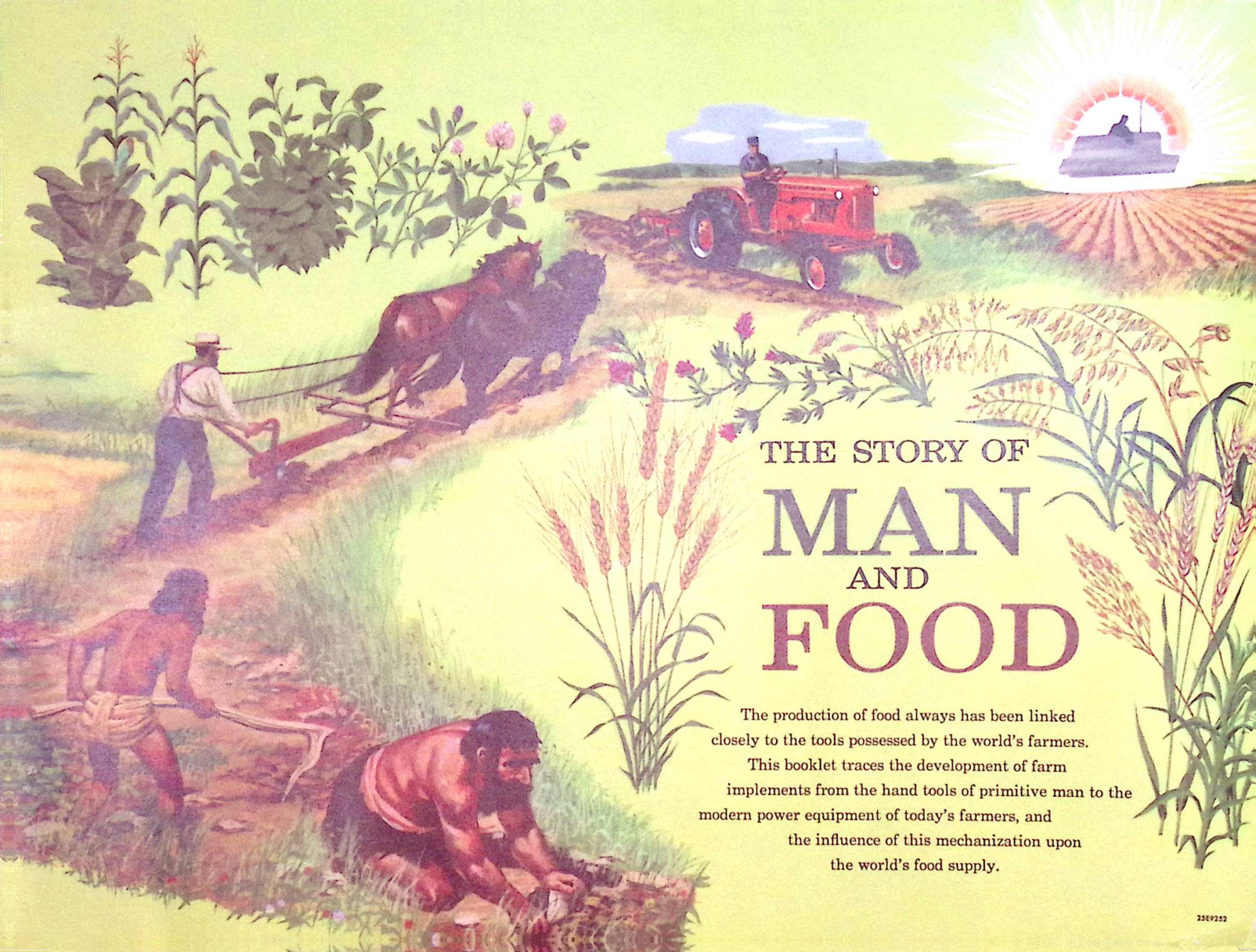

THE STORY OF MAN AND FOOD

The production of food always has been linked closely to the tools possessed by the world's farmers. This booklet traces the development of farm implements from the hand tools of primitive man to the modern power equipment of today's farmers, and the influence of this mechanization upon the world's food supply.

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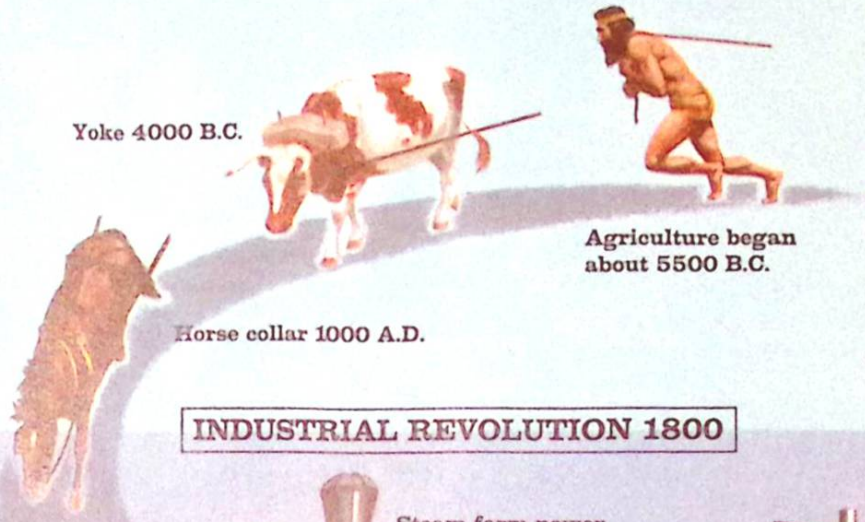
MAN AND FOOD

NO.1 EVOLUTION OF FARM POWER



Yoke 4000 B.C.

