in connection with the solution of the moot question regarding the relative merits of rock phosphate and acid phosphate can readily be seen.

The oxidation of sulfur in the soil, or sulfofication, a process which has recently received some attention and which gives evidence of being of great importance from the soil fertility standpoint has been shown to be accomplished by several species of molds. The action of these organisms in this process may become of special importance in connection with the recent suggestion for the production of available phosphorus by composting rock phosphate, sulfur and soil or manure.

The process of ferrification, or iron oxidation in soils, while largely chemical in nature according to results thus far secured, is brought about partly by microorganisms and certain molds are apparently much more active in this action than any of the bacteria studied.

Experiments on the production of available potassium by molds should also yield interesting results. No data have yet been secured on this point.

In fact, it seems evident that mold action in soils may be of far greater significance than has previously been supposed in preparing available food for plant growth. No longer should the study of microorganic activities in soils consider bacteria alone. Mold action must also be investigated, and in most cases it is undoubtedly true that only vague, incomplete results can be secured if such mold studies are not included. Many results secured in bacteriological investigations might be explained and interpreted much more clearly and definitely if the activities of molds were considered.

If soil bacteriology is to be developed to the proper extent in the future and the relation of microorganisms to soil fertility is to be established with any degree of certainty, investigations must include not only bacterial action, but the activities of molds and possibly also the growth of protozoa and algæ.

It is certainly desirable that the investigations of molds in soils and their activities and importance be carried out much more generally and on a larger scale than is the case at present. Here is a field of study rich in possibilities and the importance of work along these lines can not be questioned.

P. E. BROWN
IOWA AGRICULTURAL EXPERIMENT STATION

THE U. S. BIOLOGICAL STATION AT BEAUFORT, N. C., DURING 1916

THE general appearance of the site of the station was materially enhanced during the year by enlarging the improved portion of the grounds, and by planting grass, sea oats, trees, and shrubbery. Through these improvements the comfortableness of the station was also increased. The laboratory, as usual, was open during the summer to special investigators. The investigators, with a single exception, had engaged in research at this station before and they continued during the past season lines of work previously undertaken.

The present large series of experiments in diamond-black terrapin culture, which was started in 1909, has progressed with marked success. Several new experiments in addition to those already under way were undertaken. There are now approximately 1,600 terrapins, exclusive of the young of 1916, in the pounds which are being used for experimental purposes. This experimental work has shown quite conclusively that terrapins can be grown and kept in vigorous condition in captivity, for some of the earliest broods, hatched in the pounds at the station, have reached maturity and are very prolific in the production of eggs, and the offspring is equally as vigorous as that of the wild terrapins confined after maturity had been attained.

A total of 2,611 terrapins hatched during the summer of 1916 has to date been taken from the egg beds. This number will be some-

what increased in the spring when terrapins appear that were overlooked in the fall. Among these young removed from the egg beds there are 666 which are offspring of terrapins reared in captivity. The total number of young produced during the previous year, including those found in the spring, was 2,128; of these 50 were offspring of terrapins grown in captivity. It has been known for some time that a female terrapin may lay twice during a single season, but during the past season through the discovery of 12 nests, averaging 8 eggs to a nest, in a pen where only four females are confined, it is evident that a female may lay as often as three times during a single season.

The most gratifying results of the past year are the unusually rapid growth of the young of one year and less of age and the very low mortality. The death rate among the 1915 brood during the first year was about 8 per cent., while formerly it occasionally ran as high as 40 per cent. The death rate among the young after the age of one year or more is attained is negligible.

The observations on the habits of fishes was continued by the director of the station. It is very noteworthy that food fishes generally were unusually scarce in the Beaufort region during the past year. The "gray trout" (*Cynoscion regalis*) which is normally, with perhaps a single exception, the most important food fish of the locality, was so scarce that the fishery was almost wholly abandoned. The almost total failure of a "run" of the two important fall species, the spot (*Leiostomus xanthurus*) and the jumping mullet (*Mugil cephalus*), is equally as noteworthy.

The pig fish (*Orthopristis chrysopterus*) was found in spawning condition on the inner shore of Shackelford Banks during May and the early part of June, but the eggs of this species seem to be difficult to hatch artificially. Spawn taken in the field by stripping was brought to the laboratory for hatching, but these efforts failed. Then ripe or nearly ripe fish were confined in live cars and tanks. Those in the live cars were stripped when apparently very ripe, and those in the tanks were allowed to spawn naturally. At no time was fertilization obtained in eggs artificially spawned, but of those spawned naturally, a small percentage was successfully fertilized and cell division ensued, but all died before hatching. These experiments having failed, the eggs, which are semibuoyant in sea water, were taken by means of a tow-net and brought to the laboratory. These too died before hatching. The methods of hatching employed were those which are usually successful with other species.

