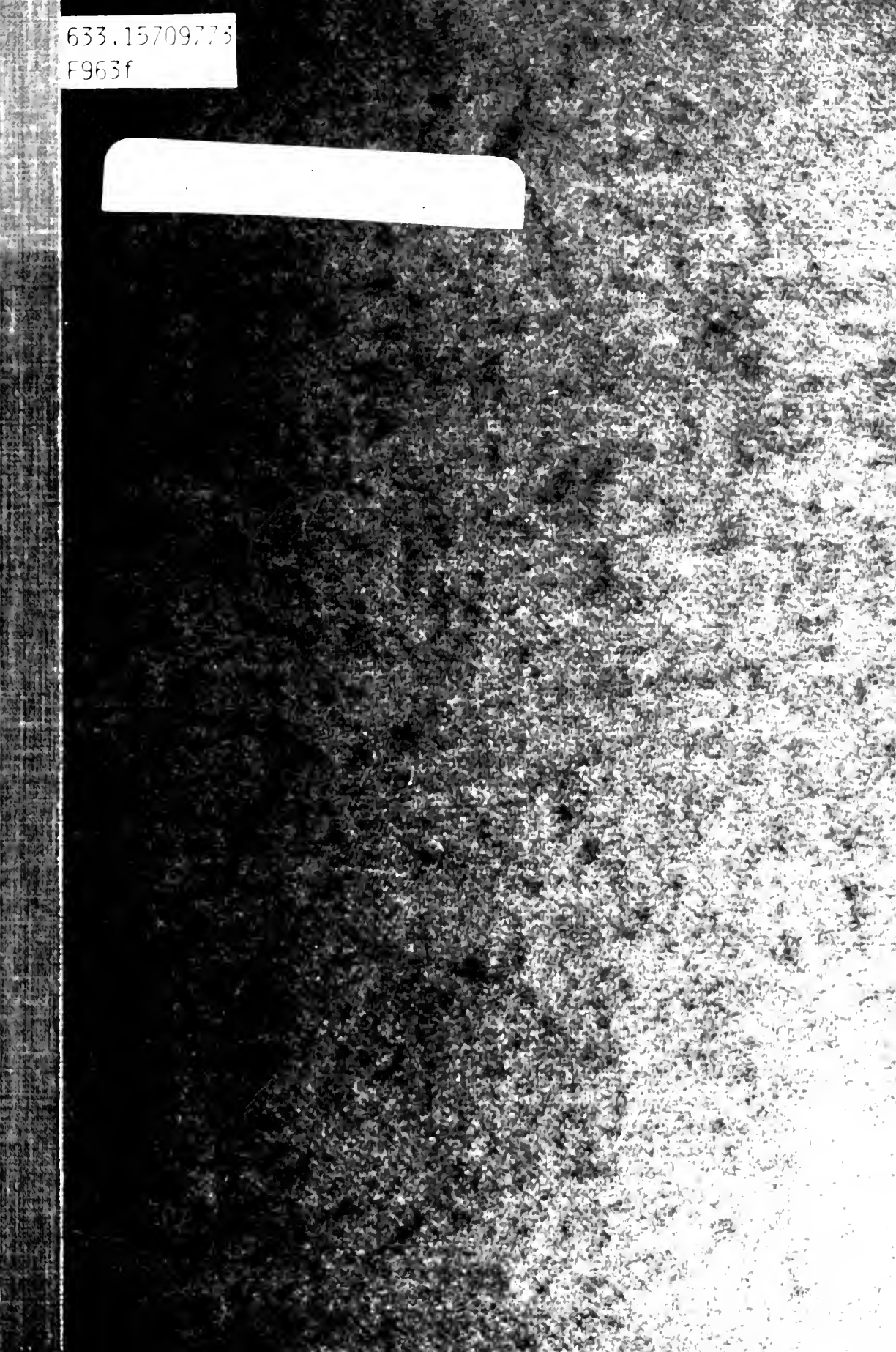


25th. ANNIVERSARY HYBRID SEED CROP

FUNK FARMS

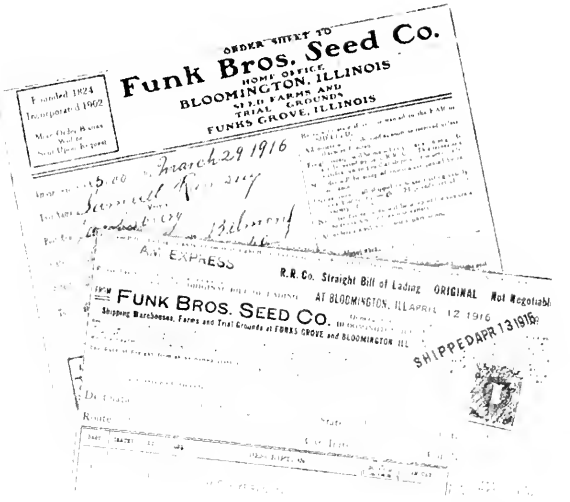
BIRTHPLACE OF COMMERCIAL HYBRID CORN

A History of Hybrid Corn Prepared by

FUNK BROS. SEED CO.

BLOOMINGTON, ILL.

First Funk Hybrid Sold in 1916



This original order and bill of lading showing a shipment of Funk's Hybrid in the spring of 1916 is the first documentary record of the sale of hybrid seed corn.

A QUARTER-CENTURY EXPERIENCE IN SELLING HYBRID CORN

The crop of Funk's "G" Hybrid seed which we are now growing will complete a period of twenty-five years in which Funk Bros. Seed Company has been privileged to bring to our farmer friends the marvelous advance of Hybrid Corn.

