# DOUBLE-CROSS HYBRID CORN

**A STORY OF SMALL PLOTS AND BIG MEN**

Donald F. Jones and Henry A. Wallace

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# First . . . Basic Research

A Foreword by William L. Slate
Director Emeritus

THE CONNECTICUT Station is and always has been a "plant science" Station. The pattern was set by Professor Samuel W. Johnson, the founder and Director until 1900, and is clearly implied in the title of his remarkable book, *How Crops Grow* (1868). Professor Johnson fully appreciated the importance of what we now term "basic research" in an Experiment Station. It was he who set Thomas B. Osborne at work on his classic researches on the vegetable proteins in 1889.

The turn of the century brought changes. The country was well out of the long depression of the 1880's and 1890's; farm prices were rising; and Dr. Edward H. Jenkins was chosen to be Director in 1900 after 25 years as Station Chemist and assistant to Director Johnson. Dr. Jenkins had completed his classic series of experiments at Poquonock (1892 to 1897) on the fertilization of cigar leaf tobacco and was well acquainted with the crop and with the problems of the growers. One of these problems was the need for better strains. In 1903 an "improvement" program was begun in collaboration with the USDA. Thus began the Station's work in plant breeding. It was just at this time, too, that Mendel's laws of inheritance were "rediscovered." Scientific excitement in genetics ran high.

At the turn of the century, practically all Connecticut farmers grew corn for grain. The demand for dairy products was steadily increasing, and a considerable amount of meat was grown. The need for "concentrates" was increasing and, to a large extent, this feed had to be purchased. At the Illinois Station, Dr. Cyril G. Hopkins was reporting success in raising the protein and fat content of corn through his "ear-to-row" method of selection. These experiments attracted wide attention and, of course, interested Dr. Jenkins here in Connecticut.

The Station Board minutes record frequent discussion of the need of adding to the staff a person to work on "the improvement of crops." Finally (1905), Dr. Jenkins was authorized to find and employ such a person. The person he found was Edward M. East, who came to the Station in September 1905.

East was immediately put in charge of the tobacco improvement program. The genus *Nicotiana* continued to be one of his major interests throughout his life. Tobacco breeding has been an active Station project to this day.

But East was especially interested in corn, as was Dr. Jenkins. Though trained at Illinois as a chemist — and hired as such by Hopkins — East was in close contact with Love, Holden, and others of Hopkins' staff, as well as Dean Davenport.

Davenport and Holden had been students of Beal at Michigan. East was appointed here as Agronomist. Actually, by 1905, he was well on the way to becoming a geneticist. He had read everything that had been written on the subject — from Darwin on. Moreover, he brought with him several inbred strains of corn that he had selfed at Illinois.

The story of East's great career as a scientist and teacher is well known. He left the Station in 1909 to accept a professorship in the Bussey Institution of Harvard, but continued as Consulting Geneticist in the Station until the early 1920's. East's student, H. K. Hayes, carried on both the tobacco and corn programs at the Station from 1909 to 1915. Another student of East's followed Hayes in 1915, Donald F. Jones, in whose honor and to whose 40 years of brilliant research this 1955 Field Day was dedicated.

The name of Donald F. Jones is probably most commonly associated with the double-cross technique, the method that made hybrid corn practical. This idea he presented in Connecticut Station Bulletin 207, The Effects of Inbreeding and Crossbreeding Upon Development, published in October 1918, and Bulletin 273, Crossed Corn. Several years elapsed before this great advance was fully recognized and exploited by corn breeders.

Of even greater significance was Dr. Jones' explanation of hybrid vigor in terms acceptable to other scientists and practical corn breeders. In this same Bulletin 207 he established the theoretical principles in accordance with Mendelian law.

Dr. I. Bernard Cohen, in *Science, Servant of Man* states the case in these words:

"Professor Paul Mangelsdorf of Harvard is inclined to think that Jones' interpretation of hybrid vigor may, in the long run, be considered the more important of his two contributions, because the corn people all over the country were more readily inclined to work with something they understood, rather than something that seemed to work on principles that couldn't be explained."



# Connecticut and the Corn Belt

Remarks of James G. Horsfall, Station Director
Donald F. Jones Day, August 16, 1955

TO PARAPHRASE a great American, we may say that fourscore years ago our forefathers brought forth on this continent a new Station. For it was on July 20, 1875 that Governor Ingersoll signed a bill passed by the Connecticut legislature to establish the first Experiment Station in America. This summer, therefore, marks the 80th year of the Station.

Two score years ago, my scientific forebear, E. H. Jenkins, hired a young Kansan. If I may paraphrase again, Jenkins said: "Young man, what can you do to improve corn. Connecticut needs a lot of milk. To get the milk we need lots of corn for our cows, and we lack good land to grow it."

