms that used tractors equipped with the Ferguson System. The three-point hitch is not a common household name, but yet it does have personal connections to our lives. As the twenty-first century advances we continue to become increasingly disconnected with the origins of our foods. We understand that tractors work the field to bring us our food, but breaking down each aspect of productivity can be challenging. The Ferguson System brought mechanization from the dredges of the past and propelled agricultural productivity into the twenty-first century. Other aspects of biology and chemistry were keeping up at a steady pace, and it was mechanization that was lagging behind. The complete diffusion of farm tractors equipped with a three point would raise the production capability of mechanization. The resolution to the costly mechanization problem was not fixed using multiple solutions, but rather just idea, Harry Ferguson's three-point hitch.

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