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Bulletin 57 - An Outline for the Teaching of Agriculture in the Seventh and Eighth Grades

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THE NORMAL SCHOOL BULLETIN

Eastern Illinois State Normal School, Charleston

July 1, 1917
NUMBER 57

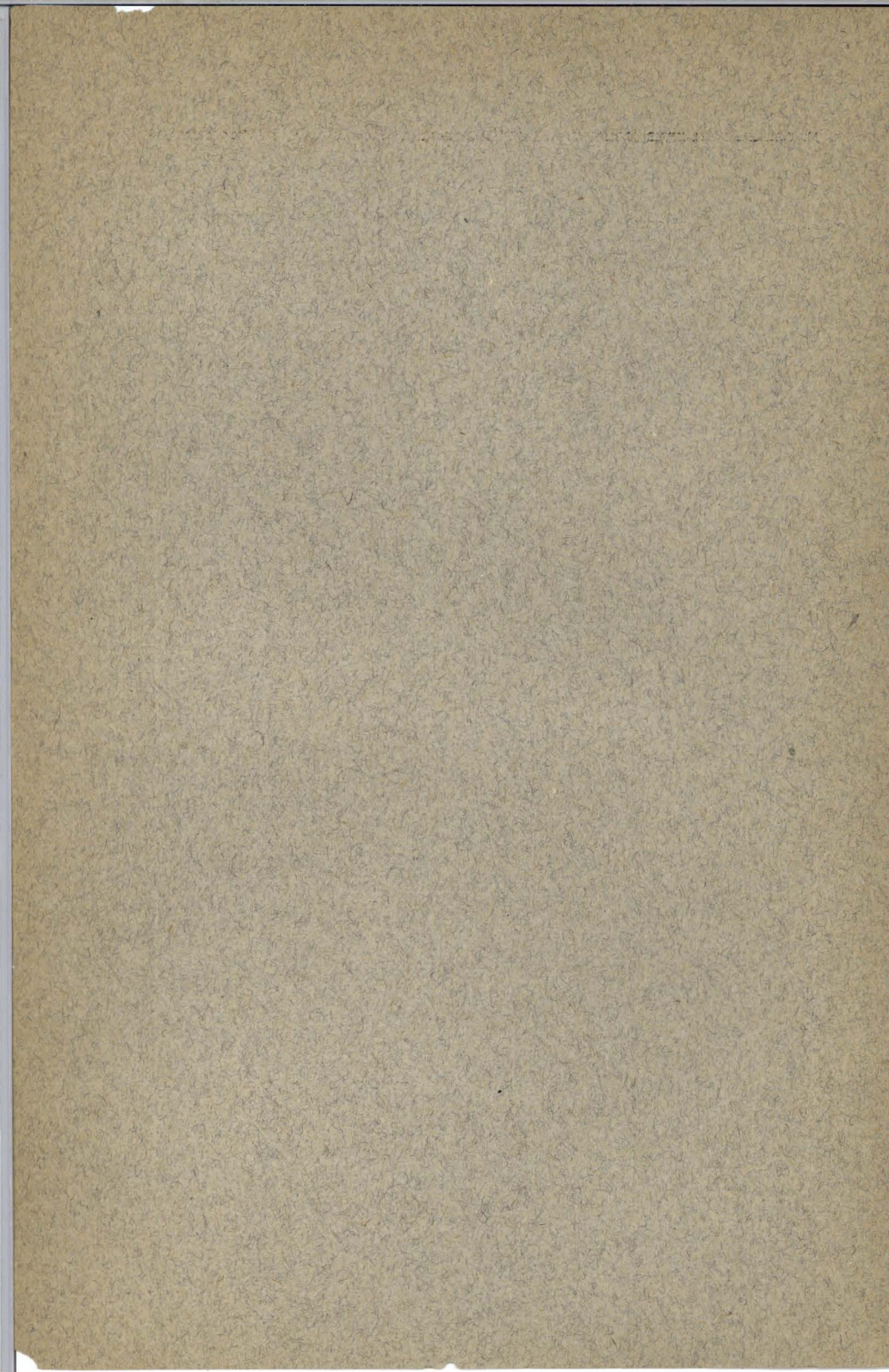
An Outline for the Teaching of Agri- culture in the Seventh and Eighth Grades

By

CARL COLVIN, B. S.

Agriculture, Eastern Illinois State Normal School

[Printed by authority of the State of Illinois.]



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PREFACE.

This bulletin is written with the idea of helping those who are teaching the subject of agriculture in the seventh and eighth grades to organize the subject matter which they are to teach. The teaching of agriculture in the grades is in the experimental stage. There is still much question as to the choice and organization of subject matter. The field of agricultural science is so large that great care is necessary in the choice of definite problems for the grades.

The first part of this bulletin offers a suggestive outline for seventh and eighth grade agriculture. The second part consists of suggestive outlines for home projects that may be carried on under the direction of the teacher. The third part consists of a list of reference books, bulletins, circulars, and pamphlets. Many of the bulletins, circulars, and pamphlets may be obtained free or at small cost. Bulletins and circulars from the Illinois Experiment Station may be obtained free. Those from the United States Government can usually be obtained free. If they can not be obtained free, they may be obtained from the Superintendent of Public Documents, Washington, D. C., at a nominal price per copy.