The study of the life history of *Gambusia* was continued chiefly for the purpose of verifying observations of previous seasons. In connection with the study of fishes in relation to the mosquito problem, it was found that the common eel (*Anguilla rostrata*) may, at least under more or less abnormal conditions, be of value as an eradicator of mosquito larvæ, for small specimens taken from reservoirs receiving the overflow of an artesian well were found to have subsisted chiefly on mosquito larvæ, which in this instance constituted about the only food available. These eels were not confined in these reservoirs, but had come there through choice by passing from salt water through the overflow from the reservoirs, a passage which remained open for an exit as well as an entrance. This then indicates that the common eel should not be overlooked in the study of fishes in relation to the destruction of the mosquito. Several collecting trips to fresh-water ponds and streams in the vicinity of the laboratory yielded the following species of fishes which do not seem to have been recorded from this immediate vicinity; *Ameiurus erebennus* Jordan, *Ameiurus catus* (Linnæus), *Erimyzon sucetta* (Lacépède), *Notemigonus crysoleucas* (Mitchill), *Notropis procne* (Cope), *Dorosoma cepedianum* (LeSueur), *Esox americanus* Gmelin, *Esox reticulatus* LeSueur, *Aphredoderus sayanus* (Gilliams), *Centrarchus macropterus* (Lacépède), *Chœnobryttus gulosus* (Cuvier & Valenciennes), *Enneacanthus gloriosus* (Holbrook), *Lepomis gibbosus* (Linnæus), *Lepomis incisor* (Cuvier & Valenciennes), *Micropterus salmoides* (Lacépède), *Perca flavescens*

(Mitchill), *Boleosoma olmstedi* (Storer), *Copelandellus quiescens* (Jordan). The two marine species, *Synodus intermedius* (Agassiz) and *Myrophis punctatus* Lütken, appear to be new to the Beanfort fauna.

Dr. Albert Kuntz, of the St. Louis University School of Medicine, continued the study of the embryological and larval development of fishes carried on during several seasons. Experiments in rearing larvæ gave only negative results.

Dr. Kuntz also made a detailed study of the skin of flounders adapted to backgrounds of different colors for the purpose of determining the degree of distribution of melanin and xanthine pigment and the relationship of the guanophores with the chromatophores when a given shade or color is assimilated as nearly as possible. Shade was found to depend primarily on the degree of distribution of the melanin pigment and the relationship of the guanophores with the melanophore. Color depends on a complex group of factors including the relative degree of distribution of melanin and xanthine pigment and the optical effects due to the diffraction of light by the guanin crystals in the guanophores.

Mr. Arthur Jacot, of Cornell University, continued for the second season the study of the life history of the mullets of the Beaufort region. It was definitely determined that the nominal genus *Querimana* comprises the young of the genus *Mugil*. At a certain period in their lives the young mullets pass through a gradual change which gives them the full adult characters. During this time the first soft ray of the anal fin is transformed into a spine, a change in the sculpture of the scales giving the appearance of a winter line also takes place, and the color is changed more nearly to that of the adult. The "jumping mullet" (*Mugil cephalus*) spawns in the fall, from October to December. The young grow rapidly and attain a length of 5 or 6 inches when one year of age. Then they appear to migrate southward by a slow and leisurely movement. In the spring they migrate northward, but by a more direct and apparently more continuous run. This migration causes a cessation of feeding and therefore of growth which is so marked as to affect the scale, leaving a "migration line." The jumping mullet, as shown from these studies, normally attains maturity when two years of age, but it may continue to grow until at least five years old. The "silverside mullet" (*Mugil curema*) spawns in the spring and the young grow rapidly. In the fall they leave the harbor to return only in small numbers. A careful search was made for the eggs and larvæ within the harbor and along the outer shores of Shackelford and Bogue banks, but no eggs or young less than 20 mm. in length were found. Since the eggs and larvæ of the jumping mullet too have not been found by the use of similar methods in the same locality, it is inferred that these two species are pelagic in their spawning grounds.