Agriculture began about 5500 B.C.

Horse collar 1000 A.D.

Through untold ages, man labored alone in the soil. About 5000 B.C. man learned that animals could provide the main effort in working the soil. For the next 6800 years, however, human and animal muscles remained his only sources of power.

Following these centuries of slow progress, a rapid series of events known as the Industrial Revolution occurred. This era began about 1800 and its first impact on agriculture was felt with the advent of the iron plow. Farm mechanization began by the late 1870's and it is from this date that we trace *Farm Power*.

Within one lifetime, there has been more progress in agriculture than during all the preceding centuries.

INDUSTRIAL REVOLUTION 1800

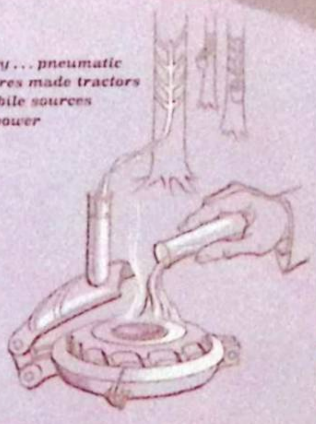
Steam farm power 1870

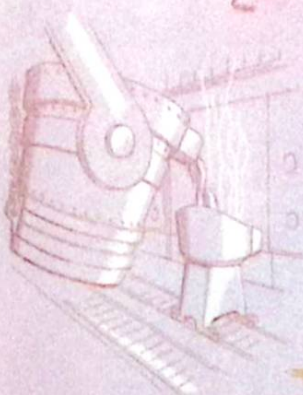
Gasoline farm power 1889

Kerosene farm power 1927 model

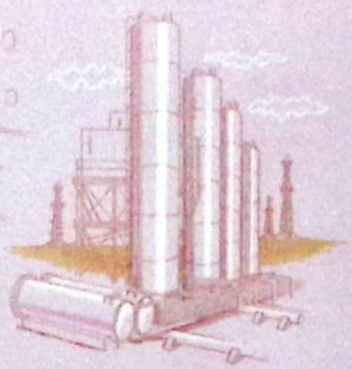
Heat Engines . . . basis for all modern farm power

Chemistry . . . pneumatic rubber tires made tractors more mobile sources of farm power





Metallurgy permitted the design of high output, lightweight engines



Gasoline, formerly a troublesome oil waste-product, was put to good use by the internal combustion engine, thereby starting a new industry

Diesel, L.P. gas, kerosene or gasoline engines power the modern rubber-tired tractor

Diesel farm power was first introduced in crawler tractors. Gas turbine power is now being tested

Evolution of Farm Power

In the beginning, men were foragers and hunters, who wandered wherever their search for food led them.

It was not until about 5500 B.C. that systematic agriculture came into being as a result of man's desire to gain some measure of control over his food supply, and to bring to an end the ever-present uncertainty of finding his next meal.

The processes of organized agriculture had their beginning when man became aware of the necessity for systematic soil preparation, planting, cultivating, and harvesting.

This was a great step forward. With the crude hand tools employed, however, only small patches of land could be prepared and planted to crops. Men, women and children slaved from dawn to dark in the bare hope that they might be able to provide enough food to sustain themselves. It was inconceivable to them that one man or family could ever produce more food than was needed for them alone.

Eventually, someone thought of using a domestic animal to replace human muscle for the arduous work of plowing. The use of animals was helped greatly about 4000 B.C., when the ox yoke was invented. This permitted the use of two animals. Further progress resulted about A.D. 1000, when the horse collar was invented. The horse, successfully harnessed, proved to be a much faster and more efficient draft animal than the plodding ox.

The introduction of horse power marked the beginning of a significant improvement in farming methods, which had been practically without change for 5000 years. From that time until as recently as 1920, the farmer relied principally on the horse as a source of power.

Mechanical farm power had its inception in the years between 1870 and 1880. In those years, the first steam tractors were developed. As these steam-driven tractors increased in numbers from the year 1880 to 1910, a new era in man's search for a better source of farm power began. The transition from animal to machine power has taken place within the span of one lifetime.

By 1902, the development of the petroleum fuel engine had reached the stage where it was adaptable to tractor use. These early petroleum fuel tractors left much to be desired. They were heavy, slow and clumsy, and their usefulness was largely limited to plowing and belt work.

In general, farm tractors fall into two classifications — the wheel type, and the crawler or track-layer type. The track-layer, as its name implies, lays its own tracks, or rails, mounted in chain fashion on broad steel plates, and rolls over them. The two long, broad tracks permit the crawler tractor to operate in mud, loose soil, and over rough ground to much better advantage than the wheel type.

The first patent on a crawler-type tractor was recorded June 11, 1850. Later, Benjamin Holt successfully demonstrated a steam tractor equipped with tracks instead of wheels. By 1907 a crawler tractor powered by a gasoline engine had been introduced. Crawler tractors equipped with diesel engines did not appear until sometime later.