In the belief that all who grow hybrid corn will find much of interest in the history of it's development we have delved into our files and records. This is the story of a Quarter-Century of Hybrid Corn in commercial use. It is not a completed story. If I did not think that the next quarter-century will bring more startling developments than the past one I would not be true to the traditions of the Birthplace of Commercial Hybrid Corn.

E. D. Funk,

President Funk Bros. Seed Co.

CHAPTER ONE

PIONEERS OF SOIL AND SCIENCE

Isaac Funk, Founder of Cornbelt Agriculture; 19th Century Backgrounds of Genetics; Gene Funk Begins Breeding Corn on Funk Farms

Great events are long in their shaping. Despite its sudden rise to prominence, hybrid corn is no exception to this rule. If you would trace the origin of hybrid corn you must unravel a tangled skein of events and places that carries back more than a century.

In the year 1824 a young man, Issac Funk, halted his ox team, weary from a long march from Ohio. On one side Isaac beheld the primeval forests of Illinois, on the other the trackless prairie. Here he decided was the land he sought. Sheltered in the forests, pastured over the virgin prairies, Isaac's herds multiplied and his dream of a vast land and livestock empire began to take shape. In the river settlement an overnight ride to Peoria, Isaac met and won Cassandra Sharp, daughter of a Maryland pioneer. Farther distant, on the shores of Lake Michigan, he developed a market for his great droves of livestock and established Chicago as a packing house center.

And from the sturdy courage of this founder of Funk Farms, sprang a vast agricultural empire; a way of life that we now call Cornbelt Agriculture, built upon the combination of livestock and corn. For 40 years Isaac Funk ranged his herds, grew corn to feed his hogs and cattle and hewed from his efforts a princely estate that was to become the birthplace of hybrid corn. Intensely patriotic, fearless in his devotion to the land he had helped to build, Isaac Funk died shortly after the Civil War, leaving to carry on his tradition and his 22,000 acre Funk Farms, eight sons and a daughter.

Stockman, breeder and horticulturist that he was, Isaac Funk could not have foreseen the part the estate he created was to have in the shaping of a way of life for millions of farmers to follow him.

The original home of Isaac and Cassandra Funk, 1834, was the first dwelling built in Central Illinois.

Isaac Funk, founder Funk Farms, and Cassandra Sharp Funk.

Nor could he have anticipated that Funk Farms would one day see a great commercial application of principles of plant and animal breeding that at the time of his death were stirring the thoughts and the imaginations of men. For, while Isaac was hewing an empire from his crude surroundings, in far-away England a young scientist, Charles Darwin laid the foundations of genetics with publication in 1859 of his book, "Origin of Species," and an obscure Austrian Monk, Gregor Mendel, in 1866 proved that genetic characters are carried distinctly from parents to offspring and transmitted in definite patterns.

But just as Darwin and Mendel turned to horticulture and plant breeding to prove theories of evolution, natural selection, and inheritance, so scientists who followed them turned to the great domestic crops and livestock to apply the principles of research for which Darwin and Mendel and other discoverers laid the background. And still united in the common purposes of a pioneer family, Funk Farms furnished the ideal proving ground for science.

A grandson of Isaac Funk, Eugene D. Funk, grew up on his father's 2,200 acre farm in the heart of the Funk's McLean county holdings. From his father, LaFayette Funk, Eugene learned at first-hand the possibilities and the limitations of livestock and crop breeding on the vast farms. In 1888 he entered Yale University and studied for three years. Instead of completing his fourth year at college, however, "Gene" Funk went to Europe to study agriculture in England, Scotland, Belgium, Holland, Germany, France, Switzerland and Italy. Fired by the vision of the things he had seen, "Gene" returned to Illinois and organized the Funk family to carry on extensive work in seed improvement. Patterned after the Vilmorin family, a famous French Nursery firm, Funk Farms rapidly became the source of all that was best in farm seeds for the cornbelt.

Hardly was "Gene" Funk established in his new work when he made his first contribution to the crop that has been his business, his hobby and his very life. The year 1892 opened with a cold, wet spring. Gene Funk remembered a strain of corn developed by a farmer in Champaign County which matured

much earlier than surrounding varieties. He sent for a bushel of this early corn for late planting and planted it June 22, later than corn in McLean county had ever made a crop. The corn matured and the young seedsmen selected the best specimens from it for further propagation.

Stirred now by the report of W. J. Beal at the Michigan station, Gene Funk, sought to improve his early variety. Beal in 1886 had reported a strange phenomena "hybrid vigor" which resulted when he crossed two widely different varieties of open-pollinated corn and planted the resulting seed. So Gene Funk sent to Minnesota for an improved early corn, "Pride of the North" recently developed by W. M. Hays and C. P. Bull at the Minnesota station. The new strain and Funk's early selection were mixed and from the resulting cross Mr. Funk developed Funk's 90-Day.

In no sense a hybrid as we know hybrids today, Funk's 90-Day established the principle of combining unrelated strains as a step in improvement. Sold and successfully grown in Hungary, South Africa, Oregon, Arkansas, Canada and eventually all over the world, Funk's 90-Day blasted a popular belief of the time that seed corn was no good when shipped more than overnight from the site where it was grown.

So enthusiastic was the response given Funk's 90-Day and so vast the field of corn improvement opened by the techniques used in its establishment that the Funks' decided to devote their resources to the seed business. Funk Bros. Seed Company was formally incorporated in 1902 with Eugene D. Funk as its first president, a position which he retains today.

Mr. Funk's four sons who are associated with him in Funk Bros Seed Company.

LAFAYETTE

EUGENE D Jr

THEODORE

PAUL A.

CHAPTER TWO

THE TEN PRETTY EARS AND WHY THEY FAILED

Ear-to-Row Test, Pedigree Breeding Produce Line Bred Corn Families; Development of Hard Pollination, Detasseling

At the opening of the twentieth century attention of corn breeders was focused on ear type.