THE Normal School Bulletin

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CHARLESTON, ILLINOIS

July 1, 1917

INTRODUCTION.

In the midst of the movement for vocational education, the teaching of agriculture doubtless has a prominent place, if only because farming is the vocation of the largest group of our people. The study of agriculture gives a direct training for the most probable vocation of the boys and girls of our schools.

But this vocational training is hardly a sufficient, and certainly not the strongest, reason for placing the subject of agriculture in the schools and requiring its study of all pupils. For years we have known that the field of science must not be omitted from the curriculum of the elementary school, but the mass of material is so large, and its relative importance so uncertain, that few teachers have been satisfied with the rambling information about general science given under the subject of Nature Study. While the facts taught have been the facts of science, their organization has been anything but scientific.

It seems quite possible now that the science of agriculture may become so well developed as to furnish both an aim and a plan for the general science work in the elementary school. Added to the usual aim of science teaching, the mastery of the method of experimental science, it has an added incentive, its strong economic value and its possible vocational utility.

However, the subject is of especial interest in that it offers specific problems about which to organize the work in general science. If the problem of corn growing is set up as the specific problem of the seventh grade work, all the work in nature study for the lower grades can be directed toward the solution of this problem. The air, the soil, plant cycles, animal life can all be studied in their relation to this and allied problems of the seventh and eighth grades.

It will not be possible by this plan to make a complete study of the science of agriculture, but it will be possible by an intensive study of one or two crops, to teach the method by which others may be studied. The home projects, in particular the garden projects, have seemed especially valuable. They have furnished the pupil an individual laboratory in which his plans and theories may be tested, and as a valuable by-product, they have furnished him a nature-made test or standard of the efficiency of his own effort.

When teachers are trained to organize and teach this subject to make it yield its possible results, it must be given a large place in our daily program of studies.

FISKE ALLEN.

AN OUTLINE FOR THE TEACHING OF AGRICULTURE IN THE SEVENTH AND EIGHTH GRADES

By CARL COLVIN, B. S.,
Agriculture, Eastern Illinois State Normal School.

SEVENTH YEAR.

Plants and the Soil.

AIMS OF THE YEAR'S STUDY.

1. To teach some elementary facts about the growth of plants.
2. To lead the child into a more intelligent appreciation of his environment.
3. To direct such home projects, of educational and economic value, as may be possible under existing conditions.
4. To establish a basis for further study of the science of Agriculture.

It is the aim of this year's work in Plant and Soil Studies to so direct the observation of the child that he may become more intelligent concerning the natural phenomena of his immediate environment. Some of the most important principles of plant growth and soil development should be taught this year. We become interested in the phenomena which we understand. Our observation is made keener by every fact we learn. There is some economic value to be gained by the study of the principles outlined for study this year. The study should also serve to enlarge the view of the child concerning life. The study this year, especially the home project work, should make the child more keenly alive to the economic possibilities of his community. The educational value of the work done in agriculture should be equal to that of the work done in the other studies of the curriculum.

Since the future production of the necessities of life depends in large measure upon the intelligent handling of the soil, boys and girls should be given a basis for further study of the scientific principles which govern the treatment of the soil. By the use of the material suggested as reference this year, or by the use of a good text supplemented with laboratory work, such a basis should be established. The survey of the district which is suggested should furnish material for a

correlation between farm life and such subjects as arithmetic, history, and geography.

First Month.

PLANTS.

I. ABUNDANCE OF PLANT LIFE.

II. VARIATION IN PLANTS.

1. Extent.
2. Value.
3. Observation notes.

III. MAN'S INFLUENCE IN PLANT DEVELOPMENT.

1. Results of selection.
2. Illustrations of changes in plant life due to man's effort.

IV. USE OF PLANTS.

1. Food.
2. Clothing.
3. Shelter.
4. Beauty.

V. PARTS OF THE PLANT.

1. Root.
2. Stem.
3. Leaves.
4. Flower and fruit.

- A. Purpose of each part in the development of the plant.

The aim this month: first, to teach the importance of plant growth to man; second, to teach the parts of the plant and their uses in the growth of the plant. The work given this month will of necessity be very elementary in form. Observation of the growing plants will be necessary. Pupils should examine a number of plants and tabulate differences. What would happen if all plants of the same kind were exactly alike in every detail? Could there be any improvement of plants under such circumstances? Man has made an effort to improve plants and new varieties are being formed all the time to meet changing conditions. This effort on the part of man is in his own interest and not in the interest of the plant. The many varieties of apples will serve as an illustration of the work man has accomplished in improving plants.

The children know the main parts of the plant. The aim this month is to classify the uses of each part in order that the work which is to follow may be more clearly understood. The plant is studied as a whole made up of various parts, all of which are necessary to the completion of the work which the plant accomplishes. Thus the stem would be of little value if it were not held in place by the roots; the root would be of

little value as a storehouse for food unless the stem were present to furnish a channel through which manufactured food may be transported; there would be need for neither root nor stem if the leaf were not present to act as a factory for the production of food. There are many relationships which may be studied in this connection. Compare the plant as an organism with the animal in its habits of growth. The pupils should understand that there is life in the plant and that growth is going on just as it is in the animal body. The method of reproduction of plants may be compared with that of animals.