Mr. O. W. Hyman, of the University of Tennessee, continued his experiments and observations on the larval development of crustaceans. The experiments in rearing zoeæ were unsuccessful, but the observational work yielded better results. The first zoea stages of *Minippe* and *Callinectes* were secured, but could not be reared beyond this stage. Scattered observations were made on the life history and habits of *Minippe*. The megalops of *Callinectes* were taken in abundance and it was found that they were hardly in confinement and molted readily to the crab stage. The young crabs molted and grew rapidly. The entire life history of the common sand-fiddler (*Uca pugilator*) was worked out. Camera lucida drawings were prepared of each stage and of all appendages of each stage.

Dr. James J. Wolfe, of Trinity College, Durham, N. C., continued his investigation of the diatom flora of the Beaufort region. This work has been greatly hampered by the difficulty encountered in securing the very scattered literature on the subject. It is proposed in the present work to give carefully revised citations and descriptions of every form occurring in the vicinity. It is also proposed to offer carefully prepared illustrations of the commoner forms.

In addition to the above Dr. Wolfe, assisted

by Mr. Bert Cunningham, of the Durham, N. C., city schools, began an investigation of the plankton collections made by the U. S. Fisheries steamer *Fish Hawk* in the Chesapeake Bay region. Some thirty-odd collections were examined by the employment of methods which it is believed will furnish fairly accurate data concerning the numerical relations of all the important species as they vary according to depth, season and locality.

Dr. L. F. Shackell, of the University of Utah, continued his studies on the toxicities of various constituents of coal-tar creosote for the marine wood borer, *Limnoria*. Among the preparations tested were composite samples of tar bases of different boiling points, obtained through the courtesy of Mr. S. R. Church, of the Barrett Manufacturing Company. It was found that the bases were highly toxic for *Limnoria;* and that the toxicity increased with the rise of the boiling point—paralleling in this respect the results previously obtained for the tar acids.

Professor H. V. Wilson, of the University of North Carolina, spent a short time at the laboratory, continuing the study and identification of the "Albatross-Philippine Sponge Collection." Since but little work had previously been done on the sponges of the far east, it is not surprising that many of the forms proved to be undescribed.

Mrs. E. Bennet Decker, of Washington, D. C., again served as station artist. She prepared a number of illustrations of diatoms for Dr. Wolfe and made drawings and sketches for Dr. Kuntz and for the director.

Samuel F. Hildebrand,
Director

Bureau of Fisheries,
Washington, D. C.

PHILIPPE DE VILMORIN

With the death of Philippe Levêque de Vilmorin on June 30, genetics and horticulture lost a remarkable friend. His published work in both fields is valuable, but perhaps surpassed by his personal influence, which he owed largely to his position as head of the large and wealthy de Vilmorin family, and of the firm of Vilmorin, Andrieux & Co., of Paris, one of the most celebrated seed-growing and seed-selling establishments in the world.

The firm first appears in 1727 as a little seed store "*Aucoque de la bonne foy*" on the bank of the Seine, kept by one Pierre Geoffroy, whose daughter and heiress married the botanist Pierre d'Andrieux. A young botanist from Lorraine, Philippe-Victoire Levêque de Vilmorin, formed an intimacy with Andrieux, and in 1774 married his only daughter. Since then the firm has borne the name of the two families, although controlled wholly by the de Vilmorins. It has been handed on from father to son, and many of the family have contributed to agricultural science. The best known is Louis de Vilmorin (1816–1869), whose name is always connected with the sugar beet.

Of the early French contributors to genetics some, like Victor Lemoine, are known only as practical hybridizers; others have done purely theoretical work, as Jordan with his study of the nature of species, and Naudin with his observations on the segregation of characters in hybrids. Louis de Vilmorin is conspicuous in both classes. To theory he contributed the centgener method of breeding; to practical agriculture he contributed the sugar beet, whose saccharine content he raised from 10 per cent. to 18 per cent. by a carefully planned series of selections. Little improvement has been made in this beet since it left his farm.

He was succeeded by his son Henri, as head of the business and the family, and Philippe, who has just died, succeeded Henri in 1899. Philippe turned over the active management of the family business to his brother-in law, Comte d'Etienne, and gave the greater part of his own time to scientific research.

In horticulture he published studies of the beet-sugar industry of the United States, the culture of ginseng in Korea and Manchuria, and the tobaccos of commerce. He likewise edited three important publications of the firm: *Les Fleurs de Pleine Terre, Le Manuel de Floriculture,* and the *Hortus Vilmorinianus.*