In this heyday of what he contemptuously called "the ten pretty ears", Mr. Funk was not only the largest commercial seed corn grower but the leading critic of contemporary corn selection methods. Mr. Funk early recognized that appearance of an ear of corn was no guarantee of its seed value. Funk Brothers maintained a large exhibit at the St. Louis Louisiana Exposition in 1904 to demonstrate that the popular show type of corn was not sound from the farmer's standpoint. With James Reid (developer of Reid's Yellow Dent) Mr. Funk set himself squarely against the then-popular rough starchy corn of late maturity, low vitality and inferior root development that was taking the blue ribbons at corn shows. The result was development of Funk's Utility Type Corn — smoother, medium dent, faster growth, firmer and more solid ears. Another decade was to pass before farmers generally, following the lead of experiment stations and farm bureaus, endorsed the utility ear.

Meanwhile Gene Funk had gone on to newer fields. He abandoned ordinary ear selection entirely to develop on a commercial scale a new system of corn improvement. For, in disapproving the value of the Ten Pretty Ears, Mr. Funk repudiated the whole principle of selection simply from either the ear or plant. The trouble with seed selection, he found, was that while the ear itself came from a good plant and carried desirable characters it would not reproduce those characters unless fertilized by pollen from equally desirable plants. In other words,

1. Dwight Funk posed for this picture of hand pollination taken in 1906 and published in De Vries' book, "Plant Breeding."

Another photo from De Vries' book showing crossing of corn families by detasseling alternate rows in a breeding block on Funk Farms in 1906.

Mr. Funk stated, merely selecting seed ears gives but one good side to a pedigree. It tells nothing of the pollinator or male parent.

To meet this limitation Funk Bros. Seed Company became the first corn breeders to engage in a large commercial scale in ear-to-row tests of seed stocks. This technique was carried out briefly as follows: Eighty to 100 superior ears of corn from outstanding plants were selected. Half the grain on each ear was shelled and planted in a separate row in the Row Test Blocks. Here the different ears competed and at harvest time the ten ears that produced the best plants and greatest yield were determined. The following year Funk's shelled the remaining one-half of the seed from these ten ears. The 10 winners were again planted in separate rows, but this time in a field isolated from any source of outside pollen. All of the even rows were then completely detasseled so as to receive pollen only from the odd rows. In this way the seed produced on the detasseled rows was sure to be a cross of the female plant on which the ear grew and the male plant which furnished the pollen. By this technique the seed in the breeding blocks was sure to have as a male parent, not just any plant but one of five definitely superior ears as proved in the yield tests of the year before. Truly, this was a tremendous step forward. The seed gathered from the detasseled plants was then multiplied by growing it in "multiplying fields" where it could cross-fertilize only with other superior plants. The resulting seed crop was then marketed to farmers.

Ear-to-row testing was hailed throughout the cornbelt as a tremendous advance in corn breeding. But its first exponent, "Gene" Funk was also its first critic. By 1907 Funk's had tested more than 20,000 fine looking ears in single rows. Pedigreed seed corn with five generations of pedigree records was being marketed by Funk's. Yields of this corn were significantly higher than had been secured under ordinary mass selection.

Yield tests were a part of the Funk Corn Breeding Program even before this photo was made in 1909.

But, Gene Funk maintained, the system did not sufficiently "fix" the characters for high yields. After the low producing bloodlines were eliminated by ear-to-row selection and the selected stocks multiplied, it was impossible to select further from the superior plants and improvement reached a ceiling. Reasoning from his livestock breeding experience, Mr. Funk decided the trouble was with the sire. Why, he asked himself, must I let all the male plants shed pollen while I take seed only from the best of the female plants that produce the best ears? Why not use only one sire to each female ear? Then the resulting seed will be fertilized by the best sires as well as borne by the best dams.

Thus hand-pollination began on Funk Farms in 1903. A crude process where ear shoots were covered by paper sacks and pollen gathered from paper bags sprinkled over them. This was the fore-runner of the system whereby more than 200,000 plants are now hand-pollinated each season on Funk Farms. And with hand-pollination Mr. Funk found that altho self-fertilization and inbreeding weakened the resulting plants, crossing of closely related strains tended to "fix" and intensify certain desirable characteristics. Out of these pollinations he began to develop what he called "Corn Families"; strains within a variety that were closely related by line-breeding. Beginning in 1903, hand pollination and crosses through detasseling in breeding blocks became the principle tools of the Funk Breeding Program. And in these "corn families" scientific investigators found the material to develop and prove revolutionary new breeding practices which were stirring the imagination of geneticists and seedsmen by 1910. Thus we reach the beginnings of the modern hybridizing technique which has revolutionized corn growing. And now, with Funk Farms right at the threshold of hybrid corn development it is necessary to integrate with the story of Funk Farms the corn breeding research carried out in other places.

CHAPTER THREE

SCIENTISTS TAKE THE CORN PLANT APART

Use of Corn in Genetic Research Establishes Inbreeding by Shull and East; Jones Combines Inbreds Into Hybrids

Because the corn plant is not only an important crop commercially but also a perfect specimen for study of breeding and genetics, Funk Farms at the outset of the Twentieth century became the rallying point, both for corn enthusiasts and for hundreds of geneticists and scientists from every related field. Dr. Hugo De Vries, the famous Dutch geneticist who re-discovered the Mendelian laws, established the principles of mutation and contributed immeasurably to the genetic understanding of plant breeding, was a visitor on Funk Farms in 1906 and devoted the greater part of the corn section of a book entitled "Plant Breeding", to the corn breeding at Funk Farms.