During the period in which the crawler-type tractor was under development, the wheeled tractor had been undergoing refinement. Though greatly improved, the wheeled tractor was not allowed to travel over public roads because its steel-cleated wheels damaged road surfaces.

In 1932, a tractor with low-pressure pneumatic rubber tires was developed and introduced by Allis-Chalmers. This stride forward not only made it possible to transport tractors over hard-surfaced roads, but greatly reduced fuel consumption in field work. Public acceptance was rapid, and the rubber-tired tractor has completely replaced the steel-cleated tractor on farms all over the world.

More powerful and efficient engines have been developed to operate on diesel, gasoline, kerosene, alcohol, and liquefied petroleum gas fuels. Hydraulic systems have replaced hand levers for lifting and lowering plows and other implements. Power steering, more efficient brakes, and comfortable seats have made the operator's work simple and easy. Weight has been reduced to the extent that a 4000-pound tractor will do more work in a day than was possible with early tractors weighing up to 30,000 pounds.

Working parts previously exposed to dust and moisture are now completely enclosed in dustproof, oiltight cases, thereby greatly increasing their operating life. Selective gear transmissions provide six to eight speeds instead of one or two. The hand crank for starting the engine has been replaced by the electric starter, and electric lights for night operation have been added. Hundreds of other refinements have been made to bring about the operating efficiency, speed and usefulness which characterize the modern farm tractors of today.

Compiled by Allis-Chalmers Research Laboratories

MAN AND FOOD

NO. 2 TILLING AND PLANTING

Tilling and Planting — Past and Present

The tangled turf and crusted earth of the earliest fields were probably first attacked barehanded. The use of hand-held animal horns and bits of rock must have been looked upon as a great advance. But even with these aids, man continued to grovel on his knees when tilling the soil.

An improvement was made when it was discovered that the animal horn or piece of sharp rock, bound to a stick, permitted tillage when standing erect. This combined tool eventually evolved into a much larger tool made from a V-shaped tree limb, with one leg left longer to serve as a handle. It was dragged by hand to produce a shallow furrow, rather than swung like a hoe.

Because of its availability, wood remained the main material for plow construction through colonial American times. But pioneers who migrated to the plains states during the Westward Expansion, which began with the Louisiana Purchase in 1803, found an unexpected fault in their plows. The sticky, virgin soils necessitated constant scraping of the moldboards.

Steel-covered wooden moldboards were the first to scour and remain clean in rich soil. These were gradually replaced with all-steel moldboards after 1860. The development of the two-wheeled riding plow and its safer, more stable improvement, the three-wheeled plow, showed that a farmer could plow his fields without getting sore feet.

Cultivating fields was a very primitive operation until manufactured harrows gradually appeared. The brush harrow was common far into the 19th century. To make a brush harrow, the farmer had only to chop down a large bush or young tree, add rocks or a log for weight, and harness it to his draft animal.

Manufactured harrows with wooden pegs or iron spikes which penetrated more deeply were in common use by 1840. Spring-tooth harrows and disk harrows were in use by the end of the Civil War.

As knowledge of farming grew, it was recognized that soil fertility was not inexhaustible but must be periodically replenished. After the Civil War, a wagon-type manure spreader became available to return to the land the fertility which had been taken from it.

* * *

Discovery that a seed nourished in the soil could multiply itself was a discovery of greater significance than any invention of man. This simple process is the foundation for nearly all kinds of crop production.

Seeding remained a manual operation until far into the 19th century, when a workable grain drill was invented. This device, which sowed the seed much more evenly than hand broadcasting, came into general use by 1860. Modern grain drills plant seed in regularly spaced rows, instead of scattering it, and they immediately cover the kernels with a light layer of moist soil to promote early germination.

Problems of planting corn are somewhat different from those of planting small grains. Corn is usually planted one to several kernels at a time, at regularly spaced intervals and in rows varying from three to four feet apart. This allows for root growth and cultivation.

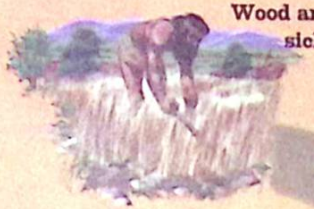
The American Indian planted his corn in small hills. He used his primitive hoe to open a hole into which he dropped several kernels. Hand planting of corn with the use of a hoe continued into the 19th century. A mechanical corn planter, patented in 1839, provided some of the features of modern planters. These have seed boxes with a revolving plate notched to accept the proper number of corn kernels. From the seed plates the kernels drop down a tube into a furrow opened to receive them. A covering device closes the furrow. Two-row, four-row and even six-row planters are now common.

After planting, small grains such as wheat require no further cultivation. Corn, however, must be cultivated several times to kill weeds, until the corn reaches a height where it would be damaged by further working. Corn cultivation 150 years ago was still a hand operation. The hoe was the only accepted cultivating tool until a one-horse, single-shovel cultivator was invented in 1820. Improvements converted this into a straddle-row, two-horse cultivator. This implement became popular by the 1870's because of its ability to cultivate both sides of the corn row at the same time. Two, three and four-horse cultivators were common in the Corn Belt between 1910 and 1924. Modern tractor-mounted cultivators, developed from these, will cultivate from one to six rows simultaneously.

