SCIENCE

VOL. 99 FRIDAY, JUNE 23, 1944 No. 2582

SCIENCE: A Weekly Journal devoted to the Advancement of Science. Editorial communications should be sent to the editors of SCIENCE, Lancaster, Pa. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

AGRONOMIC ADVANCES IN THE AGRICULTURE OF THE CORN BELT AND THE GREAT PLAINS REGIONS[1]

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THE topic assigned to me presents several obvious problems, the chief of which is to cover the subject adequately within the allotted time without too many omissions of worthy contributions. Any failure to include important phases of work must be charged to the speaker in his inability to properly deal with this wealth of material within the short space of 30 minutes.

There has been one extremely outstanding development in the agronomic work of this region, of such vital importance, and with results so significant that it deserves special emphasis. The greatest single accomplishment of the past 25 years has been the evolution of a degree of cooperative research effort that has made this quarter of a century a period of unusual advancement. The close relationships between the United States Department of Agriculture and the various state experiment stations have unified the research toward common goals. Free exchange of ideas and materials is an established practice and is aiding greatly in promoting scientific agriculture.

Federal workers have aided in many phases of regional coordination. Generally, the United States De-

[1] Contribution from the Division of Agronomy and Plant Genetics, University of Minnesota, St. Paul, Minn. Paper No. 2120, of the Sci. Journal Series, Minnesota Agricultural Experiment Station. Presented at the meeting of the American Society of Agronomy in Cincinnati, Ohio, on November 10, 1943.

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partment of Agriculture has not developed experiment stations in the individual states but has furnished some regional research workers who often make their headquarters at the state experiment stations. It is common for these federal workers to be accepted on the same basis as the state workers with equal rights and privileges of action. Naturally such state and federal programs would fail without the necessary cooperation between research workers to make regional coordination possible.

Before proceeding further in a discussion of cooperation it should be made clear that not all the work has been done by the agronomist. The breeding of improved crop varieties brings to attention the importance of plant diseases and the plant breeder and the plant pathologist have cooperated closely in the development of new varieties. The breeding of wheat will illustrate the principles involved. The plant breeder is primarily responsible for deciding which crosses to make and the breeding methods to be followed while the pathologist leads in the creation of the epiphytotic. Selections are made under disease conditions and the two phases of improvement are dovetailed, one with the other. More and more attention is being given to quality studies and the cereal technologist joins in the cooperation to conduct the various milling and baking studies using the material from the breeding plots for his investigations. Finally, the agronomist, the pathologist, and the cereal technologist study the assembled data and reach a joint conclusion as to the suitability for release of any new varieties that may have been produced.

In some cases the soils worker enters into the cooperation in the testing of the varieties under different soil conditions and in response to varying levels of fertility. It would appear that this phase of investigation merits greater study than has generally been given it in the past, as promising results have been obtained at several stations.

Cooperative wheat research between the United States Department of Agriculture and the Minnesota Agricultural Experiment Station was initiated in 1907. From this early work there developed the regional conference where research workers meet to discuss their mutual problems. Similar conferences are held in the hard red and soft red winter wheat states. These conferences have done much to further the advancement of the improvement programs.

In the hard red spring wheat area black stem rust threatened the extinction of wheat growing in many sections. Thatcher wheat, a cooperative development of the United States Department of Agriculture and the Minnesota Agricultural Experiment Station, was introduced in 1934. In 1941, Clark estimated that 18,000,000 acres of Thatcher were grown in the United States and Canada. W. C. Helm, president of the National Millers Federation, states, "Thatcher wheat was a God-send to the Northwest." Disease epidemics often make it necessary to replace existing varieties. Because of severe epidemics of leaf rust, Thatcher wheat is being replaced by other more satisfactory varieties most of which are resistant to both stem and leaf rust. Many promising new strains are under test in the various experiment stations.

In the spring wheat region durum wheats are of considerable importance and recently Carleton and Stewart, two rust resistant, high quality macaroni varieties, were released to farmers of the durum area.

In the hard red winter wheat region much progress has been made as a result of cooperative effort. Two new varieties of promise are Comanche and Pawnee.