Astute scientist that he was, De Vries, though he recorded and photographed inbreds on Funk Farms, gave scant attention to the possibilty of further improvement by intensifying blood lines instead of by purifying varieties or mixtures by removing undesirable bloodlines. In De Vries' book as viewed today, however, one sentence stands out with significant prominence. "If," he wrote, "experience should prove that one year's self-fertilization is sufficiently harmless, the process of corn breeding could be shortened in the same way as the Svalof method may be considered as shortening the older process of breeding cereals. An experimental test of the Svalof method" (A Swedish technique of developing small grain varieties by pedigree breed-

Dr Hugo De Vries (left) on a visit to Funk Farms in 1906 with Lyle W. Funk (facing camera) J. Dwight Funk and President "Gene" Funk (right).

ing from one pure inbred plant and mutiplying the seed stock of this superior plant to the proportion of a variety), De Vries wrote, "would probably lead to some essential changes in the breeding of corn." No prophet ever spoke truer words than these!

Previous to his visit to Funk Farms, Dr. DeVries delivered the principle address at the opening of the Carnegie Institution for Experimental Evolution at Coldspring Harbor, New York. In this new institution devoted to genetic research, G. H. Shull in 1905 began inbreeding corn. This, with inbreeding started the same year by E. M. East at Illinois and continued at Connecticut, is the first record of inbreeding corn by direct self-pollination. Both East and Shull, however, were botanists interested mainly in the mechanics of genetics. Corn served as their vehicle just as Mendel had used peas and De Vries utilized the evening primrose on which to prove his theories. Nevertheless, their results, when reported in 1908 and 1909, aroused interest among their associates and both East and Shull turned to Funk Farms for further substantiating data on the phenomena of hybrid vigor which they had observed in combining inbred lines.

In a letter to E. D. Funk in 1914, Dr. Shull urged continuation of work in crossing "corn families" which Funk's were conducting. While predicting great things from the hybrid vigor generated in the cross, Shull apparently visualized it as a cross between closely linebred varieties—not between self-fertilized inbred lines. There are many reasons for this conception, chief among them the practical difficulty of multiplying seed stocks of inbreds to make the crosses and the many weaknesses of the inbreds developed up to that time.

It remained for a follower of East at Connecticut, Dr. D. F. Jones, to suggest the method of crossing two inbred plants then crossing the resulting single cross with another single cross, similarly built from two other unrelated inbreds.

This double-cross containing four inbreds in its pedigree is the pedigree combination used in practically all commercial hybrid strains of today. With the ease of obtaining seed from these double-crosses, hybrid corn as we know it today, was ready for a trial on an experimental scale. Jones with H. K. Hayes, who worked at Connecticut and then went to Minnesota, reported the new method. A cross of four of the early inbreds was put together and the seed was tested in Ohio and other cornbelt points. However, the hybrid was several bushels under the good open-pollinated in yields, it was of mixed color due to use of two white and two yellow inbreds in its pedigree and it lacked resistance to disease and insect hazards of the cornbelt. Not until several years later when inbreds were developed for the cornbelt at Funk Farms, was hybrid corn to receive a real reception in the cornbelt. The story of the origin of commercial cornbelt hybrids is the story of that development and of the man who brought it about on Funk Farms, Dr. James R. Holbert.

Dr. J. R. Holbert, Plant Breeder for Funk Bros. and originator of more successful hybrids than any other man.

CHAPTER FOUR

A MAN AND AN IDEA MAKE AN INDUSTRY

Dr. J. R. Holbert Builds the First Successful Crosses and Commercial Hybrid Corn Is Born On Funk Farms

Study the highlights of America's agricultural progress and you find that every sweeping development results from a background and a need brought to fruitation by some leader. The miracle of hybrid corn is no exception. What John Deere with his steel moldboard plow was to the prairies, what Cyrus McCormick and his reaper brought to the plains, what the Funk's and other midwestern pioneers built into a cornbelt agriculture . . all that and more has James Ransom Holbert given to the greatest agricultural revolution of our time . . . . . Hybrid Corn.

A Hoosier farm boy, hoeing his father's Indiana cornfields when Shull and East were beginning their inbreeding experiments, Jim Holbert is of the stuff from which agriculture draws its strength. With the unbounded energy that has characterized his entire career, Holbert astonished his instructors at Purdue University with the diversity of his interests and the thoroughness with which he tackled each problem. From his course in crop breeding at Purdue, young Holbert branched out into fields of research unexplored at that time. Working independently in the laboratories and fields, seeking the answers to problems still unprobed, even as an undergraduate he was a respected fellow-worker in the Purdue Botany Department

It was this insatiable curiosity that drew Jim Holbert to the magnetism of Funk Farms. Deeply impressed by the enthusiasm of the letters with which the unknown Purdue student bombarded him, E. D. Funk offered Holbert an opportunity to get a taste of practical plant breeding by spending his summer vacations on Funk Farms. What a team they made, the skilled experienced seedsman and the young, talented student! No phase of Funk

Farms operations was closed to Holbert. No project which interested him was denied his researches. And when graduation in 1915 released Jim Holbert's full talents for his chosen work he thrilled to the magnitude of his first assignment from Mr. Funk. Brief and to the point as he has always been, Gene Funk gave his pupil a lifetime assignment in the one order: *"Breed a better strain of corn than any we have ever produced."*

Jim Holbert lost no time in tackling his job. With a speed that seems inspired in looking back on his first work, he settled quickly on the basic techniques. Spending the summer of 1915 in Minnesota on an extensive cereal disease survey, Holbert discussed his problem with H. K. Hayes, the great plant breeder who had worked closely with East and Jones at Connecticut and was then carrying on inbreeding work at the Minnesota station. "If I had to improve corn and do it quickly and effectively Hayes advised, "I would start with inbreeding."

