orienting. The unfertilized ova become milky and opaque within twenty-four hours.

Stripping these fish is not entirely successful, as the eggs are so sticky that they clump together and adhere to the fingers of the operator or to anything else they may touch. Moreover, it is difficult to obtain sufficient sperm for a large number of eggs by stripping the male. It is perfectly possible, however, to obtain a few eggs from the female in this way and enough sperm to enable the process of fertilization to be studied under the microscope. Attempts to strip should only be made on those fish which are actually beginning to spawn, when the eggs will flow freely. At this time there is little danger of injuring the female. It is usually possible to determine at least twenty-four hours before the act begins which female is ready to spawn, as the males will follow or chase her about the tank.

The eggs take from two days to a week or more to hatch, depending on the temperature. The ova are perfectly transparent and the developing embryo is easily visible under the binocular.

Further directions for breeding that may be desired can be found in the books of Smith[1] and Wolf.[2]

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[1] Smith, Hugh M., 1909, "Japanese Goldfish," W. F. Roberts Company, Washington.

[2] Wolf, Herman T., 1908, "Goldfish Breeds and Other Aquarium Fish," Innes and Sons, Philadelphia.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION M—AGRICULTURE

On account of the unusual number of bodies meeting at New York during convocation week whose field borders on agriculture, the Section of Agriculture held only a single session. This occurred Wednesday afternoon, December 27, 1916, in Brinckerhoff Theater, Barnard College, Columbia University, and was presided over by Dr. W. H. Jordan, of the New York Experiment Station. In the absence of the retiring vice-president, Dean E. Davenport, of Illinois, who was unable to reach the meeting on account of delayed train service, it was necessary to dispense with the vice-presidential address. This address was entitled "The Outlook for Agricultural Science" and has been published in this journal.[1]

The feature of the session was a symposium on "The Adjustment of Science to Practise in Agriculture," participated in by Dr. H. J. Wheeler, of Boston, Dr. J. G. Lipman, director of the New Jersey Experiment Stations, Dr. G. F. Warren, of the College of Agriculture at Cornell University, and Director B. Youngblood, of the Texas Experiment Station. Approaching the subject from different angles, the speakers brought out the many important considerations which affect the adjustment and determine the extent of the application of the teachings of science in agricultural practise.

Discussing "Some Factors lying between Scientific Results and the Farm," Dr. Wheeler laid down the proposition that true science is always in accord with the best practise; there is no antagonism between science and good practise, although political, economic and other factors may intervene to modify the extent to which the findings of science are profitable or directly applicable. The prosperity of the farmer is a prime requisite to the application of science in his business. The element of risk is unusually large in farming, and uncertainty as to the character of the season and the price of his products often makes the farmer of limited means hesitate to introduce changes suggested by science. A favorable tariff has in some countries been a large factor in creating conditions under which science can be profitably applied, together with a larger element of stability of the industry.

It was held that agriculture must be stimulated by political action; if the industry is depressed so that the farmers are not making money, science can not lend an effective helping hand to the art. The encouragement of private ownership of land, the adjustment of the farm to the farmer's capacity, and adjustment of the farming system so as to distribute and give employment to the labor throughout the year, are all important as determining factors lying between knowledge and its utilization on the farm. The condition of the land as, for example, the need of drainage, may be another factor in realizing advantages from the application of scientific principles. Illustrations were drawn from German agriculture to show how favorable conditions have been a means of developing agriculture and of putting into practise the teachings of the experiment stations and other educational agencies. As an example, the use of fertilizers was

[1] Science, N. S., Vol. XLV., p. 149.

cited, which represents the application of science in determining the fertilizer needs and of education in their intelligent use.

Emphasis was laid on the importance of the true interpretation of science in practise, and attention was called to some of the factors which may upset the laboratory results and conclusions when they come to be applied. Hence broad generalizations from laboratory experiments under artificial conditions are to be made with great care. It is necessary to know not only the exact conditions under which the experiments were made, but the modifying character of various factors occurring in nature. The present confidence of the farmers in scientific work and their readiness to adopt suggestions makes it highly important that the teachings be sound from both a scientific and a practical standpoint.

In regard to "The Limitations of Science to Progress in Agriculture," Dr. Lipman mentioned first of all those inherent in investigators, which necessarily have the effect of retarding progress in acquiring knowledge and applying it in the field of agriculture. While contending that science itself knows no limitations, he agreed that there are many important phases of agricultural questions which have as yet eluded science because of the limitation to human ingenuity and ability to discover. Lack of vision is a most frequent deficiency; the outlook needs to be broadened as the problems become more intricate and technical. There needs also to be a quite thorough understanding of farm problems and of conditions surrounding the industry, so that the findings of science may be properly related to practise and practise may thereby be made scientific. Dr. Lipman strongly urged the adequate preparation of men for research in this field.

But apart from this, the greatest limitation of science in agriculture at present is in its application. This is due quite largely to lack of education of the average farmer. The man power is the real measure of efficiency of production, rather than the acre, and the increase of this measure means more education. To raise the level of production there must be a higher level of education among the mass of farmers. Economic conditions constitute another type of limitation in this connection. The scientific facts may be known beyond doubt, but owing to conditions the employment of these may for the time being be impractical and uneconomic.

Lack of working capital was mentioned as another very serious limitation to the application of science, which often hinders raising the level of production; and the same is true of lack of cooperation among producers, because single-handed the American farmer is often not able to fully utilize the findings of science or to take advantage of them as he might if broader areas and larger interests were concerned.