The farmer knows the capabilities of his soil and treats it accordingly. With the modern equipment now available to him, he can prepare his seedbeds, plant and cultivate his crops in a manner calculated to produce the highest yields of which his land is capable.

MAN AND FOOD

NO. 3 STORY OF THE HARVEST



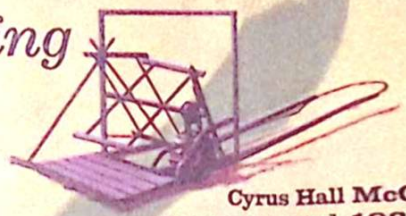
7000 years ago
Wood and stone sickle

Scythe and cradle introduced in U.S. between 1776-1800

Flailing
From Biblical days

Winnowing

Reaping

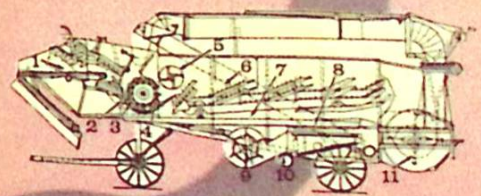


Cyrus Hall McCormick reaper patented–1834

C. W. and W. W. Marsh reaper patented–1858

Threshing

Treadmill power for stationary threshing machines–1850's



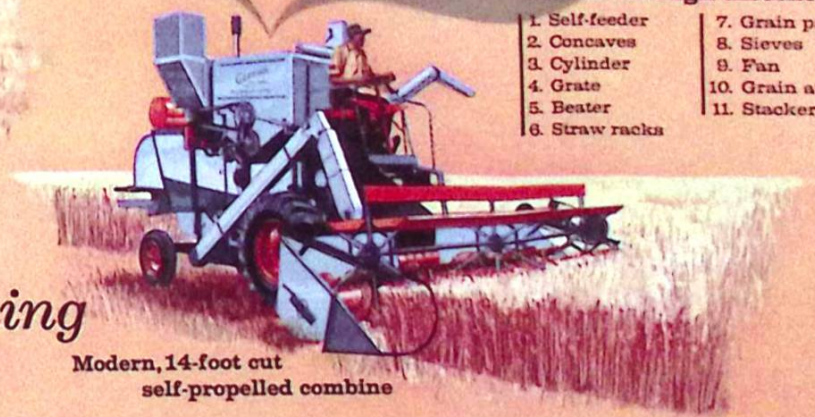
Section through thresher

1. Self-feeder
2. Concaves
3. Cylinder
4. Grate
5. Beater
6. Straw racks
7. Grain pan
8. Sieves
9. Fan
10. Grain auger
11. Stacker fan

Picking corn by hand faded when the 2-row tractor-mounted corn picker appeared in 1929

Modern, tractor-powered pull-type combine

Combining



Modern, 14-foot cut self-propelled combine

Story of the Harvest

Abundance or scarcity of food has always had an influence on trade, politics and warfare. A country that has large reserves of stored food is in an enviable position. A country without sufficient food for its people is likely to choose different politicians and change its government policies.

The sickle, the most basic of harvesting tools, in its earliest form was a straight rod with sharp flints set in a groove. It was developed into its present curved form in Egypt 4400 years ago. The curved sickle was a wooden hand-tool with flints placed at the important cutting sections.

Then came the scythe, which permitted man to stand erect when reaping grain. An improvement of the scythe, known as a cradle, appeared in the United States sometime between 1776 and 1800. It not only cut the grain stalks, but also gathered them into bunches ready for tying into sheaves.

The mechanical reaper, patented by Cyrus McCormick in 1834, required two men for operation. One man drove the horses while another walked along behind the reaper and raked the grain off the machine at proper intervals. A reaper invented by C. W. and W. W. Marsh in 1858 allowed two men to ride on the machine and tie bundles by hand.

Reaped grain was allowed to stand in shocks in the fields until it dried and ripened, then was flailed to beat the chaff and grain loose from the straw. The flail was a club attached to a long rod with a thong; it was in use from Biblical times until far into the 19th century.

It was necessary to separate, or winnow, the chaff from the grain after flailing the grain heads free from the straw. Winnowing was accomplished by repeatedly tossing a quantity of mixed chaff and grain into the air, so that the lighter chaff could be blown away by the wind, and the heavier grain kernels dropped straight to the ground.

Hiram and John Pitts, of Winthrop, Maine, were granted a patent on a threshing machine in 1837. A rotating cylinder with metal teeth forced the grain stalks against a corresponding stationary set of teeth. Most of the grain and chaff was thus beaten from the stalk.

The mixture of straw (stems), chaff and grain was then delivered to a vibrating rack with openings in the bottom, which permitted the chaff and grain to fall through onto a series of sieves. The vibrating action of the rack moved the straw onto a conveyor that deposited it in a pile a few feet from the machine. In the meantime, a strong blast of air created by a fan blew the chaff out the rear of the machine, while the grain kernels dropped through the sieves onto another conveyor and were delivered to a sack or a wagon. Thus, with this one machine, the work of flailing and winnowing was reduced to one simple operation.

The combine, or the combined reaper-thresher, as it was originally known, is a mobile version of the thresher with either a mower for cutting the grain, or a pickup attachment for gathering grain that had previously been cut and arranged in windrows for uniform curing.

Our more arid western states had generally accepted the combine in its larger forms by the late 1920's. In 1935, Allis-Chalmers introduced a small combine, designed to meet the needs of farmers with limited acreages of grains, beans and seed crops. This development brought national acceptance of the combine. The binder-thresher system of harvesting has since almost passed out of existence.