The fall of 1915 found Holbert back at Funk Farms. Without waiting for the next growing season he went to work. From the great seed fields of Funk's Yellow Dent he plant-selected several thousand ears. The best 1200 of these were shelled and put in envelopes. Half of the seed was put into ear-to-row tests in the standard technique. Holbert, though, found that from 1200 ears a mere two dozen were the outstanding yielders. Uniformly medium dent and all outcrosses of linebred "corn families" in the Funk's Yellow Dent variety these 20 ears formed the foundation of Funk's 176A Yellow Dent, which, introduced in 1917, far excelled any variety established by prior methods.

Even before this, though, Jim Holbert was seeking a more direct method of fixing the characters he sought in the new strain of corn. In his summer vacation work he had found a number of "corn families" developed by Funk's that were remarkably fixed in characters. So nearly pure were these line-bred families that they exhibited many characters which breeders have subsequently learned emerge only after three to four years of direct inbreeding. In the closely-bred Funk's 90-Day families, Holbert made a number of crosses. At the same time, 1916, he made 30 self-pollinations in Funk's 90-Day and Funk's Yellow Dent. These inbred lines were then combined in experimental crosses. Funk's 329 was an immediate outgrowth of these hand-pollinations between line-bred families. It was the first variety ever established by controlled cross pollination of two families. Neither family was inbred as closely as is done in self-pollination, as it is practiced today, but they had been purified to a remarkable degree by a long period of line-breeding. Funk's 329 outyielded its parent strain, Funk's 90-Day, by 20 bu. per acre and showed vigor and uniformity that was, for the period, truly amazing.

Carrying his crosses of line-bred families even further, Holbert with Mr. Funk in 1915 completed

This root pulling machine to test root systems played an early part in putting "Standability" into hybrid strains.

a cross of three varieties, Leaming, Funk's 90-Day and Funk's Yellow Dent. The three line-bred families from three varieties produced a hybrid of wonderful vigor. Sold in 1916 it was first hybrid corn ever marketed commercially. However, the lines were not sufficiently inbred and tested to use successfully, and Jim Holbert turned again to the inbreds that he was developing from the self-pollinations made in 1916. By 1918 Holbert had produced enough seed of better-looking inbreds that he could look forward to growing a hybrid crop big enough to provide a real test of the new technique.

Jim Holbert smiles wryly when he recalls that first test. "I was so sure of myself," he relates, "that in 1918 I asked Mr. Funk to reserve a 40 acre field for the 1920 season. All went well in 1918, the first season, and the inbred ears were multiplied by hand-pollination to furnish enough seed for an isolated breeding plot of two acres in 1919. Into this two acre plot went the two inbreds in alternate rows. Then disaster struck! The summer was hot and dry and the pollinator inbred "folded up"; failed to set pollen and only enough single-cross hybrid seed was produced to plant 20 rows of the field that was planned for 40 acres."

These 20 rows, however, were enough to prove Holbert's work. The amazing hybrid single-cross drew admirers from all over the corn belt. Delegations from universities admired the corn. Many predicted that the new variety from this seed would sweep the cornbelt. Few paid much attention to the drouth-stricken nubbins from which Holbert and Mr. Funk told them the crop sprung.

For 25 years every Funk's Hybrid Seed Ear has come from a plant carefully detasseled by hand.

The pollinator parent of that first hybrid field has since gone the way of thousands of weak inbreds that perished for every strong one that has survived. The other inbred, though, is the same Inbred A that is still used in good hybrids over the cornbelt. With Inbred A the following year, Holbert made a three-way cross using Inbred B (since dropped) and Inbred L developed from the Leaming variety and still used in hybrid pedigrees. The crop was a success and the use of single crosses was proved. So it remained only to combine inbreds into two single crosses and the resulting singles into the double cross. Commercial hybrid corn had become a reality.

Double-Cross hybrid, known as "Pure Line Double Cross 250" was sold commercially by Funk Bros. beginning in 1922. By 1926 it was proved through three years (no Funk Hybrid, either then or now, has been offered except experimentally until proved three years) and became the leading item in the Funk Farms line of seeds. You will find Double Cross 250 in the 1926 Funk catalog where after two-years' notice it was introduced to commemorate the twenty-fifth anniversary of the incorporation of Funk Bros. Seed Co.

Pure Line Double Cross 250 was followed inevitably by better hybrids. Many readers will remember Funk Hybrids 517 and 365 which supplemented 250 during the twenties. More will recall Funk's 220 and 206 which emerged just in time to meet the challenge of the drouth years of 1934 and 1936 and perhaps, more than any strains before or since, established **hybrid corn as an** essential of good farming practice. These of course were followed by the Famous "G" Hybrids that each year are further improved for the benefit of the Corn Growers of America.

CHAPTER FIVE

THE TWENTY SICK EARS AND WHAT THEY TAUGHT

Corn Disease Project Unites Research Forces At Funk Farms; Proves Superiority of Hybrid Corn Breeding

Without the story of "The Twenty Sick Ears" it is improbable that the story of hybrid corn could be written as triumphantly as it can be today. For, from this crushing blow which fell on Funk Farms in 1917, evolved the cooperation of Funk Farms, the United States Department of Agriculture and the State Experiment Stations that eventually led them to pool their resources in the improvement of hybrid corn.