In the improvement of wheat varieties there has been a significant tie-up with the milling interests. In the spring wheat area the Northwest Crop Improvement Association has made possible the cooperation of the milling interests in the testing of new lines of spring wheat in sufficiently large plots to provide flour for experimental trials by the large commercial mills. Under this arrangement new varieties are tested by the millers in their own experimental laboratories. When all results are tabulated, representatives of the laboratories meet with the research workers and free and frank discussions follow. These relationships have broken down the suspicions and the lack of understanding that may have existed between the two groups of interest. The result of this arrangement has been to rapidly advance the spring wheat improvement program. The Southwest Crop Improvement Association is carrying on a similar type of program in the hard red winter wheat area and the coordinated breeding program is benefiting greatly. It is significant that the processors of wheat and other crops have come to realize the need for research in the betterment of crop varieties.

Workers in the soft red winter wheat area are concerned with problems of disease resistance, winter hardiness, and quality improvement. The Soft Wheat Breeding Conference is furthering cooperative research in much the same manner as in the hard red spring and winter wheat states.

Previous to the placing of corn improvement on a definite cooperative basis much progress had been made by individual workers. Several of the corn-producing states were carrying on a breeding program under the leadership of F. D. Richey, who was in charge of corn improvement in the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture. There existed a spirit of cooperation and several regional meetings

had been held to discuss mutual corn breeding problems. In 1925, the directors of the Corn Belt experiment stations accepted corn improvement as a major regional program under the Purnell Act which made new funds available for special phases of agricultural research. A special corn committee outlined a plan of corn improvement under the Purnell Act and this program was published in the *Journal* of the American Society of Agronomy in September, 1926. The program proposed outlined in a broad, direct manner the needed investigations. The following recommendation is quoted from this report:

> The committee feels that everything possible should be done to promote this personal cooperation, as this appears to be the best method of coordinating the program as a whole. With this in mind they recommend strongly that travel, necessary to an annual conference of the workers interested, be recognized as an integral part of the program and that specific provision for such travel be budgeted out of Purnell funds.
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> At such meetings, a report of the season's investigations should be presented and discussed. Contemplated new research should be outlined. This would provide for voluntary cooperation and coordination.

How successful this voluntary corn improvement cooperation has been is known to layman and scientist as well, as hybrid corn today marks one of the greatest accomplishments of agricultural research. According to a recent article in *Life* magazine, hybrid varieties were responsible for an increase in the U. S. of 629,000,000 bushels of corn last year. During the present war emergency with the added demands for increased production, consider the great significance of such an increase. The Bureau of Agricultural Economics of the United States Department of Agriculture estimated that, in 1943 in the 12 corn belt states of Iowa, Ohio, Indiana, Illinois, Wisconsin, Minnesota, Michigan, North and South Dakota, Nebraska, Kansas and Missouri, more than 78 per cent. of the corn planted was of hybrid varieties. Beyond a doubt the time is near when the old open-pollinated varieties will no longer be grown commercially and every corn farmer will grow hybrid varieties. It should be noted that the corn workers have made the necessary plans to maintain seed supplies of all important open-pollinated varieties as a constant source of the germ plasm they provide.

Waxy corn once looked upon as a genetic curiosity can be used to replace tapioca and to otherwise serve in the manufacture of adhesives. The new variety Waxy Iowa Hybrid 939 developed cooperatively by the Bureau of Plant Industry and the Iowa Agricultural Experiment Station appears very promising. Tests have shown it to be a satisfactory substitute for tapioca with many people unable to distinguish between commercial tapioca and the waxy corn product when the two kinds are made into puddings. In some cases, preference was shown for the corn product. Since our annual imports of tapioca have averaged about 350,000,000 pounds, with most of the supply coming from the Dutch East Indies, it is apparent that waxy corn offers a product of great value. It is believed that by 1945, the supply of first generation hybrid seed will be sufficient to provide for food needs as well as for the manufacture of adhesives.

The oat crop provides another illustration of cooperative advance, with the United States Department of Agriculture cooperating with the workers in all important oat producing regions of the United States in the greatest impetus in oat improvement in our history. Crossing Victoria with Richland resulted in high yielding, strong-strawed varieties which are resistant to both black stem and crown rust and to the smuts. The Wisconsin Station has released the variety Vicland; Iowa, the varieties Tama, Boone and Control; Nebraska, the variety Cedar, and South Dakota, Vikota, all having come from unified efforts in oat improvement.

These varieties have been accepted by the farmers with open arms and the demand for seed has exceeded the supply. According to Dr. L. F. Graber, of the Wisconsin Agricultural Experiment Station, from the original distribution of Vicland in 1941, there were at least 1,000,000 acres grown in Wisconsin in 1943 and he expects that of the two and one-quarter million acres of oats grown in Wisconsin in 1944, 1,500,000 acres will be seeded to Vicland. This represents a most unusual acceptance of a new variety within a short period of 2 to 3 years.