The young man's name was Donald F. Jones. He was bold: he trod where the geneticists had feared to tread. He took the corn plant, a pliable piece of clay, and molded a new industry in America — the hybrid corn industry — a new source of wealth.

Hybrid corn earns for the citizens of America enough new wealth every year to pay half the staggering cost of the first atomic bomb. In Connecticut alone, hybrid corn creates enough new wealth every year to pay three times the cost of running the entire Experiment Station, with its researches on bugs and blights, potatoes and petunias, soils and squashes, tobacco and tomatoes, food and feeds, fertilizers and fungicides.

We on the staff of the Station are proud of Donald F. Jones, as are our visitors. We come together today to honor our distinguished associate and friend.

Many men have already foregathered to honor Dr. Jones. You saw some of his medals and plaques here today.

The Connecticut Seed Trade Association now adds a new plaque to those honoring Dr. Jones. To be erected on State Highway 10, this bronze marker will be presented to the Station by Mr. John T. Moss, president of the Connecticut Seed Trade Association, and it will be accepted by Mr. Charles G. Morris, the senior member of the Board of Control.

Hybrid corn is a synthetic commodity — just as synthetic as nylon. I mean by synthetic that it must be manufactured and sold. It cannot be made in the home workshop. The farmer cannot produce his own hybrid seed.

The production of hybrid corn is a business. The Experiment Station does not grow things for sale. Research is our business, discovery is our product.

Before hybrid corn could produce wealth, it had to be made widely available. One of the men who pioneered on this frontier is here today.

Sometimes scientific ideas languish because no one in industry senses their commercial significance. That was not so with double-cross hybrid corn. Henry A. Wallace was ready to put the new corn breeding technique to work. He was editor of a farm paper in the Corn Belt and familiar with Jones' writings. He had a Master's degree in science and he had already done corn breeding research.

He organized in 1926 the first company to develop, produce, and sell hybrid corn seed. He stands at the forefront of the men who put hybrid corn on American farms.

Henry Wallace went on to win a distinguished place in American agriculture and in American life. He has very graciously consented to come here today to speak of "Small Plots and Big Men."



# Small Plots and Big Men

**Address of The Honorable Henry A. Wallace**
**at Mt. Carmel Farm, August 16, 1955**

IT WAS PRECISELY 30 years ago this month that I first visited Dr. Donald Jones at The Connecticut Agricultural Experiment Station. Six years before that I had received from Dr. Jones several of the famous Chester-Leaming inbreds started in Illinois by Dr. East in 1905. I still remember looking at these Leaming inbreds, growing in Connecticut in 1925 after 19 years of inbreeding, and reflecting that they grew much better in Connecticut than they did for me in Iowa.

Because I started corresponding with Dr. Jones in 1919 and because I was a farm paper editor Dr. Jones gently kidded me about the thousands of tons of printers' ink I had spilled trying to improve corn-breeding methods in the Corn Belt. He thought amazingly little had been accomplished by my almost weekly articles on the future of hybrid corn.

As I remember it Jones gave most freely of his time to showing me around the Station's experimental farm. The pollinating season had just been completed and he was not nearly as busy as he had been a week earlier. It was a small farm with small buildings and small fields. Dr. East had had to rent land on which to grow his inbred corn from 1906 to 1909. Even since 1910 when the Station acquired the Mt. Carmel land, the amount of land devoted to inbreeding, crossing, and yield-testing corn has amounted to only 5 to 10 acres.

No State Agricultural Experiment Station has ever accomplished so much with so little land, money, and salaries. The marvel is that Connecticut, which is about 38th in corn acreage, should have, during the first 20 years of this industry, done perhaps a hundred times as much for corn as the great Corn Belt State Experiment Stations in states where they grow 50 to 100 times as much corn as Connecticut, and where their experimental farms are far larger, their appropriations greater, and their scientific personnel more numerous. But comparisons are often odious and I am sure Dr. Jones would not wish to criticize the great Kansas Experiment Station at Manhattan any more than I would wish to criticize the Iowa Experimental Station at Ames.

The explanation for the success of the Connecticut Station lies, it seems to me, in the greater scientific maturity of Director Edward H. Jenkins, who spent 55 years of his life with the Station in one capacity or another. In 1874 Jenkins had obtained his B. A. degree from Yale and had taken some post-graduate work in chemistry. Then he studied at the University of Leipzig and at a forestry school in Saxony. Yale finally gave him an earned degree of Doctor of Philosophy in 1879. All this I mention because I think it explains in some measure why so much was accomplished with so little at The Connecticut Station.

