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What Science Contributes to Agriculture

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Science Education

WHAT SCIENCE CONTRIBUTES TO AGRICULTURE

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The collection stage when man gathered insects and berries for food provides the first record of primitive agriculture.

It was not long, however, before man discovered that his standard of living could be raised by means of hunting and fishing. This is called the first period of the history of agriculture development by many historians. During this period man matched his wits with nature and drew his conclusions from natural phenomena. Superstitions, traditions, customs, and conventionalities played a very important part in the lives of men. Many strange beliefs were carried along from one generation to another. Many of these beliefs served as inhibitory forces to agricultural evolution. Some of them branded men as the slaves of nature and her laws. In this primitive period nature provided many things for the livelihood and protection of the physical and biological development of animals and man which she does not provide now. The question may be asked, is man largely responsible for this change and for the links in the long chain of man's evolution?

The hunting and fishing stage furnished some background of experience for man to enter the pastoral stage. It was during this period that the problems of crop and livestock production received little consideration beyond natural methods. Some men carried strange beliefs which they gained from their contact with nature. Jacob knew little if anything about the modern laws of heredity and had never heard of Genetics. Therefore, it is not surprising that he believed in maternal impressions and the oddities of telegony in animal breeding.

As the discovery of simple tools made of stone lifted man out of the collection stage into the hunting and fishing stage; so the domestication of animals lifted him into the pastoral stage which was the next great level in agricultural and cultural human evolution.

The immediate effect of each new power over nature was to increase the food supply very greatly. This meant that many more people could live in a given area and maintain a higher standard of living. It was during this period that men began to learn the advantage of working together in getting their living.

Life on the pastoral level has many pleasant features and men could have lived very comfortably if they had never got beyond it. But it is one of the characteristics of the human race that it is always seeking for improvement and progress. It is never content to remain stationary. Having made these two great improvements

in the supplies of animal food, man's capacity for learning next led him to the discovery of means of increasing and improving the food supplies which came from plants. Nature furnishes fruits, nuts, berries, barks, leaves, and many kinds of roots. However, the one which most of us would hardly think of has really been of the greatest importance. This is the seed of wild grasses. It is in developing these that man made his greatest achievements in the increase of plant food. From these come our various grains, such as rice, wheat, oats, barley, and corn.

Nature is so bountiful in providing various kinds of plant food that it was a long, long time before it occurred to man that it was worth while to try to make any improvements. He gradually discovered two things that he could do: first, destroy plants of no use to him and give their place to more useful plants; second, improve the quality of the useful plants from the point of view of their food production. This he did by carefully selecting the seed from the best plants, and improving the food bearing quality of plants themselves until each plant instead of producing enough seed to fill a thimble, would produce a good handful. This was the beginning of a highly scientific agriculture, when man began to conquer some of the ways of nature through plant and animal breeding and improvement.

As a foundation serves a building, so our present scientific program has been founded upon many of the principles discovered in these earlier stages.

Down through the years has come the development of a great program of scientific agriculture. Much has come from the experiment stations of foreign lands and from the state experiment stations. The object of this paper is to enable the reader to gain a distinct conception of a few things science is contributing to agriculture today.

Some choose to call this the cooperative stage but to observe the manner in which cooperative creameries and other cooperatives are fighting for new customers leads men to believe we may make more real progress if we call this the scientific stage of agriculture, and employ those principles.

In a recent survey of 28 agriculture colleges the 15 most significant scientific courses offered to teachers of agriculture and taken by those preparing to teach agriculture, were found to be the following: Principles of Dairying, Field crops and Plant Genetics, Farm Management, Principles of Livestock Feeding, Breeds and Types of Livestock, Farm Mechanics, General Horticulture, Principles of Marketing Farm Products, Soils and Fertilizers, Principles of Agriculture Economics, Farm Poultry Production, Methods of Teaching Agriculture, Principles of Veterinary Science, Rural Sociology, and Experience and Practice Teaching.

First, in order to limit the scope of this discussion it will be confined to the field of productive agriculture. Second, an endeavor will

be made to give a few concrete illustrations of what science contributes in only a limited number of these 15 subjects or courses. The third, objective is to illustrate a few of the complex problems which to a large extent remain unsolved in the minds of the practical and average productive farmer.

All should recognize that there is much useful information in scientific research laboratories and libraries. Those very close to the soil are most interested in those scientific principles which become available for useful purposes to the average farmer. It is not sufficient that the scientist labor in the research laboratory and make new discoveries. These discoveries in many cases must be translated, simplified, and interpreted for the average farmer. This is the new challenge to country agents, agriculture teachers, extension specialists, and home demonstrations agents. Private corporations produce products with simplified directions for their use and are paid profits for their discoveries. Agricultural college bulletins all serve the same purpose. When most of our farmers will avail themselves of the opportunity to learn from college bulletins, all agriculture sciences will leave a more marked imprint upon the economic life and general welfare of our rural population. However, a large number of our practical farmers, who are foreign born and who read scientific bulletins with difficulty, present special problems which must be solved largely through personal conferences and simplified directions.