Smooth awn barley varieties gave an added stimulus to barley production in the Corn Belt states. The barley breeder must keep in mind two important objectives, suitability as a feed type and for malting purposes. At present with the help of the malting interests varieties are tested at the Malting Research Laboratory, University of Wisconsin, to determine their probable malting value. This work is making for more adequate testing of new lines resulting from barley breeding and is another illustration of the closer relationships between industry and the research workers.

For many years the flax breeders have worked closely with the industrial users of flax products. Since the early twenties, the Flax Development Committee of the Flax Institute of the United States has subsidized the research of the flax breeders and each year this committee has underwritten the expenses of a regional conference where the research data are presented for discussion. The industrial workers have given their side of the picture, their problems

and needs and the mutual relationships have led to a splendid appreciation on the part of the industry and the agronomist alike of the value of mutual interdependence.

To-day the flax breeder strives to produce disease resistant, high yield varieties with a high percentage of oil of superior drying qualities. Recent examples of the effectiveness of this program of research are the varieties Crystal and Koto. Crystal produced by the Minnesota Station and the United States Department of Agriculture is immune from races of rust common in the United States, is resistant to wilt, and its seed yields a high percentage of oil of good drying quality. Koto, developed cooperatively by federal workers in the North Dakota Station, is a high yielding wilt resistant variety, which while not pure for resistance to rust, has not been injured appreciably under severe rust conditions. Both Crystal and Koto will be distributed to growers for planting in 1944.

In the Southwest the development of combine types of grain sorghums has been of significance. These shorter stalked varieties have reduced labor requirements and have made it possible for the farmers of that region to maintain a reasonable acreage of grain sorghums during the present shortage of labor and farm equipment.

Sorghum varieties with waxy seeds, of similar use to waxy corn, offer possibilities as the starch may be used to substitute for the cassava starch of industry. Waxy kafir, developed at Lubbock, Texas, and Waxy Club at the Hays, Kansas, station are two varieties that have proved promising.

The soybean was introduced from the Orient many years ago but for a long period of time it was of relatively little importance. Much credit must be given to the agronomist for his studies in the methods of growing, harvesting, and utilization of the soybean. Without this ground-work the crop could never have attained its present importance. With the added impetus of the war, the soybean is a major crop in the Corn Belt. For the years 1927–31, soybean for seed acreage averaged 1,114,000 yearly with a production of 15,845,000 bushels. In 1942 the acreage was 10,762,000 with a production of 209,559,000 bushels, an increase of nearly 1400%. The October 1 estimates indicate a production nearly as great in 1943. Consider the significance of the development of soybean production in the light of our present war needs for fats and oils, and the ever expanding uses in industry of which the plastics are a notable example.

The soybean is coming to the front as a food plant. Our armies are using millions of pounds of soybean flour. Scientists have developed edible varieties of soybeans and its use as a green vegetable is becoming popular. A considerable quantity of green soybeans was packed by the canners in 1943 and the crop was found in not a few Victory gardens. As its value becomes better known we may expect the soybean to become one of our important vegetable crops. Those who have eaten properly prepared soybeans predict a great future for this plant which has long been a principal food product of the Chinese.

Various types of soybean flour processed by the miller are finding favor with the most exacting of cooks. The present war probably will stimulate the use of soybean products as natural prejudices are broken down under the stern demands of necessity.

Turning our attention to the forages we find further striking developments. Probably no other forage has shown such a complete shift in its center of production as alfalfa. In 1899 only about 2 per cent. of the alfalfa acreage of the country was in the north central states. In 1919, this percentage had risen to 10.4 per cent.; in 1929, to 25 per cent.; in 1939, to 45.4 per cent., the approximate relationship at the present time. It is interesting to note that today the four leading alfalfa states in order of acreage are Minnesota, Michigan, Wisconsin, and Iowa. In 1943, these four states produced approximately 39 per cent. of all the alfalfa hay produced in the United States.

Wendelin Grimm, the German emigrant to Minnesota, must be given much credit for the increase of alfalfa acreage in the north central states. However, without the experiment stations to test the variety and to prove its place, Grimm alfalfa probably would never have reached its place of importance. As with other crops previously mentioned, cooperation has had its part with the federal and state workers testing promising strains. To-day, Grimm alfalfa is rapidly on the way out because of its susceptibility to wilt. New desirable varieties of promise are Ladak, Ranger, and Buffalo. Ladak, a winter hardy variety introduced by the United States Department of Agriculture from India, is fairly resistant to wilt and in Minnesota has proved more persistent than Grimm. Ranger and Buffalo, wilt resistant varieties developed at the Nebraska and Kansas stations, respectively, in cooperation with the United States Department of Agriculture, are wilt resistant and otherwise generally satisfactory producers.