Jenkins, with his liberal arts education, his wide scientific experience, and his travels abroad, became one of the best judges of scientific brains in the United States. He had, moreover, the personality and contagious enthusiasm to hire men away from the larger institutions. Most important of all, he inspired men and made them like to work with him. Since this is an 80-year celebration of the founding of The Connecticut Station, and since Dr. Jenkins more than any single person made the Station outstanding, I would like to list chronologically some of the men on whom Dr. Jenkins left his imprint either at The Connecticut Experiment Station at New Haven, or at Storrs. It is a very partial list and I am sure that there are many people in this audience who know many names which should be added. Naturally the names which occur most readily to me are of those who have contributed notably to corn and chicken genetics.

First, I would list Dr. E. M. East, especially picked by Jenkins himself in 1905.

Second, I would list Dr. H. K. Hayes, who carried on Dr. East's corn inbreds after East left for Bussey Institute. Hayes later did remarkable wheat- and corn-breeding work at the Minnesota Station.

Third, I would list Dr. Donald F. Jones, whom we are especially honoring this afternoon as he completes a 40-year term of unique service almost as long as that of Jenkins himself.

Fourth, I would list Dr. L. C. Dunn, who was picked by Dr. Jenkins in 1919 for chicken-breeding work after Dr. Jenkins assumed responsibility for both New Haven and Storrs.

Fifth, I would list Dr. Paul Mangelsdorf, the noted corn historian of Harvard, who spent the first 5 years of his scientific career at this Station.

Sixth, I would list William L. Slate, who took over the directorship of the Station in 1923 when Dr. Jenkins became Director Emeritus. Mr. Slate continued with his full energy the broad-gauged scientific policies which had characterized Dr. Jenkins' leadership from the moment he had taken over the Vice-Directorship in 1882 and especially after he became full Director in 1900. Mr. Slate picked the present Director, Dr. James G. Horsfall, who is carrying on the Connecticut tradition of pure science which has an uncanny way of ultimately proving to be practical.

Seventh, I would list Dr. Walter Landauer who has done so much of the fundamental work of poultry genetics. While it was Dunn who actually picked



Landauer, it was Slate, in the Jenkins tradition, who had the courage to give Dunn the green light to bring Landauer from Germany to work on the scientific problems of poultry inheritance.

Eighth, out of chronological order, I would list two men who were not picked by Jenkins — Osborne and Mendel — who did so much to lay the foundation of our modern knowledge of the nutrition of both animals and human beings. Thomas B. Osborne began his classic researches on the "vegetable proteins" in 1889, at the suggestion of Professor Samuel W. Johnson, then the Station Director. During the next 20 years, Osborne, working almost alone as a Station chemist, made great advances in our knowledge of the chemical nature of the proteins and amino acids of the grains and seeds. Then he became curious about the relative nutritional value of these complex compounds: what part did each play in animal physiology? In 1909, with Jenkins' encouragement and support, Osborne invited Lafayette B. Mendel of Yale to collaborate. To this great team we owe much of our present knowledge of nutrition. They were the first in this country to use the white rat for this type of research. They were the American pioneers in vitamin research. From the beginning their work was a Station program, aided for many years by a grant from the Carnegie Institution of Washington.

Those of these men I have known personally have all been hardworking, devoted scientists. More than that, they have had at least a touch of genius. Of all those listed I probably knew Dr. East best. He had called on me in 1919 at Des Moines and had talked to me about starting a commercial seed corn company in eastern Illinois. I had done my first crossing by the detasseling method in 1904 but had known nothing about producing inbreds as a preliminary to crossing until I read in 1910 a paper by Dr. George Shull.

Beginning in 1913 I had done considerable crossing of varieties, using both very wide crosses and early sorts on very late sorts. Some of my crosses had outyielded the college strain of Reid corn as decisively as would some of the modern hybrids. But they were not uniform and I worried about whether my source of pure foundation stock could be maintained. At this moment Dr. East appeared on the scene, and an article by Dr. Jones on double crosses. I met East a second time at a Genetics Conference in Washington in 1921. The third time, when I really got to know him as a man, was when he invited me to participate in his Round Table on Population at the Institute of Politics at Williamstown, Massachusetts in 1925. As I sat around and talked with East in the evenings, I found him cynical, irascible, prejudiced, warm hearted, stimulating and utterly charming. I disagreed with him on many things but with regard to the nature of heterosis I am today still more in accord with his rather vague ideas than with the more precise ideas of many of those who have come after him.

East undoubtedly was a spiritual grandson of Darwin who had influenced Beal at Michigan State, who in turn touched East through Davenport and other

Illinois men who had studied with Beal. It is interesting to speculate whether East would have ever made his extraordinary contribution if Jenkins had not taken him away from Illinois in 1905. My own feeling is that while East would have done well at Illinois he would never have made his unique contribution except for the opportunity afforded by The Connecticut Experiment Station under Dr. Jenkins' leadership.