In considering "Economic Factors affecting the Application of Science to Agriculture," Dr. Warren maintained that when the attempt is made to apply the principles of natural science to industry no method is scientific that fails to count the cost. Because scientists sometimes fail to take full account of the economic aspects of agricultural problems, farmers criticize them as theorists, and because farmers refuse to follow their teachings scientists often criticize them for being unprogressive. It was held that while there is opportunity for improvement in agriculture as in all of the industries, "the erroneous but well-nigh universal idea of the city that science can easily double agricultural production leads to the most unfortunate public policies."

The effects of transportation, distance from market and special local conditions, were considered. Products which are easily and cheaply shipped may be produced long distances from market, while perishable products and those that are bulky are advantageously produced near market. For this reason the eastern dairyman is warranted in growing his hay and buying most of his grain, shipping his milk and butter to nearby cities. New York state is suited by climate and soil to the growth of sugar beets and efforts have been made to establish the industry there, but sugar can be shipped long distances, and near market it can not compete with bulky products, such as cabbages, potatoes and hay. Furthermore, it is not enough that a product pay; it must be part of the best paying system. Dr. Warren held that the farm practise of a region is usually found to be quite closely adapted to its economic conditions, and that in a long-settled agricultural region any effort to decidedly change the type of farming should be undertaken only after careful study of all the factors involved.

Some dangers to be avoided in the practical interpretation of experiments on fertilizers, feeding stuffs, etc., were illustrated, and some applications of the law of diminishing returns were made to broad generalizations from such experiments. The law of supply and demand also has an important bearing on the intensity of farm practise; and it was explained that the "two-blade of grass theory," first exploited as a means of doubling the farmer's profits, has given way to a tendency toward the other extreme which holds that good crops are an injury to the farmer since they are usually accompanied by lower prices. Both extremes were declared erroneous. The conclusion was drawn that "agricultural practise is the resultant of many forces acting in as many different directions," all of which must be fully taken into account in prescribing rules for improvement.

In considering the subject of "Regional Conditions in Determining the Type of Agricultural Inquiry," Director Youngblood took for illustration the state of Texas, which is especially well adapted to the purpose. Within the state the variation in rainfall is from 8 to 55 inches, in elevation from sea level to approximately five thousand feet, in temperature from semi-tropical to strictly temperate, and in topography from flat to rough, while the soils of different localities are derived from various phases of at least ten geological periods. And apart from these physical differences the general character of the agriculture, the distance from market, and the intellectual status of the people all have to be taken into account in adjusting the agricultural inquiry to the needs of the locality.

The plan in Texas is adapted to these diverse conditions by means of a system of branch experiment stations located in typical agricultural areas and closely articulated with a central station at the agricultural college. In a sense these branch stations represent the industries of the locality and deal largely with practical questions, the plans for the experiments all being made with the advice of the experts at the central station, where a strong scientific basis is worked out on which to rest them. Director Youngblood laid emphasis on the endeavor to educate the people to the appreciation of all agricultural investigation, however simple or technical, and he expressed the conviction that even under the new and often transitional conditions in his state technical studies may be of the greatest practical value and may be made popular with the people.

In commenting on the papers in this symposium, Dr. Jordan drew the conclusion of the value of sound research and carefully guarded interpretation. He asserted that the experiment stations have been and are still putting too much time on mere variables that have no general significance, and too little on broad fundamentals. He also called attention to the fallacy and unwisdom of attempting to state the results of experiment in terms of dollars and cents—measures which have no real permanent or scientific significance.

Dr. L. H. Bailey referred to the difficulty in interpreting in the lives of the people and in public policy the results of agricultural investigation and inquiry; and he mentioned the desirability of a large and powerful organization which should bring its influence to bear in this direction, especially in expressing the voice of science in political matters and measures of public policy.

The officers elected for the coming year were as follows: *Vice-president,* Dr. H. J. Waters, president of the Kansas State Agricultural College; *Member of the Council,* President R. A. Pearson, of the Iowa State College; *Member of the General Committee,* Dr. J. G. Lipman, of the New Jersey Experiment Stations; *Member of the Sectional Committee* (for five years), Dean A. F. Woods, of the College of Agriculture, University of Minnesota.

E. W. ALLEN,
Secretary

SOCIETIES AND ACADEMIES

ANTHROPOLOGICAL SOCIETY OF WASHINGTON

THE 506th meeting of the society was held in the Lecture Room of the Carnegie Library, on February 6. On this occasion Dr. J. Walter Fewkes, of the Bureau of American Ethnology, presented a paper on "Prehistoric Ruins of the Mesa Verde National Park," illustrated by lantern slides.

Dr. Fewkes described in detail the uncovering and repair of a large pueblo-like building in the Mesa Verde Park, near the ruin known as Sprucetree House. This work was accomplished by the speaker during the summer of 1916. The structure brought to light was 113 feet long by 100 feet wide, the ground plan showing the existence of four circular ceremonial rooms compactly embedded in fifty rectangular enclosures which were formerly used for secular purposes. From its wide southerly outlook this ruin has received the name of Far View House. It is the first pueblo habitation of this type ever found on the plateau.

After an extended consideration of the kiva or sacred room in its relation to pueblo architecture Dr. Fewkes described certain prehistoric kivas of the type generally called towers which he found in a canyon near Ouray, Utah. From their location on top of inverted cones of rock these were called by him Mushroom Rock ruins. The shape of these inverted cones of rock bore evidence to the enormous erosion which has occurred in this region.

FRANCES DENSMORE,
Secretary