Corn produces more food than any of the other grains in the United States. This grain is native to the Western Hemisphere. Machines for the harvesting of corn were first developed in the United States to handle the large acreages of this crop. A system used for the harvesting of corn involves the use of a mechanical picker which is sometimes called a picker-husker. This machine snaps the ears from the stalk, husks and delivers them to a trailed wagon.

Another machine, the corn sheller, shells the kernels from the cob. Then the corn may be milled for mixing with other foods for balanced animal diets, or it may be prepared in many ways for human food.

A more recent development is the picker-sheller, which snaps, husks and shells corn in one operation as the machine progresses through the field.

With the modern harvest tools now available to him, the farmer can harvest his crops quickly at full maturity and obtain the greatest return for his effort and investment.

Marion County Farmer

WEATHER FORECAST

Weatherman Howard Johnston states that scattered showers 300 miles to the east have little chance of arriving here. Local crops, in good condition because of heavy early June rains, should be able to withstand another week or ten days of dry heat without damage.

Planes Save Crops . . . Dust Destroys Pests

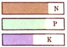
Joe Black, well-known local crop-duster, flew a "dawn patrol" Tuesday morning in his ancient biplane. His mission: destroy *Leptinotarsa Decemlineata*, known otherwise as potato beetle.

The potato beetle, not seen in either Marion or Everett counties for many years, had suddenly re-appeared and was causing severe damage. Absence of winds and heavy dew Tuesday a.m. made for ideal dusting conditions. The dust, a recent product of a western chemicals firm, proved to be the undoing of the beetles. Spot checks made in Ed Brown's field (town of Claymore), the first dusted, showed 100 percent success.

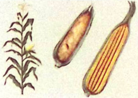
Black has been busy dusting fields since Tuesday and has finished hi[s] work in the towns [of] Claymore, Randall [and] Leatham. Two o[ther] crop-dusters who fl[y for a] down-state pest c[ontrol] company, have been [...]ing remaining port[ions] of Everett and Marion counties. If wind and moisture conditi[ons re]main favorable, [...] state that bla[...] both counties [...] complete [...] noon.

Ar[...]

Soil Tests Show Faults



A report on the Agriculture Experiment Station analysis of a soil sample taken from the field of Cal S[...] dale Towns[hip] Friday b[y] G. K. [...]



New Hybrids Developed

Recent products [...] breede[...] [ca]lled K-B2 by the seed [com]pany, was planted as directed. [...] what appeared to [...] start, the plants [...] do better than [...] [vari]eties in dry

CROP BOOSTER FOUND

A type of mold, first found in the Orient, caused abnormal stem growth of rice plants. Organic chemists have succeeded in isolating pure crystals of the fungus substance that affected plant growth.

Experimental use of a very dilute form of this material on wheat offers possibilities for better control of plant growth. Foreseen benefits could be control over stalk height and the amount of grain per stalk to contribute to easier harvesting.

RESEARCH WORKERS GETTING FACTS

[Y]our farm journal's [scie]nce reporter recently [sp]ent a day on a major [tr]actor manufacturer's [...]farm. The tests seen [...] show why tractors [are d]urable, safe, and [...]ved.

[...] tractors undergo[ing] [t]ests were new models soon to be in the dealers' showrooms. Every farm operation is duplicated in these tractor tests. Belt, power take-off work, and field chores were all represented. The men testing these shiny new tractors

(Turn to Page 18, Col. 1)

Chemical Engineer Offers Cure

In an interview Friday, at the Roe Chemical Laboratory in Easton, O. R. Prince stated that his firm's [...]

AGENT GIVES PLAN

Thursday evening, Agriculture Agent G. K. Boswell addressed Morton County Farmers at the Holbrook town hall. The main subject of his talk was a proposed cultivating system to make the soil retain more winter moisture.

Boswell's plan, which is similar to moisture conservation plans used in more arid areas, calls for the use of the "duckfoot" [...]

STRANGE INSECT ENTERS AREA

An insect not recognized by area farmers has been found in several isolated areas along state highway 71 in Ruston County. Specimens were gathered [...]

More Effective Crop Irrigation Shown

A mobile, diesel-driven [...] were demonstrated to a [...] M. B. Young, White[...]

Science Aids the Farmer

Today, the farmer has many silent partners. These are professional people engaged in services which ultimately help the farmer to improve the quality and increase the yields of his crops, to control plant and livestock diseases, to destroy insects, conserve his soil, and build up the fertility of his land.

Farmers have always been interested in the weather because the yield and quality of their crops depend upon it. Weather reports are, therefore, very important to the farmer. Modern advances in more accurate weather predictions include the radiosonde-carrying balloon and the use of radar. These devices, used in conjunction with other weather-predicting instruments and communications with distant weather stations, as well as reports from fliers, provide more accurate long-range weather predictions than were previously possible.

Some of the services available to farmers may seem remote, but are important. A man on skis high in a mountain range may not be a joyful winter vacationer, but a skilled snow surveyor taking measurements of snow fields. The purpose of his unusual work is to provide an accurate prediction of the quantity of irrigating water that will be available to farmers in the lowlands the following summer.