A chance to do a lot of hard thinking with a small amount of money and complete freedom may be worth more than great appropriations for research hemmed in by restrictions.

East, like Jenkins, was a chemist who had very little in the way of a farm background. I judge that both had a strong sense of humor and an appreciation of good conversation. As scientists go they were both men of the world and yet both were tireless workers. I still wish I knew what strange alchemy drew Jenkins to East at Urbana, Illinois in early 1905. If Jenkins had not gone to Urbana, most of our hybrid-corn work would have come via Shull and there is reason to think it could not have come nearly so fast. True, Shull did nearly everything that East did and even saw the significance of much of the work first. Shull even made some double crosses back in 1912 or 1913. As a theoretician Shull was magnificent but he did not have a Jenkins to furnish continuity.

When Jenkins and East picked Hayes in 1909 they insured that the inbreeding work would be expanded. Hayes started fresh inbred lines which were to be so important to Dr. Jones later. My contacts with Hayes were in Minnesota. He was more jovial than East but equally stimulating. On one occasion he furnished me a single cross of two Minnesota lines and I furnished him a late inbred which was a good pollen producer. We both proceeded to make the same cross, which was a 3-way and therefore had to sell for a little more money than a double cross or 4-way. This 3-way was so popular in spite of its slightly higher price that it was sold for many years.

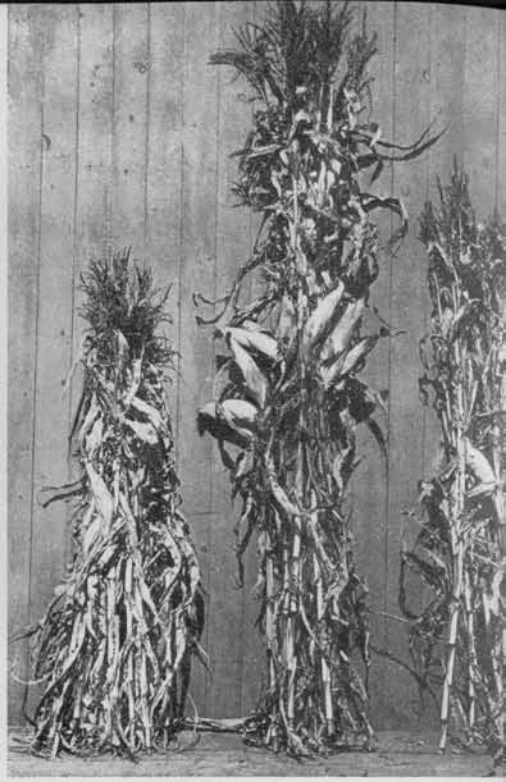
In those days I was not very orthodox about how many inbreds would go into a cross. In the Iowa corn yield test I would often enter either single crosses or a cross of an inbred on a variety. Beginning in 1926 and continuing for a number of years, the corn company I founded used largely 5-, 6-, and even 7-way crosses. I had found that the single crosses were sometimes very good one year and not so good another year. When they were good they were so good that you might think it well worth while to go to the extra expense of producing hybrid single-cross seed even if the kernels were round and the seed cost was $2 to $4 a bushel higher. Probably it was not the extra seed cost that turned the tide against the single cross. That could easily have been borne because an extra $1 an acre for seed means nothing if a corn is really superior.

We may have been wrong, but we reached the conclusion that on the whole it was safer to have a number of inbreds in a commercial hybrid. I personally carried the number of inbreds to an extreme which gave adaptability but lost