In connection with alfalfa production one must not overlook the splendid contributions on time and methods of harvest and other agronomic questions as related to the maintenance of stand. These investigations are largely responsible for the shift of alfalfa acreage to the north central states and for making alfalfa one of the most profitable of crops.

A striking development in crop change has been the introduction and distribution of Korean lespedeza. This plant with its ability to grow on the acid soils

of the more humid and milder temperature areas of the middle west has been a life saver for many farmers. The ability of the crop to reseed itself has led to many changes in rotations as has been so well demonstrated by the Missouri Agricultural Experiment Station. Lespedeza is of especial value in those sections where alfalfa is not adapted.

Sweet clover from the position of a weed of no value has come to be an important hay and pasture crop. In some regions it is tending to lose its popularity and to be replaced by other clovers. The production of varieties which will remain leafy over a longer period of time is one of the major problems. The coumarin content of sweet clover and its relationship to crop utilization is being investigated by some workers.

Recently registered new sweet clovers, as reported by Hollowell, are Spanish and Evergreen of the *alba* species and Madrid, an *officinalis* variety. Spanish, introduced from Madrid, Spain, is adapted to the Corn Belt, Great Plains, and the intermountain states. Evergreen was selected at the Ohio station and is adapted to the Corn Belt and the eastern edge of the Great Plains states. Madrid, the yellow flowered variety introduced from Madrid, Spain, possesses early seedling vigor, and resistance to fall frost. Its earliness permits it to escape the drouth common during the summer months in the Great Plains.

The United States Department of Agriculture is cooperating with several state agricultural experiment stations in the improvement of red clover. Two recently registered varieties are Cumberland and Midland. Cumberland, resistant to southern anthracnose and crown rot, is adapted to the southern region of the principal red clover belt. About 120,000 pounds of certified seed were produced in 1942. Midland, a winter hardy variety with some resistance to northern anthracnose, is adapted to the middle or central part of the Corn Belt. Some 220,000 pounds of certified seed were available for planting in 1943.

Crested wheat grass is a popular forage plant in the northern Great Plains area, where its ability to grow under the very dry conditions of that part of the country led to its increased usage as a hay and pasture grass. Professor R. I. Throckmorton, Kansas Agricultural Experiment Station, in a letter states:

> The introduction, distribution, and use of crested wheat grass in the Northern Plains has added enormously to the value of millions of acres of land. In this connection I found in August through a survey that approximately 3 million acres of land have been returned to grass in the Great Plains during the last 10 years through natural reseeding and that a like acreage has been returned to grass through artificial seeding. In other words, approximately 6 million acres of cultivated land in the Great Plains have been returned to grass during the last 10 years. Most of this took place since 1938.

In the Plains region there have been developed new methods of harvesting seed and in the reseeding of native grasses, as buffalo, grama, and the bluestems, returning these areas unsuitable for cultivation to grass where they may be expected to yield a maximum of grazing value. In a relatively short time much has been done to repair the damage that was done from placing these lands in cultivation with the accompanying erosion and destruction of native stands of grass. It is impossible to adequately estimate the monetary value to the nation of the reclamation of these grass ranges.

Smooth brome grass was usually considered as a weedy grass until it was shown that it could qualify as a meadow and pasture grass. Today it is frequently grown in combination with alfalfa to provide a suitable hay and pasture mixture. The agronomist is breeding for greater disease resistance and finer quality of forage with considerable promise of success as improved types are under test at several of the grass breeding stations. The growing of mixtures of alfalfa and other legumes with suitable grasses is an accepted practice proving of great value for rotational pastures and hay crops.

Reed Canary grass, while localized in the more northern states, is another example of the utilization of a wild grass for the benefit of agriculture, as it is a plant capable of growing on certain types of peat soil that are wet a part of the year. Since its introduction much marginal land has been reclaimed and has taken its place in increasing the acreage of productive farm lands.