For more than 20 years preceding, Funk Bros. Seed Co. had employed the germination test to eliminate from seed corn any ears that contained kernels either dead or lacking in vitality. Mr. Funk however, felt that the germinator could do more than determine whether corn would grow. There should be, he reasoned, a definite correlation between seedling appearance and field performance. In attempting to work out this correlation, Mr. Funk soon found that corn failures in the germinator and in the field exhibited the same discolorations and unthrifty appearance. Accordingly Funk's embarked upon a program of carefully selecting only seed ears that produced clean healthy sprouts on the germinator and discarding any ears whose kernels were discolored and whose sprouts rotted on the germina-

Arthur Funk reading germination test and telling assistant which ears to save. Photographed in 1917.

tor. Thus began ear testing for both germination and freedom from molds and rotting.

Not yet were these molds and rots considered due to anything more than the natural decay of dead or dying plant material. Strong and vigorous kernels grew clean seedlings; kernels from weak ·s failed to grow and when growth stopped, rot l mold started. This was the hypothesis on which unk's and other corn breeders conducted their germinator tests.

Though this germinator test was operated without knowledge of the fact that these rots and molds were due to the presence of specific and infectious corn disease organisms, ear tests in the germinator produced results because the tests eliminated diseased kernels. But corn diseases continued to multiply and, still unrecognized, to infect healthy plants.

Funk's were germinating hundreds of thousands of ear samples in the spring of 1917. For some unknown reason great blocks of ears were being discarded as trays and sections of the germinator turned out seedling failures. Then, one fateful spring day, an employee called Mr. Funk's attention to the "Twenty Sick Ears." On a tray which had contained a moldy seedling in the preceeding test, almost all the seedlings were covered with mold, kernels dead, rotten and discolored. Immediately Gene Funk checked the ears from which the kernels came. He found them to be of the utility type, supposedly vigorous as contrasted to weak, chaffy ears. But these supposedly healthy ears were germinating weak seedlings.

Then Gene Funk had an idea. He ordered a section of the germinator torn down and rebuilt with entirely new materials. New sawdust was placed in new trays. Fresh muslin was cut from a bolt and the twenty ears were retested. Every kernel sprouted and grew. Among them there was not a trace of rot or a speck of mold. Suddenly Gene Funk realized that those supposedly irrelevant molds and rots might be the root of the whole trouble. They were transmitted from sick to healthy corn just as surely as hoof and mouth disease infected healthy herds from diseased cattle. But, Gene Funk knew, this corn field plague could not be stopped by sending government inspectors through millions of acres to eradicate diseased plants and disinfect fields. And with corn diseases widespread, apparently no means existed to protect healthy seed and to guard against disease outbreaks in America's greatest cereal crop.

America was at war and Gene Funk visualized a plague stalking the cornfields and taking a toll in famine comparable to the great influenza outbreak of that time. Speedily he bundled the "20 Sick Ears" and their records together. Holbert and Mr. Funk took their records to Purdue where, as an undergraduate, Jim Holbert had prepared a thesis on diseases of oats. Purdue scientists were alarmed. Then Mr. Funk took his exhibit to Washington where he then served as a member of the food

The United States Department of Agriculture Laboratories at the Corn Plots on Funk Farms

administration. Senators, scientists, men high in the councils of the nation, heard the story of the "Twenty Sick Ears." When Gene Funk left Washington he had obtained the appropriation and the enabling authorizations for an investigation of corn diseases under the Bureau of Plant Industry.

Funk Farms with its great mass of research and factual information was selected as a field station for the investigation. Jim Holbert, who had headed Funk's research was loaned to the U. S. D. A. with his farm facilities by Mr. Funk to study the problem. As Agronomist in the U. S. D. A., Jim Holbert continued his work. Allied with him now were the outstanding scientists of the country.

Soon Holbert and his associates had identified, classified and determined partial control measures for eight distinct and separate diseases of corn. Twenty per cent of the corn crop, field tests proved, was being lost by disease. But not in new germinator techniques, not in field sanitation, not in seed treatment, did Holbert find his greatest weapon for reducing the inroads of disease. No, he discovered that among thousands of lots sampled he had in those precious inbreds developed at Funk Farms, characters for disease resistance that defied every degree of infection and that carried this disease resistance over into hybrid corn combinations.

With the resistance of hybrid corn to diseases taken for granted as it is today, it is difficult to realize the impetus that the disease-resistant properties gave to hybrid development. Under the common banner of the United States Department of Agriculture and it's far-sighted chief, Dr. Wm. A. Taylor, federal, state and private breeders began to exchange inbreds and to attempt combinations with stock supplied by co-workers. Into one project were gathered inbreds developed by Holbert and other workers. Without this free interchange of ideas, results and materials, Holbert says, "The hy-

These men discovered corn diseases. Left to right: Dr. Holbert, Eugene D. Funk and Dr. A. G. Johnson, U.S.D.A., pathologist for the Corn Disease Research on Funk Farms.

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brids of today could not have been made. No one had a sufficient number of good inbreds to do the job alone." And, characteristically, it was Jim Holbert who contributed the lion's share of the ammunition for the job. Into hybrid combinations went his original inbreds A and L. To them he added K, 90, Hy, R4 and other mighty sires and dams of corn renown that now help to make up the pedigrees of the majority of the best hybrid strains.

By 1936 hybrid corn had arrived. Approximately 5% of the corn acreage in the great corn states of Illinois. Indiana, and Iowa, was planted with seed that defied adverse weather, resisted disease and insect pests and produced 15 to 30 per cent higher yields than the best open-pollinated. The pioneering job was done. Gene Funk's fellow farmers had shared in a generous measure the resources of Funk Farms and the genius of Dr. Holbert.