A man who works hand in hand with the farmer is the agricultural agent. He may recommend, in the event of suspected soil deficiency, that a soil sample be taken. This sample is forwarded to an agricultural experiment station or one of the state agricultural colleges. Here, a soil chemist makes a soil analysis.

The findings of the soil chemist, accompanied by his recommendations, are then sent to the farmer. If a chemical fertilizer is prescribed, another farm service would be called upon. The fertilizer would be based on a formula developed by an inorganic chemist in the laboratory of a chemical manufacturing firm.

Problems of insect infestation may require knowledge possessed by the entomologist. The identification of the crop-consuming pest, as well as plant and weather conditions, will indicate which insecticide should be applied. Insect pests in bygone years had to be tolerated, because means for their control were lacking. This resulted in heavy crop damage.

The practice of spraying crops, particularly vegetables and fruit trees, became common following World War I. Arsenate of lead, methoxychlor and Bordeaux mixture are among the standard insecticides and fungicides. Spraying and dusting equipment at present available ranges in complexity from manually operated or tractor-mounted sprayers and dusters to permanent plumbing systems with hydrants situated in convenient locations in orchards. The insect and fungus killers may be spread in dust or liquid spray form, either from the ground or from an airplane.

A curious aspect of the entomologist's and the insecticide chemist's work is that some insects tend to become resistant to insecticides. For this reason, war against these pests is a continuing one that calls for constant development of new, more effective insecticides.

Resistant strains in insects have counterparts in plants. Hybrids are strains of plants developed for special growing conditions, pest problems, and higher crop yields. The man who makes the hybrids available to the farmer is the seed producer. Employes of the seed producer, known as seed breeders, are the experts who develop these hybrids.

In this country, Luther Burbank began development of his bountifully producing plants in 1872. The present-day seed breeders and plant physiologists carry on this work to produce an ever-expanding list of hybrids. A new tool made available to the plant breeder by the atomic age is the radioactive tracer. Tracers allow the plant breeder to follow chemical elements through the complete plant cycle to determine plant requirements and limitations.

Tractor and implement manufacturers constantly strive to provide the farmer with the best of modern equipment. When the farmers' needs in equipment are determined, the many and varied skills of designers and engineers are called upon. They develop new machines and implements that will perform the farmer's work with the greatest ease, effectiveness and economy.

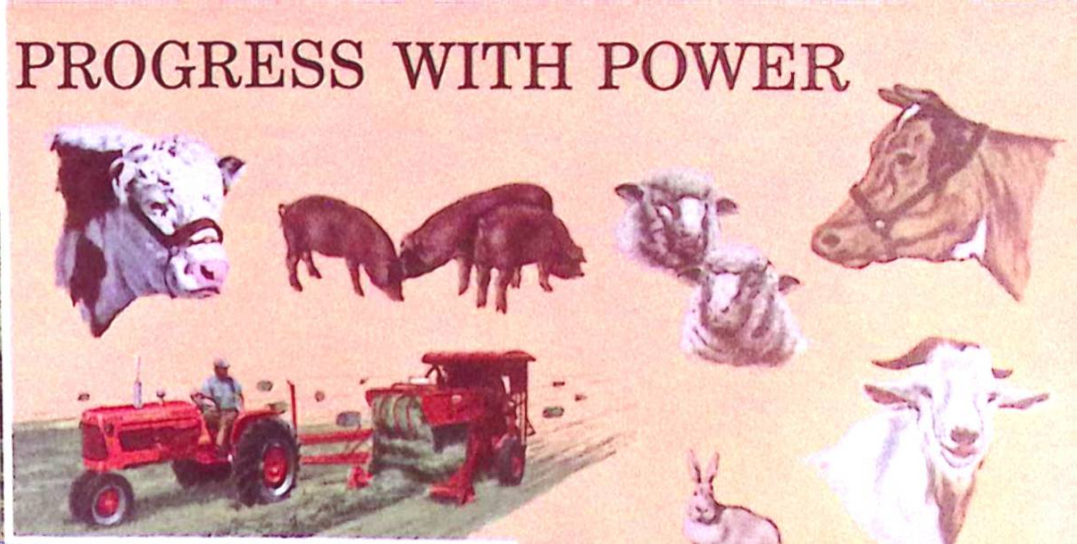
The research, design, development and manufacture of a new piece of farm equipment require skill and knowledge in such widely varied fields as engineering, metallurgy, and chemistry. Manufacturing alone may require the ability of such men as draftsmen, foundrymen, machinists, forge operators, and welders.

A view of a man on a tractor in a field far from cities may present a lonely picture, but this man is not alone. With him go the contributions of many skilled partners, in a joint effort to assure better crops from his land.