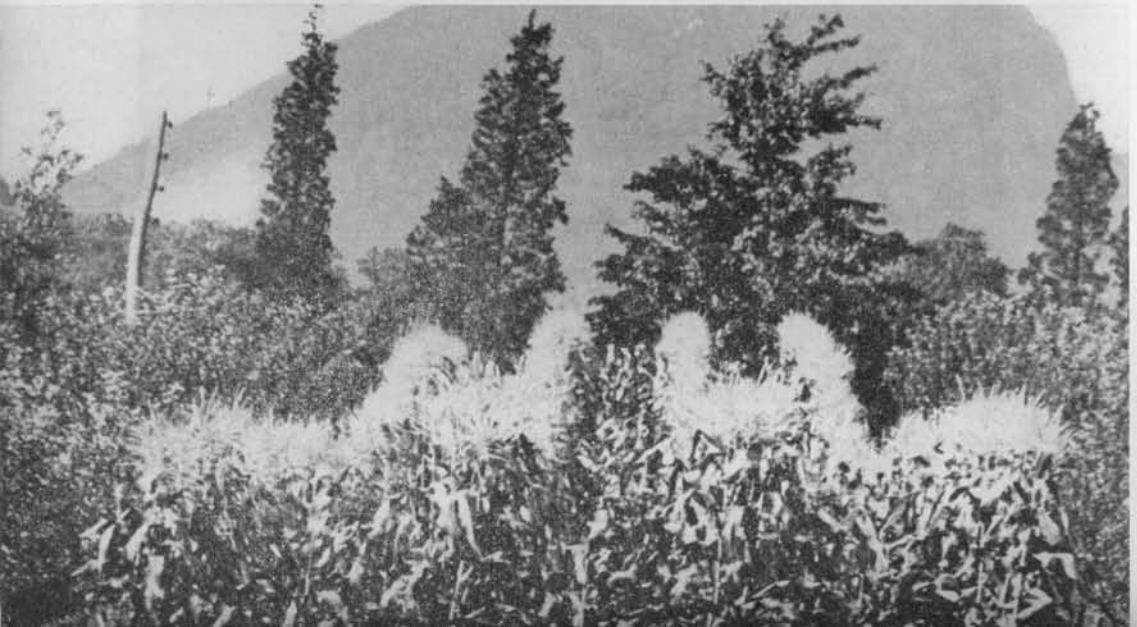
Corn growers and geneticists around the world are indebted to Dr. Donald F. Jones, shown here in a 1948 experimental plot, both for the double-cross method of producing hybrid corn, and for his explanation of the phenomenon of hybrid vigor.

First commercial production of double-cross corn was in Clinton, at Carter Hill Farm of George S. Carter, whose 1921 field of Burr-Leaming is shown above.

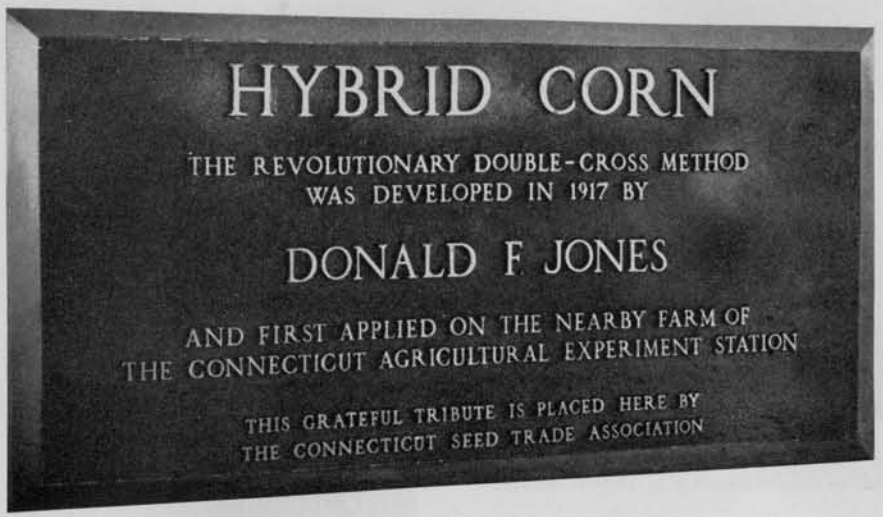


# CONNECTICUT . . . Birthplace of Double-cross Hybrid Corn

Photos on these pages have helped to tell the story of double-cross hybrid corn: At left above, C. A. Gallastegni in the double-crossed Burr-Leaming crossing field at Mt. Carmel Farm in September 1919; below, Dr. Jones 1917 photograph of the first crossing plot (21 by 100 feet) of double-cross hybrids. Pollinator was a Leaming single cross (1-6 x 1-7); Burr-White and other single crosses and inbreds, detasseled, served as other parents.



Below, eight successive generations of self-fertilization (0-7) of the Illinois Leaming variety. Above, Leaming inbreds 1-7 (left) and 1-6 (right) and first generation hybrid (center), the pollinator of double-cross Burr-Leaming.




The Connecticut Seed Trade Association presented to the Station this plaque, and it has been placed on Connecticut Route 10 in the Mt. Carmel district of Hamden, about one-quarter mile east of the Station farm there.

As for the past 40 years, men sought out Dr. Donald F. Jones at the 1955 Field Day named in his honor, to hear first-hand the Connecticut story of basic research . . . research that has proved of inestimable value to mankind.

the uniformity which the farmers had been taught by the corn shows and agricultural colleges to desire.

The practical compromise which is used to this day by nearly all commercial seed concerns is the 4-way or double cross as originated by Dr. Jones here at The Connecticut Station in 1917. The Hybrid Division of the American Seed Trade Association thought so highly of Dr. Jones' contribution that they gave him a special plaque in 1947.