So with the approbation of his colleagues, Dr. Holbert resigned his post as Senior Agronomist of the U. S. D. A. and accepted the vice-presidency of Funk Bros. Seed Co. The field station was discontinued and since that time new inbreds and Improved, Strains of original inbreds developed on Funk Farms have been used exclusively in Funk's "G" Hybrids. The greatest tribute to the continuing superiority of Dr. Holbert's research is the fact that, twenty-five years after they bought Funk's first hybrid, leading farmers of the cornbelt have turned to Funk's "G" Hybrids to get the full benefits of Dr. Holbert's genius on more than two million acres of corn planted in Funk's "G" Hybrid Seed.

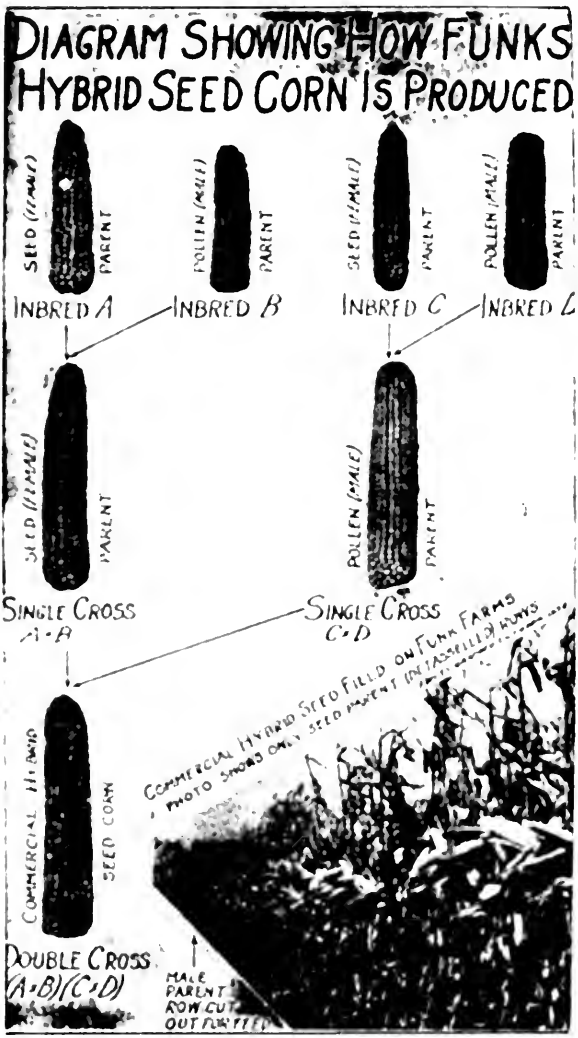
CHAPTER SIX

HYBRID CORN OF THE PRESENT

How Hybrids Are Bred, Produced and Processed by Funk Bros. Seed Company and Associate Growers

Stripped to its essentials, the breeding of hybrid corn consists of three steps, beginning with an ordinary or open-pollinated corn plant.

First, the superior open-pollinated plant is selected and self-fertilized by pollinating the silk with pollen from the tassel of the same plant. The same process of self-pollination or inbreeding is repeated on those plants from the inbred ear which exhibit desirable characters. The inbreeding is continued for five to seven generations. By this time, if the plant originally selected happens to be one among thousands whose germ plasm is sufficiently good to "fix" superior performance in hybrids, then the in-



This diagram shows how four inbreds are combined into two single crosses which are then planted in alternate rows to produce the double-cross seed which the farmer plants.

bred is used commercially. With each succeeding generation of inbreeding it will have lost vigor but it will have gained amazing uniformity and ability to transmit its characters into crosses.

The second step is to make a single cross of two inbreds developed by this process of self-pollination. These two inbreds are crossed, first experimentally by hand-pollinating the shoot of one inbred with the pollen of another. If the cross is a success it is then duplicated on a commercial scale by planting the two inbreds in adjacent rows and detasseling the female or ear parent so that its ears are pollinated only by the male or pollinator parent. This single cross or foundation seed, as it is called, is used in the production of commercial hybrid seed corn. The single cross gains amazing hybrid vigor while retaining the purity and desirable characters of the parent inbreds.

In the third step which produces the hybrid seed which the farmer plants, two single-crosses are combined in an isolated production field. The single cross that is to be the ear parent is detasseled. Fertilized by pollen from the tassels of the male parent, it produces the hybrid seed ears which are processed and sold for seed. The ears from the pollen-parent are not used for seed.

The hybrid seed corn for farm planting is thus, the result of crossing two single-crosses into a double-cross. Each single cross is produced from mating two inbreds so the hybrid seed corn is really the offspring of four inbred lines. In practice, of course, hybrid seed production is not this simple. Literally hundreds of thousands of plants are inbred before one promising inbred line is developed. These inbreds are combined in hundreds of patterns seeking to develop a pedigree that will produce a superior hybrid. In Funk Farms Nurseries, for example, more than 200,000 hand pollinations are made each summer in the search for new and superior "G" Hybrids.

But once an inbred is discovered and "fixed" it will breed true and it may even be further improved by back-crossing it with the variety from which it sprung or by crossing it with another inbred and developing a new inbred from this single-cross by what is called convergent improvement. But in the final analysis, the quality of the hybrid seed that any firm merchandises is determined by the skill of its breeding department in creating inbreds, improving them, and combining them into superior hybrids. To test the effectiveness of these combinations Funk Bros. Seed Company and Associate Growers maintain a system of more than 2,500 Trial Plots strategically located in 48 states where experimental and commercial "G" Hybrids are tested by actual performance against one another and against other corn. On the basis of these Trial Plot results new "G" Hybrids are added to the line after they have proved their superiority through three or more years of testing.