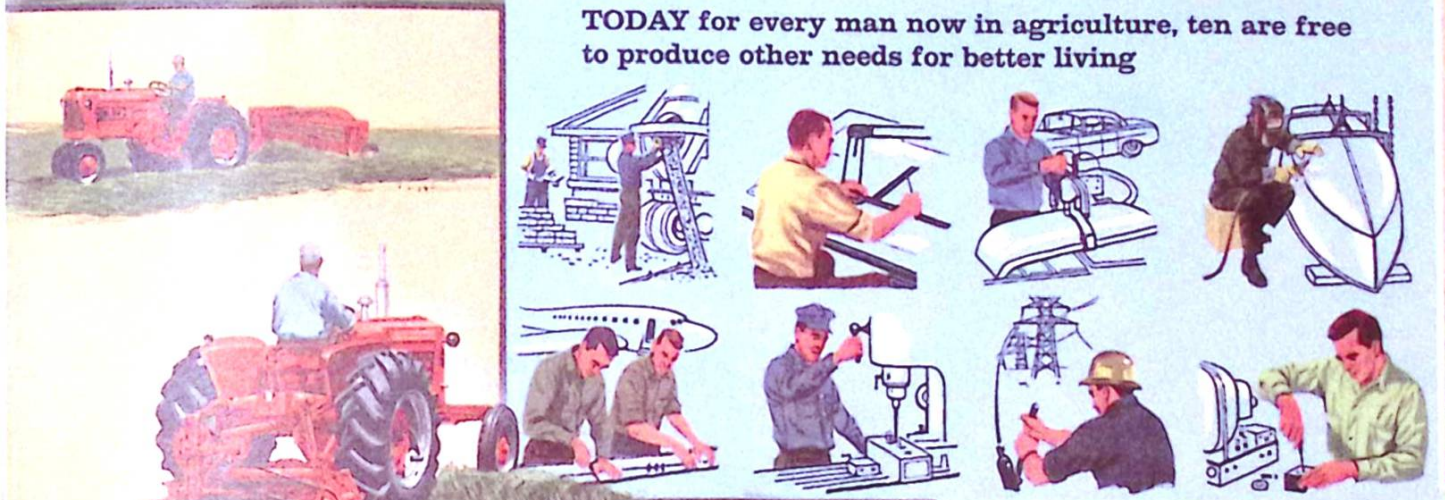
MAN AND FOOD NO. 5

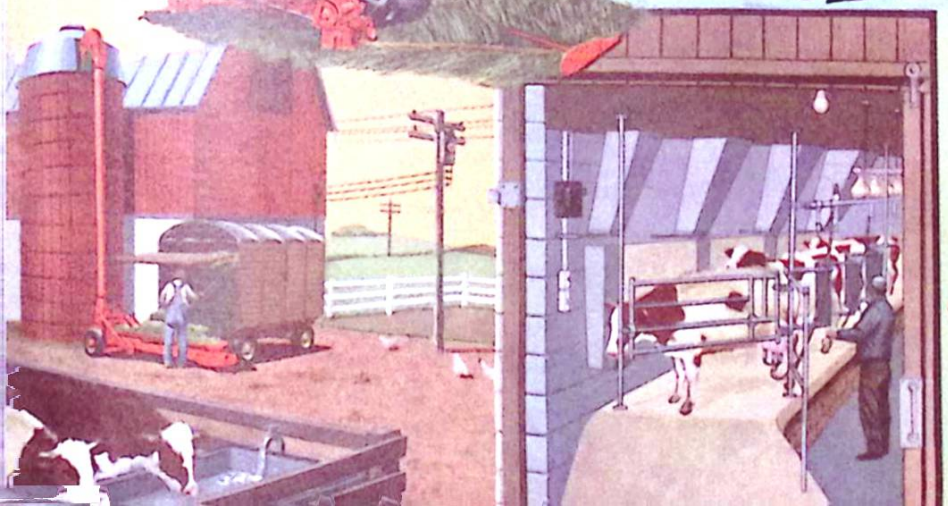
Until about 1830, most of our nation's manpower was required to grow food

PROGRESS WITH POWER



TODAY for every man now in agriculture, ten are free to produce other needs for better living





POWER GIVES US ALL MORE LEISURE LIFE

Progress With Power

Movies, television plays, and unrealistic novels of life in the early United States suggest that living was a simple matter of maintaining moisture-free gunpowder and an eye peeled for pesky redskins. These make exciting adventure yarns, but the people who write these stories sometimes tend to disregard facts for the sake of more colorful fiction. Life in the U. S. until after the middle of the 19th century would have little actual appeal for most modern Americans.

Life for an American on a farm before the beginning of mechanization was, in all likelihood, quite dull. The farm was an independent, self-sufficient unit that provided for the needs of the farm family, but very little more. The feeling of independence may seem enviable, but it resulted in a meager variety of foods, clothing, and other requirements. It is possible that there could have been trading between producers of wool and cotton, as an example, but poor communications and transportation made such bartering difficult.

Since the 1850's mechanization has changed the manner of living of the American population, both rural and urban. The most important factor in promoting the use of machines in our land has been and is the free enterprise system. None of the rest of the world's people have ever enjoyed equal conditions of mutual trust and confidence which are the lifeblood of free enterprise. In these slightly more than 100 years, efficient machines have made hand labor not only out of style but prohibitively expensive. To illustrate: a modern wheat grower would not suddenly stop his tractor in mid-furrow because he noticed that his shoes were worn out. Also, he wouldn't slaughter a steer, tan the hide and cobble his own shoes while neglecting his own specialized work. Such an absurdity would result in variety in a farmer's routine, but the shoes produced could easily cost several hundred dollars in loss of wheat, which is this farmer's cash crop.

The modern American is a specialist in his chosen field. Mechanization of our country has been responsible for the continuing trend towards specialty. The effect is efficient use of efficient machines. Today, ten of eleven men needed for farming in the 1850's are free to do other types of work.