In the survey of 28 agriculture colleges, the course, Elements of Dairying, ranked first from the standpoint of the institutions offering the course and also as the course taken by agriculture students majoring in agriculture education and planning to teach. A few of the fundamental principles which science contributes to this course will be outlined. These are taken from the course content outlines submitted by instructors teaching this course in agriculture colleges. Many of the statements are comments given in the outlines.

Real progress has been made in the science of feeding dairy cattle from an economic standpoint. A tribute is due scientific research for the balanced ration, and the mineral requirements for production and maintenance. The method of judging dairy cattle in America has been more closely related to the field of art than to the field of science. In the end, however, the economic viewpoint will prevail and will determine the course of procedure which many are now choosing to do by trial and error. The proven sire index and the science of animal breeding and genetics are contributing factors in the more satisfactory solution of this problem. A large number of instructors in the survey stressed the value of the Babcock test for fat in milk and indicated that the scientific research work which is going forward with the various vitamins has made real contributions to dairy husbandry. Those engaged in productive agriculture are dependent upon these and hundreds of other scientific discoveries made available as a result of research. In Minnesota many

farmers are engaged in the raising of Shorthorn cattle, primarily for dairy purposes. Many of these men have little knowledge of the science of Genetics and animal breeding. Most everyone will agree that a very thorough knowledge of the science of animal breeding offers no surplus of information for the successful development of a herd of this type for dairy purposes. The South East Experiment Station at Waseca, Minnesota, has made a contribution to the solution of this problem. This is a common problem since many farmers have failed to solve it through their own efforts.

Genuine and lasting progress has been made in the science of plant Genetics and crop improvement. All appreciate the many years of careful research that are necessary for the development of new varieties. All are thankful for Red Wing flax, Velvet barley, Minrus oats, Thatcher wheat and the Minhybrid varieties of corn. Farmers recognize that these varieties have desirable qualities from an industrial standpoint as well as high yielding ability. The Minnesota Experiment Station and all the geneticists who helped to produce these varieties should derive much satisfaction in the way they have served our farmers. The science involved in seed certification has done much to keep varieties pure and give buyers the opportunity to purchase high quality seed. The aid of science is needed in finding more productive permanent pasture grass mixtures and also more desirable annual pasture crops.

Farm Management in this brief discussion deals only with the management of a given farm or group of farms in a rather definite locality. The broadest division for the application of scientific development in productive agriculture is undoubtedly in this field. It demands a thorough knowledge and application, of all the scientific principles of agriculture information. To those who are especially capable, it offers an opportunity for the application of science through research. In Minnesota is a large storehouse of knowledge which may be applied in this field. Farmers are receiving help in the management of crops and soils, livestock management, building location and construction, operation of power units and many other problems. Just at this time many farmers are asking, shall we build a new electric fence and for what class of livestock is it adaptable? The more successful farm management specialists are executives of all sciences which serve productive agriculture. Farm management research has contributed a simplified system of farm accounts. The greatest difficulty is to get more farmers to keep them. Recent surveys disclosed that only about 5 per cent of the farmers keep complete farm accounts.

Some of the most helpful scientific information has come through scientific research with soils and fertilizers. The relation of soil acidity to the successful growing of many of the leading legume crops such as alfalfa and sweet clover has been solved by scientific methods. Science has provided many tests to determine the degree of acidity in soils. These were rather inaccurate and intricate at

first, but through new methods of research they have been highly perfected in their degree of accuracy and simplification. Science has taught agriculture how to diagnose unfertility. It has correlated the physical, chemical, and biological factors of soils so that farmers may select crops which are adapted to them. Science has demonstrated the value of high analysis fertilizers. While there are superphosphate fertilizer containing 45 per cent phosphoric acid, science will provide for agriculture a phosphate fertilizer containing over 65 per cent P_2O_5. However, farmers will call upon science for the best methods of using this concentrated product. It is believed that soil science will in cooperation with other fields of knowledge find the better practices in using this new product. By means of plot demonstrations many farms have been transformed to productive acres from marginal acres. Soil science will some day correlate with all the others factors which give value to farm lands and furnish a more accurate measure of land values.

Agriculture Economics is one of the fundamental courses in the field of agriculture. It helps to make a farmer the captain of his vocation. He will understand the science of economics with index figures, its price cycles in enterprises, the relations of industrial cycles to agriculture, and be prepared for periods of depression in agriculture. Some of the finest and most valuable contributions in agriculture economics are from the United States Department of Agriculture, the division of Agriculture Economics of the University of Minnesota, and other colleges, farm journals, the radio, and many of our daily newspapers. Thus science is doing much to help solve the problem of land use, conservation of agriculture resources, and the farm tenancy problem.