The rather worn-out phrase of pastures being exercise grounds for livestock is still appropriate to portray the situation on many farms. The necessary research information is available so that such a condition need no longer exist. Within recent years added attention has been given to our pastures both temporary and permanent as investigators have learned how to increase pasture yields by proper renovation methods and grazing practices which make for high production. Probably no other farm enterprise is so little appreciated by the average farmer as his pasture. This viewpoint is changing rapidly as the research and extension workers demonstrate the possibilities of good pasture management.

Under war conditions the sugar beet is of added importance. There has been significant improvement in adaptability to specific conditions and resistance to the principal disease (Cercospora leaf spot) limiting production east of the Continental Divide. Great advances have been made in the substitution of the machine for hand labor in the growing of sugar beets and sugar beet workers believe that complete mechanization of sugar beet production is in sight.

A new phase related to our present war emergency

is the growing of the Russian dandelion (*Taraxacum kok-saghyz*), a cousin to our common dandelion, for the production of natural rubber. Trials are being made by federal workers in cooperation with the state agricultural experiment stations. Numerous problems of germination, seed storage, seed and root harvest, and the combatting of diseases and weeds occupy the time of the investigators as practically nothing was known about the culture of the crop when the work was initiated in America a little more than a year ago.

Our present acute shortage of fibers made it essential for several of the states to cultivate hemp as a fiber plant. As with milkweed, in some areas, the plant is shifted from its former position of an undesirable weed to that of an economic crop. In Wisconsin the hemp industry has operated for many years and agronomists were able to provide the necessary information to enable farmers in other areas to produce a new crop about which they knew little or nothing.

Before the present war paper was imported from Europe for the manufacture of cigarette paper. With the supply of paper shut off, industry looking for a substitute turned to the use of flax straw fibers, and to-day we find a new industry built on this need. The paper processors, cognizant of the need for superior varieties of flax and suitable supplies of weed free straw are providing funds for research and otherwise cooperating with the agronomists toward these goals. Formerly farmers who made a regular practice of burning their flax straw now find it profitable to grow a clean crop and through the sale of the straw, augment their financial returns from the crop. The straw from some 300,000 acres of flax finds a ready market each year.

Using the State of Minnesota as an example, Dr. C. O. Rost, Minnesota Agricultural Experiment Station, states:

> At present, in our state, an amount of fertility equivalent to at least 500,000 tons of commercial fertilizer is removed annually by potatoes, sugar beets, grains, livestock and livestock products. This represents fertility which leaves the farm. Our farmers are replacing only 1/10 of this amount of plant nutrients. It is clear that this practice cannot be continued indefinitely. The situation in Minnesota is typical of the 5 states which have within their borders 70% of the excellent and good crop land of the United States.

The increased use of commercial fertilizers has aided many farmers to grow profitable crops. In general, the farmers of the Corn Belt and the Great Plains Area have been slow to use commercial fertilizers. In part this was due to their being blessed with inherently fertile soils. Years of crop mining have changed the picture. Soil scientists have proved the value of commercial fertilizers and in many cases their use has proved the difference between a profit and a loss. For this region the end is not in sight as the surface has but been scratched and we may expect commercial fertilizers to be used almost universally in the near future.

Research on the insect problems has received attention at some of the stations. Progress to date indicates that much may be done to control insects through the breeding of varieties resistant to their damage, although agronomists and entomologists have developed farm practices essential in the control of most insects.

No discussion of crop research advances would be complete without giving some attention to those plants which persist in growing where they are not wanted. The weed research program, another example of unified research, was started in 1935, when the United States Department of Agriculture entered into a cooperative program of attack on the control of field bindweed. Regional cooperation in this area included the agricultural experiment stations of Kansas, Nebraska, Iowa, and Minnesota. All efforts were pooled and a series of uniform experiments was conducted at each station.

The weed program has given results which could not have been obtained by the states working alone. For example, root analyses for all stations were made at Ames, Iowa, making possible a standard, uniform procedure. Regional conferences of the workers from the federal and state agencies have led to revisions of research, improved methods of attack, a unification of effort and the drawing of conclusions that have solved many of the weed problems.

The weed research has shown that weedy plants can be controlled and eradicated without paying a tax so great that the farmer could not afford to cope with the situation. The use of cropping methods in connection with proper cultivation has made it possible for farmers to gain returns from their farms while carrying on an intensive eradication program.

Studies of the physiology of the weed have led to farm practices which are most effective in reducing its vigor and affording desirable crop plants a better opportunity to compete. To-day a good farmer may purchase a farm infested with field bindweed while 10 years ago he would not have considered such a farm.