In my own company they swung over almost completely to double crosses and dropped the 5-, 6-, and 7-way crosses after I left active management of the company. With the inbreds available at that time they were probably right. But with the many good inbreds available today I am not completely sure. It is a question of adaptability from place to place and season to season. In any event the 4-way cross will no doubt dominate the commercial picture in field-corn seed production for some time to come. An exception must be made for sweet corn when they set great store on uniformity and use single crosses and 3-ways.

If the old-fashioned corn shows still had the ascendancy they had back in 1910, it is probable that farmers today would pay the extra 30 or 40 cents an acre for single-cross seed so as to get the greatest possible uniformity. Today farmers are still enough under the spell of uniformity as a goal so that for many years to come they will probably prefer 4-way or double crosses to 6- or 8-way crosses even though with modern inbreds properly picked and placed, 8-way crosses might, over a period of years, give maximum heterozygosity at the most loci and therefore would on the average be most adaptable and high yielding.

Perhaps the best permanent expression of the fruitful relationship between Edward East and Donald Jones is in the outstanding book *Inbreeding and Outbreeding* published in 1919. Dr. Jones wrote the chapters in the central part of the book and Dr. East wrote the introductory and concluding chapters. I have recently been informed that Dr. Jones' chapters present the same ideas that appear in his Bulletin 207 by the Station in October 1918. It is my great personal regret that I did not come across this magnificent work until the summer of 1955. Reading the book in 1955 I am utterly amazed at how well it stands up in spite of the many scientific discoveries made since it was written. Nowhere have I seen portrayed so clearly the influence of the early German and English hybridizers on Darwin. Dr. Jones gives Darwin credit for doing the most important of the pre-Mendelian work in this field. Jones' one criticism of Darwin is that he was wrong in thinking the *evil effects* of inbreeding continued as the *process* was continued.

Probably the most notable contribution of Dr. Jones in this 1919 book was the clear-cut mathematical expression of just how Mendelism works to reduce vigor in inbreeding and how it works to increase vigor when inbred strains are crossed. This application of Mendelism to "hybrid vigor" is all done in a simple, logical way. Jones tied together the Darwinian principles with the Mendelian so clearly

as to build a foundation for the method of explaining hybrid vigor by bringing together complementary dominant growth factors from the opposite side of the cross.

Jones a little later was probably the first to recognize that linkage would make it impossible to get *all* the favorable growth factors into one *"super-inbred"* which might not require crossing and might outyield the best hybrid. For a brief time a few theoretical Mendelians in the early days may have looked expectantly for that "super-inbred" which would be homozygus for all the favorable dominant growth factors. It was thought that by back crossing and long continued selection with large numbers involving many lines there could be assembled eventually "inbreds" which would at least yield as well as ordinary corn.

But Dr. Jones, being familiar with the phenomenon of close linkage, suddenly realized that those who held to this simple Mendelian concept were doomed to disappointment. Jones in his 1919 book was the first to make it clear that East, Hayes, and Shull had effectively related all the facts of inbreeding and cross-breeding to Mendelian theory.

Jones himself was probably the first to use the fact of "close linkage" as a means of explaining why there could never be an "inbred" as good as the best hybrid. East and Shull thought there was physiological stimulation resulting from the interaction of different hereditary factors. Dr. Jones dropped the East-Shull concept of heterosis in 1918 in favor of pure Mendelism as the explanation.

Most modern corn geneticists will no doubt hold with Dr. Jones with regard to his main thesis so ably presented in 1919 and modified only slightly thereafter. I, for one, am very glad he presented so clearly and so early the Mendelian or so-called "additive" explanation of why so much hybrid vigor resulted from inbreeding followed by crossing.

With regard to many characters the Jones explanation of favorable dominants obeying Mendel's law is no doubt correct as an explanation of heterosis. I trust Dr. Jones will forgive me for mentioning it here on this day, but I feel I must say that my own prejudices for 35 years have more and more led me back to the belief that the best hybrids are not necessarily composed of inbreds with the largest possible number of favorable dominants.

Some people call this the doctrine of "over-dominance" and attempt to put it on the Mendelian basis by saying that often times the heterozygus combination of a dominant with a recessive is better than the homozygus combination of two identical dominants. Long years of observation without much scientific evidence leads me to favor this explanation so far as certain characters are concerned.

In the case of corn I note that when two good "general inbred combiners" are crossed they do no better on the average, and often not quite so well, as when a "good general combiner" is crossed with a "poor general combiner." It should be noted that "poor general combiners" almost always cross poorly with other "poor general combiners." Of course in cases of this sort we are dealing with complex



factors, governing general vitality, which come from many chromosomes. The question is why a complex of good characteristics governing vitality may on occasion be given more ability to live when crossed by a complex of poorer characteristics.