The actual production of Funk's "G" Hybrid Seed Corn is conducted both on Funk Farms, on other

farms where fields are grown under Funk's supervision and on the farms of "Associate Growers": seedsmen who produce "G" Hybrids from foundation single crosses furnished by Funk and grown, processed and sold under Funk's rigid, expert supervision. Today, Associate Growers produce Funk's "G" Hybrid seed in Illinois, Indiana, Missouri, Iowa, Nebraska, Kansas, Colorado, Pennsylvania and Maryland. This is in addition to seed production by Funk Bros. Seed Co. on Funk Farms, at Mason City, Illinois, and in other selected sites over the cornbelt.

The three steps in making a hand pollination. Tassel is bagged to collect pollen (above) and ear shoot below, right, is covered with cellophane bag to protect silks from pollen when they emerge. Pollen from tassel is then sprinkled over ear silks and large bag placed around ear (lower, left) to exclude unwanted pollen

CHAPTER SEVEN

WHAT'S AHEAD IN HYBRID CORN

Hybrids of the Future Will Far Excel Present Strains in Yields and Resistance

Funk's research staff is constantly improving the foundation stock used and bringing in new blood lines by developing new inbred strains. This all ties in with an extended system of testing present day hybrids along with hundreds of experimental hybrids in hand-planted test plots throughout the important corn growing areas of the United States. Improvement means higher yields per acre, better quality and more profit for the farmers who grow Funk's "G" Hybrids.

How do we improve hybrid corn? So far we have only started—only learned how to use the methods that have accounted for such a wonderful increase in the productivity of our greatest crop. Even more startling developments may be expected in the future.

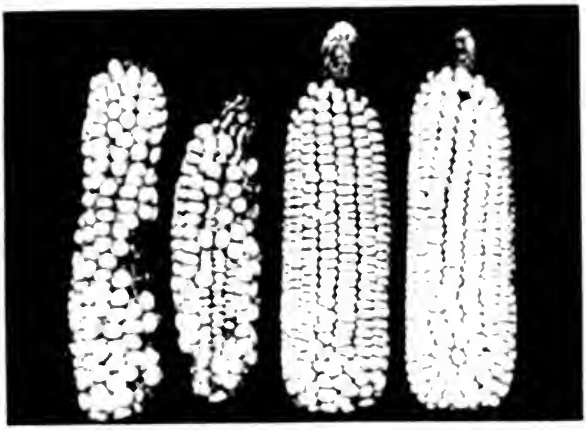
Recall open-pollinated corn for a moment. Recall the occasional outstanding plant—one of hundreds that bore a good, well-matured ear on a thrifty, healthy standing stalk. So far the corn breeder has merely caused that individual to be repeated two, three or more times in every hill of corn. Ear size of hybrids today is no greater than the best open-pollinated ears produced years ago. The *good* has been caused to repeat itself in *every* stalk of corn.

What of the future? What would it mean if we could add an average of one-half inch to every ear of corn? There are 3556 hills per acre at a 42 inch check. With three plants per hill there are over 10,000 plants. One-half inch of each of 10,000 ears would mean 5000 inches additional ear corn per acre. Assume a 12 inch ear. This would mean the equivalent of over 400 extra ears or a yield increase of four to five bushels per acre.

What about adding two more rows of kernels to each ear? It can be done. There are about 50 kernels from the butt to the tip of an average ear. Two more rows would mean 100 more kernels. Not much it is true—just a handful of corn. But if 100 kernels could be added to each of the 10,000 ears on an acre it would mean 100,000 additional kernels of corn and from eight to ten extra bushels per acre.

Counting the chickens before they are hatched? Not at all. They are on the way in the shape of good Funk's "G" Hybrids. The corn breeder does not scorn a few more kernels per ear but battles to make each possible gain.

If we could have seen our present day hybrids twenty-five years ago, we'd have thought we were truly in King Corn's own private heaven. Our ideals have been moved forward tremendously since then. We have attained our ideals of twenty-five years ago but instead of finding the job done have discovered in the twenty-five years even more improvements yet to be made.



A striking illustration of how extra grain yield is bred into "G" Hybrids. The two ears at left are a famous inbred developed by Dr. Holbert and released through the U.S.D.A. The two ears at the right are the same inbred as improved by Dr. Holbert exclusively for Funk's "G" Hybrids since he became plant breeder and vice-president of Funk Bros. Seed Co.

Yield is not the only important factor in the program for the production of more profitable Funk's "G" Hybrids. Grain quality, maturity, stalk quality, root anchorage, disease resistance including the seedling stage, stalk rots and ear rots, insect resistance, cold survival, heat and drought survival and dozens of other factors must all be considered in building these more profitable Funk's "G" Hybrids. As we build for higher yield and greater profit we must fortify accordingly all along the line. Just as no chain is stronger than its weakest link—no hybrid is more profitable than its most vulnerable spot—be it stalk, root, resistance to disease, insect, heat, cold or drought, weight, maturity or quality.

Present day hybrids are being made more efficient machines for converting soil moisture and plant food along with carbon dioxide and sunshine into higher yielding, more profitable crops of corn? "G" Hybrids are being developed with ability to perform well over a wide range of soil types and fertility levels.

We could enumerate many more problems that have the attention of Funk Bros. experts as they work toward higher yielding, more profitable Funk's "G" Hybrids for the future. But men must do these things. And in the men who are developed or brought into the organization rests the future contribution of Funk Farms. If you would look into the future, pay a visit to the Birthplace of Commercial Hybrid Corn. But lift your eyes from the marvels of the fields to look around you, at the men who do these things. "Gene" Funk and his four sons associated with him in Funk Bros. Seed Co. have gathered about them a group of men worthy of this setting. It is of these men as well as the background of their firm that Jim Holbert must have been thinking when he answered a request for a prophecy with this statement: "The hybrid corn that any firm merchandises will be as good as, and no better than, the creative genius and the integrity of the personnel of that organization."

FUNK BROS. SEED CO.

BLOOMINGTON, ILL.