Haying formerly took a great amount of effort. Men, boys and hired hands of neighboring farms worked together in a cooperative effort to get the hay cut, cured and stored as rapidly and easily as possible. A look at an early hay field would show many men with scythes. No matter how hard these men worked, their output was sufficient only to support their own families, with very little remaining to feed the non-farm population.

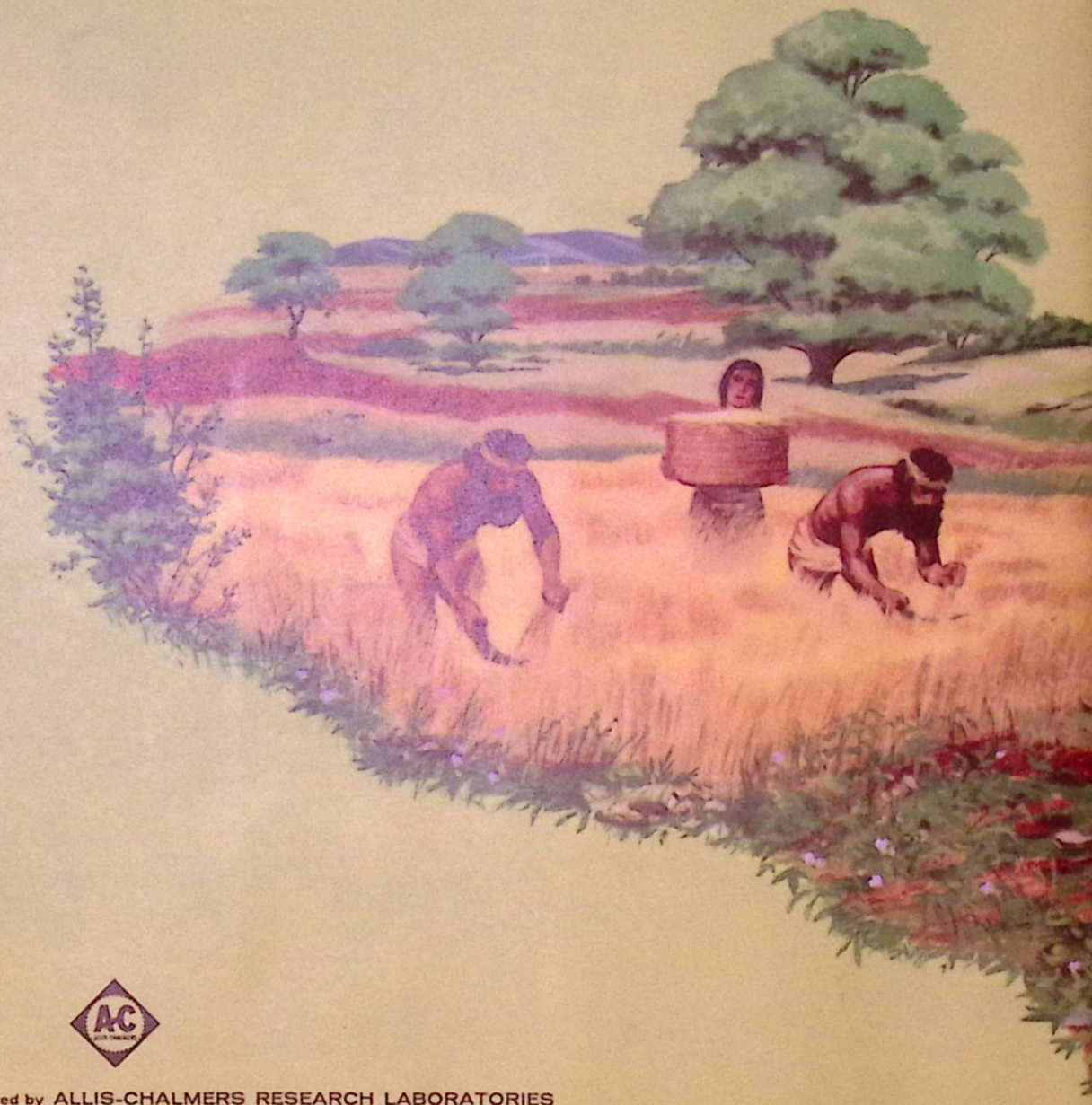
The very same hay field today might show one man on a rubber-tired tractor and mower, where 35 men had labored with scythes. He would be progressing at a speed at which none of the scythemen could have walked. In his wake would lie a continuous ribbon of drying hay which would subsequently be raked and baled by other fast-moving machines.

Hay may also be harvested as green silage, which is cut and chopped by a forage harvester. Then it is hauled directly to a silo where a blower will elevate it through a tube into the silo for storage as winter stock feed. Here again, machines have replaced muscles.

Men released from the heavy manual toil of yesterday's farms are now free to build or make the many necessities and luxuries we enjoy today. Yet our country is a greater agricultural country than ever before. And is, also, the greatest manufacturing nation the world has ever known.

If progress in general has been great, recent progress is sensational. Refinements in the mechanization of farming and manufacturing are constantly forthcoming. Automation, or the automatic operation of machines, and nuclear power are the newest of our important developments. Where they will lead us is unpredictable, but we may be sure that they will bring an even greater abundance of everything that people need and use in their daily lives.

We can all be thankful for the progress that mechanization in agriculture has made possible.



Compiled by ALLIS-CHALMERS RESEARCH LABORATORIES

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