To me it even seems as though certain mildly deleterious recessives may play a definite role as we seek the best hybrids. At any rate if we have outstanding inbreds on one side of a cross, I believe we can tolerate a large number of weaknesses on the other side, provided that the other side furnishes certain specific characteristics in which the good assemblage of inbreds is weak.

Undoubtedly Dr. Jones and most other corn geneticists, including those in the company I founded out in Iowa, will disagree with me. They can probably prove their point scientifically with regard to a whole series of single loci. The point I am making is that the science of breeding consists in discovering at which loci homozygosity is best and at which heterozygosity is best. My own guess is that on the average many semi-deleterious characters of a complex nature may be helpful and not merely to be tolerated when properly covered up by a "good dominant." In brief, what I would ask for is heterozygosity at most loci, asking for homozygosity chiefly where economic characteristics might otherwise be impaired by heterozygosity.

The reason I make this point here today is that it seems to me that the whole tendency in modern, commercial, hybrid breeding is to narrow the source of germ plasm. I am afraid many strains may be discarded as inferior when they may have something important to contribute.

In this connection Dr. Paul Mangelsdorf, who was brought to The Connecticut Station by Dr. Jones in 1921, has done a magnificant job in collaboration with the Rockefeller Foundation and National Research Council of putting many different strains of Mexican and South American corn into cold storage so that they can be grown only once every 10 or 15 years and yet maintained. It has been one of the tragedies accompanying the superior power of modern hybrids that so many of the old-fashioned strains have been dropped completely. Who knows which of these so-called inferior sorts may have had just one block of superior genes to contribute at some critical future juncture when the environment may have changed? Of course, we cannot, as a practical matter help all living things to expand indefinitely. We do have to make choices. What I would urge is that the time has now come to slow down and look around.

Hybrid corn, mostly double cross, is now grown on 99 or 100 percent of the corn land of the great Corn Belt. Here and there the Indians may have a little pre-hybrid corn. Small samples of the leading open-pollinated varieties have been put in cold storage. Nevertheless, in the great Corn Belt literally hundreds of different types of open-pollinated corn have been swept into oblivion by the extraordinary, rapid expansion of hybrid corn acreage after 1934. In 20 years there was at least a 98 per cent switch from one type corn to another. It was

far more devastatingly rapid and complete than the replacement of Indians by the white man.

Dr. Paul Mangelsdorf will preserve effectively the Mexican sources of one-half the blood which furnished the varieties out of which our modern inbreds come. But the so-called New England flint, which has been grown in the northeastern quarter of the United States for perhaps a thousand years, never seems to have sojourned in Mexico. Therefore it is important that various representatives of the 8- and 10-rowed sorts as grown by the Indians and the people of New England and parts of New York up until 1935, be preserved.

Thanks to Dr. East, Dr. Hayes, Dr. Jones and many others who caught the vision of hybrid corn in the second decade of the Twentieth Century the wealth-producing power of the Corn Belt has been enormously increased during the past 20 years. Undoubtedly the corn farmers owe a great debt of gratitude to all who played any part in making hybrid corn a reality.

Like Dr. Jones, I am not one to rest on past accomplishments. We both look to the future. As I look to the future, I ask that in our enthusiasm for hybrid corn, the great commercial companies, the State Experiment Stations, the U.S.D.A., and such foundations as the Rockefeller Foundation may preserve certain types of life which a streamlined, efficiency-minded civilization might in its headlong rush sweep into the discard.

Those who look back on us in the year 2000 may well ask why we were so careless in permitting the destruction of so many types of germ plasm. In the case of corn I read in the literature of 100 years ago of sorts which had more ears than any kind we are growing today. Other sorts had much larger ears than anything we now have. When the corn shows built up the craze for uniformity nearly all of these sorts were swept away. Corn-show corn for a time furnished strenuous competition to off-beat corn and threw most of it into the discard. But no sooner had the corn shows established their ideals of uniformity for certain types than hybrid corn stepped in and completely replaced the corn shows.

It is high time, it seems to me, for those of us who have played a part in making hybrid corn so universal, to prepare for the judgments of the corn geneticists of the year 2000. This principle applies not only to corn but to all living organisms, especially to those where new types of breeding have suddenly resulted in the replacement of old-fashioned sorts.

The Connecticut Station and Dr. Jones in particular have taken a long view of the future. Dr. Jenkins created the finest type of research atmosphere for East, Hayes, and Jones at a time when practical results for the Connecticut farmer were many long years ahead. In this connection I am sure that the East and Jones 1919 book on "Inbreeding and Outbreeding" had much to do with giving Dr. Jenkins the courage to make The Connecticut Station a continuing place for fundamental research.