There is one definite fact which scientists must recognize; namely, that farms are operated as units, each by itself, many in the selfsame and often in the old way. The question may be asked what agencies can and will help to transform the individual farmer so he will avail himself of the opportunities to develop and practice the principles of scientific agriculture of which economics is a part? And so in the practice of agriculture many problems are involved in a number of enterprises, and call upon the principles of science, sometimes in a general, but more often in a special way, to supply the answer.

Principles of veterinary science is also one of the fifteen significant courses. It contributes much to practical agriculture. Under the organization of the State Livestock Sanitary Board and the help of the Bureau of Animal Industry, tuberculosis has been practically eliminated in cattle in Minnesota and many other states. This is another example of what can be done when science is employed through cooperation. But while this disease has been successfully stamped out; there are still many difficult problems to solve. There are many challenges to scientists in this field. All are hoping and waiting that new research discoveries will help solve the disease

problems of garget and mastitis, Bang's disease, pregnant fever in ewes, paralysis in chickens, and many others. Everyone will welcome a new method of hog cholera prevention, a cheaper and more reliable vermifuge for hogs and poultry. Students who go into practical agriculture and educational fields have received much help from science in the prevention and control of livestock diseases.

This is a brief summary of a few of the sciences which contribute much to agriculture. Others are of equal importance but space does not permit their discussion here.

This is the way the problems of science come to the productive farmer, the county agent, the agriculture instructor, and all those associated with agriculture in general. They are not always logical and coherent, and may be rather unexpected.

The process of getting theoretical knowledge is known as experience education. The field of agriculture and its related sciences are so varied and far reaching in scope that one cannot hope to teach all this information nor to get all the varied experiences even in four years high school agriculture and four years of college work in agriculture. What basic principles of plant science, animal science, Pathology, Genetics, and others will be of the greatest value to the student from every standpoint? This is one of the leading problems of agriculture education.

It is the task of those engaged in agricultural education to select those principles from the many and varied agricultural sciences which will function in the lives of the students. Such principles should be adapted to the interests, needs and abilities of the group. Agricultural education in Minnesota high schools is using the principles of science as related to each of the fields of knowledge to motivate, inspire, guide and to develop the student of today, the citizen, the farmer, and the scientist of the future.

The various agricultural and science courses of the Minnesota college of agriculture are helping to mold the lives of many farm boys through the instructors who have graduated from this institution. These students are splendid salesmen and excellent boosters for the program of scientific agriculture. They test classroom information with experiments and field demonstrations. We in agriculture call this farm practice and experience.

This combination of a fact-finding by means of information and proving it with experience is helping to develop a new type of farmer, who may be called the scientific farmer. He will be capable of employing the principles of science, and when the need arises, in many cases he may use the advanced scientific information to find the solution to his problems. He will be more interested. He should be happier and the general welfare of those engaged in the vocation of productive farming and its related vocations should profit as a result of this educational process.

As a high school teacher of agriculture, the writer wishes to express gratitude for the many fine contributions which the sci-

ences have made to the agricultural teaching profession and hopes that all will be prepared to meet each challenge as it comes.

The agricultural teachers are happy to be associated with the Minnesota Academy of Science and will endeavor to do their part in the inspiring task of advancing scientific agriculture.

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OPPORTUNITY FOR HOME STUDY OF ANIMAL LIFE ONE FACTOR IN PLANNING NATURE STUDY COURSES

ABSTRACT

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An investigation was made of the opportunity for home study of animal life. The kinds and the number of animals to be found in the homes of children were studied in relation to (1) the age and the grade of the children, (2) the housing environment of the children, and (3) the disadvantages and the advantages surrounding certain children.

Careful plans were made so that a random sampling of Minnesota's children would be reporting home conditions. From 34 different school districts 7,458 children contributed material for the study. These schools were 11 Minneapolis upper grade, 11 Minneapolis elementary grade to include one special school for crippled children, and 12 outlying Minnesota school systems. Children were drawn from the third through the twelfth grade. Data were collected in the spring of 1929 and tabulations were made at once.

From this survey on opportunity for home study of animal life as one factor in planning nature study courses the eight general conclusions reached are:

1. Of the 7,364 school children of normal rank, 66.8 per cent have one or more kinds of animals in their homes; 28.9 per cent report having one animal, 15.9 per cent two animals, 7.2 per cent three animals, and 14.6 per cent report having four or more animals each at home. A large proportion of children thus were found to be having close association with animals through the possession of them in their homes.

2. The Minneapolis elementary grade school children have slightly more opportunity for the home study of animal life than do the Minneapolis upper grade children. In general, boys tend to report having slightly more opportunity than girls for the home study of animal life.

3. The percentage of children having animals, when considered in relation to the ages of the children, shows only slight variation from age to age.