The examples given represent but a cross section of developments and many more illustrations could be given if time permitted. Nearly every experiment station is short-handed and the pressure for information is very great. It is believed important that agronomists should not lose sight of the significant

values obtaining from long time research problems because of the pressure for quick, so-called practical results. If a shift is made and is carried too far, great losses are certain to occur and all should plan to carry on or to resume their activities in fundamental research just as soon as humanly possible.

OBITUARY

HARRIS HANCOCK

ON March 16, 1944, Harris Hancock, professor emeritus of mathematics of the University of Cincinnati, died at his home in Charlottesville, Va. A scant dozen miles away is Ellerslie, the ancestral Hancock home; here he was born seventy-seven years ago, the son of Richard Johnston Hancock and Thomasia Harris Hancock. After attending the University of Virginia and the Johns Hopkins University, where he received his A.B. in 1891, he went abroad to study with eminent British, German and French mathematicians. At Cambridge he studied with Cayley, Forsyth, Glaisher and J. J. Thomson. In Germany, at the University of Berlin, he attended the lectures of Fuchs, Frobenius, Kronecker and Schwartz. Here he was profoundly influenced by the lectures of Schwartz on the theories of his great teacher, Carl Weierstrass, one of the most subtle and penetrating critics of mathematical rigor and logic. After receiving the doctorate in philosophy from Berlin in 1894, he proceeded to Paris, where at the Sorbonne, he studied under Darboux, Picard and Poincaré, a triumvirate whose writings and researches form a rich legacy for geometry and analysis. At Paris he was awarded the degree of doctor of science.

Returning to the United States, he taught at the University of Chicago for six years. In 1900 he came to the University of Cincinnati as the head of the department of mathematics. Here he began work on a series of books over the fields of mathematics to which he had given his principal attention, while in Europe. His first two volumes, on "Maxima and Minima" and "The Calculus of Variations," were founded on the lectures of Weierstrass and helped to familiarize American mathematicians with the work of this great savant. Both volumes were published by the University of Cincinnati Press; the first indeed was edited by President Howard Ayres, who was presumably a confirmed Weierstrassian. These were followed by his books on "Elliptic Functions" and "Elliptic Integrals," both published by the house of Wiley. The work on "Elliptic Functions" was planned on a heroic scale as a three-volume treatise. Only the first volume, on "Analysis," of some five hundred pages, was published in full. The second, which was originally designed to cover the entire gamut of applications, was finally scaled down to form a monograph on "Elliptic Integrals." The third volume, on "General Arithmetic and Higher Algebra," was never published in its original form. But parts of this volume were presumably incorporated into the next of Dr. Hancock's books, a two-volume treatise, of some 1,250 pages, on the "Foundation of the Theory of Algebraic Numbers." This work was published by Macmillan with the aid of the Charles Phelps Taft Memorial Fund. As a sequel to this work, he finally brought out in 1939, two years after his retirement, his "Developments of the Minkowski Geometry of Numbers," also published by Macmillan and with the aid of the Taft fund.

These books brought to the American mathematical public the researches of foreign mathematicians in a more digestible form than that offered by the professional periodicals of the time. Hancock had access to Weierstrass' lectures in the Mathematischen Verein in Berlin; and his bringing these lectures to America, first in a series of abstracts in the *Annals of Mathematics,* and later in his books, he performed a great service for American mathematics. He had, too, the gift of clear exposition; he was never hurried, either in his writing or his lectures. At his own good time, the argument marched on to an inevitable and satisfactory conclusion.

It must surely be a matter of amazement that Harris Hancock, so unhurried, so deliberate, could have accomplished such a vast amount of important work in his lifetime. Apparently he was never very busy. Indeed he was always ready to give friendly advice and assistance to his students, to tell a good darky story, to discuss the culture of roses or the breeding of fine horses. In his classroom he adopted the principle stated so well by Nevin Fenneman: "Primary education should develop your weak points; university education your strong." The stupid, the slothful, the indifferent, he left to sleep in peace. But if you showed a spark of interest in mathematics, a gleam of ability, you were a marked man thereafter. He worked the able student constantly and unmercifully until he was finally delivering complete lectures.

Dr. Hancock's good students loved him; and even the poor and indifferent respected his ability and ease in the realm of mathematics. To many of his students, especially the engineers, he was known as the "Handy Man"; whenever a problem arrived at some seeming impasse, he had always a handy transformation that would save the day. They were baffled and amused by his southern pronunciation; and they all looked forward to Derby Day as a national holiday