I have not had time to read all of Dr. Jones' scientific treatises. But what I have read makes it very clear that Dr. Jones takes an exceptionally long view of the everlasting continuity of science. In the late 1600's and early 1700's the fact of sex in plants was clearly established for the first time. Incidentally, much of the work was done by Quakers and Congregationalists. Appropriately, Dr. Jones has both lines strongly represented in his own ancestry. Dr. Jones is perhaps more familiar than anyone with the great contribution made by Darwin through Beal and the Illinois group. More than anyone Dr. Jones has traced the precise influence of Mendel on modern corn breeding.

Dr. Jones, your prestige in the world of corn breeding is enormous. All I ask is that you use this prestige to expand the characters in the corn gene pool of the future Corn Belt inbreds. Knowing your ancestry and the spirit of Jenkins and East, I am sure you will rise to the challenge of the future, with a sense of deep dedication.

In conclusion, Dr. Horsfall, I wish to express my sincere hope that The Connecticut Station during the next 80 years will render a service as outstanding as it has since 1875. May you and your successor be blessed with four such unique research men as East, Hayes, Jones, and Mangelsdorf. May you, Dr. Jones, find the next 30 years as enjoyable and fruitful as the past 40 have been.

# Presentation and Acceptance

Remarks of John T. Moss and Charles G. Morris
on presentation of the plaque given by the
Connecticut Seed Trade Association

It is indeed a pleasure to be here today representing the Connecticut Seed Trade Association. We of the seed trade, as well as the farmers, owe Donald F. Jones a tremendous debt for his contribution to agriculture.

It is my own personal opinion that no one can realize the importance of Dr. Jones' work unless he has lived in the mid-west, where the economy revolves around hybrid corn. During my four years in Iowa after the war I saw at first hand the benefits Dr. Jones' efforts afforded the farmers there. The results of his work take many forms. For example, special hybrids are bred for particular soil conditions, others to produce ears at the right height for more efficient mechanical corn pickers. As a result it is almost impossible to find anything but hybrid corn being grown in the Corn Belt. These corn farmers enjoy a better living because of Dr. Jones' work at The Connecticut Experiment Station.

We of the Connecticut Seed Trade Association consider it a privilege to present the plaque honoring the work Donald F. Jones did here on this farm which has so benefitted farmers throughout the world.

JOHN T. MOSS

On behalf of the Board of Control, I would express the Station's deep appreciation of this award. Our scientific staff are constantly working and experimenting selflessly for successful results, not for rewards as the world too often rates rewards in money or in public honors. To realize that their scientific labors have added to the volume or quality of food production or have prevented deterioration in food as a result of the methods used in its production, its processing, or its distribution is the reward that warms a scientist's heart. This tribute therefore is most gratefully received by all the personnel of the Station, from the Board of Control to the most recent member of our scientific staff.

CHARLES G. MORRIS



# DONALD F. JONES DAY

## AUGUST 16, 1955


## ANNUAL FIELD DAY

### *Program*

*(1 p.m., following lunch hour)*

*Welcome*: Dr. James G. Horsfall, director

*Presentation of historical marker*: John T. Moss, president of The Connecticut Seed Trade Association

*Acceptance*: Charles G. Morris, for the Station Board of Control

*Address*: "Small Plots and Big Men," The Honorable Henry A. Wallace, former Vice-President of the United States

### *Tours and Exhibits*

*(10 a.m. to 5 p.m.)*

**THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION**

## FIELD DAY NOTES

### August 16, 1955

**The Man We Honor.** Donald F. Jones, head of the Genetics Department and world-renowned authority on genetics and plant breeding, has been a staff member of this station for 40 of its 80 years. In 1917, working with corn inbreds made here over the years by Dr. Edward M. East and Dr. Herbert K. Hayes, Donald F. Jones crossed two single-cross hybrids to produce the first double-cross hybrid corn. His double-cross method made possible the practical development of hybrid corn. Dr. Jones' explanation of hybrid vigor in corn was a new contribution to the theory of genetics. Under the leadership of this distinguished scientist, the Genetics Department of The Connecticut Agricultural Experiment Station has given the world better hybrid corn for grain and for ensilage, and many of the superior hybrid varieties of sweet corn. The central exhibit at this Field Day suggests the honors that have come to Dr. Jones as a scientist and benefactor of mankind.

**Our Distinguished Guest.** Henry A. Wallace, as editor of Wallaces' Farmer and Iowa Homestead and a corn breeder, has been called "truly the John the Baptist of the hybrid-corn movement." He organized in 1926 the first company to develop, produce, and sell hybrid corn seed. He was Secretary of Agriculture from 1933 to 1940, Vice-President of the United States from 1941 to 1945, and Secretary of Commerce in 1945 and 1946. He stands at the forefront of the men who put hybrid corn on American farms.


THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION
FOUNDED 1875