References—Nos. 1; 2; 3; 8; 9; 13; 11.

Second Month.

FACTORS NECESSARY FOR THE GROWTH OF PLANTS.

I. Food.

1. Elements necessary to plant growth.
2. Method of taking in food.
3. Source of food.
 - A. Soil.
 - B. Air.

II. MOISTURE.

1. Rainfall as a source of water.
2. Use of water in the plant.
 - A. As a food carrier.
 - B. As food.
 - C. As a support to the plant.
 - D. Amount of water required by different plants.

III. AIR.

1. Need for air.
2. Method of breathing.

IV. LIGHT.

1. Light as energy for the work in the factory.

V. HEAT.

1. Source of heat.
 - A. Natural.
 - B. Artificial.
2. Use of heat to the plant.

The aim: to teach some facts about the factors which are necessary to plant growth. The ten elements which are necessary to the growth of plants are: carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, magnesium, calcium, sulphur, and iron. Most of these elements are known in some of their common forms. Study these forms. Teach the difference between an element and a compound. Some of the combinations of elements should be noted, as water, car-

bon dioxide, and salt. Study the way plants take in food. Note that the food taken from the soil must be in solution before the plant can take it into its system. Emphasize the fact that nearly all the weight of the plant is made up of the food that is taken in from the air. The root hairs on young plants can be observed. Why do plants usually wilt when they are first transplanted? How might this wilting be prevented?

The uses of water should be classified. Simple experiments can be carried on in boxes or out of doors to show the need for water all the time by plants. The amount of rainfall should be studied. Plot curves to show the rainfall during the months of the year in your locality.

Compare the leaves of the plant to factories. The need for air, light, and heat in these factories may be compared to the need for fuel in the plow factory. Simple experiments may be carried on to show that plants will not grow if one of the factors mentioned is lacking. Note the difference in color between leaves that are exposed to light and those that are shut away from the light. Drive out the air from a flower pot containing a growing plant, by filling the soil with water. Note the time before the plant shows the ill effects of such treatments. Keep a record of the temperature for one month. Plot curves to show the changes of temperature during the month.

References—Nos. 1; 3; 5; 7; 8; 65.

Third Month.

CORN.

I. IMPORTANCE OF CORN GROWING IN ILLINOIS.

1. Extent of corn acreage.
2. Yields of corn.

II. USE OF CORN.

1. Products used in locality.
2. List of all products made from corn.

III. JUDGING CORN.

1. Selection of samples.
2. The score card.
 - A. Breed characteristics.
 - a. Shape and size of ear.
 - b. Shape and size of kernel.
 - c. Color of grain and cob.
 - d. Roughness of kernel.
 - B. General characteristics.
 - a. Weight.
 - b. Space between rows.

- c. Tips and butts.
- d. Proportion of corn.
- e. Maturity and germ quality.
- f. Uniformity.
- g. Soundness.

IV. CULTURAL METHODS.

- 1. Soil.
- 2. Planting.
- 3. Harvest.
- 4. Fertilizers.

The aim: to teach the most vital facts concerned in the selection of seed corn, and the production of larger yields.

It is not possible to study many of the farm crops in the limited time given to agriculture in the rural school. Study corn as a typical crop in this State. A detailed study of this crop so far as time will permit will be of greater value than a mere skimming over the facts which concern the growth of many crops. Make a classified list of the products that are made from corn. Much of the time this month should be given to corn judging. Laboratory work will be of much greater value than textbook work this month. Provide a pad of score cards for each pupil. These may be obtained by writing to the State Farmers' Institute, Springfield, Illinois. Each pupil should bring a ten ear sample at the beginning of the work. Let him choose the sample without advice or direction. Call for more samples after a study of corn has been made and compare the two sets of samples.

The type of corn should be studied with great care. Pupils should be able to distinguish between two ears of corn having different type, as they would between a draft horse and a driving horse. Much attention should be given to the uniformity of type in the samples studied. The single ear may be studied as a unit in the same way that the ten ear sample is studied. A field study of the differences between stalks of corn should be made. The importance of picking corn in the field that is to be used for seed will be apparent if a field study of the variation among plants is made. Every grain of corn has wrapped up in it the possibilities of a corn plant. Emphasize the necessity for caring for the seed during the fall and winter months. Correct methods of storing seed corn should be studied and boys and girls should be urged to help pick the seed corn and to take care of it through the winter.

Some time should be given to the culture of the corn crop. A study of the factors which influence the yield of corn in this state can be studied by obtaining from the experiment station

bulletins which show results of various treatments of corn. Study the treatment of soil that has given best results in corn growing.

Study the value of corn as a fattening food. Show that it has had much to do with the development of the feeding industry in Illinois. Some problems may be given in cost of production and marketing of corn. List the items that should be considered in the cost of production of an acre of corn. Most corn will shell eighty-eight per cent of the total weight of the corn and cob. How does this compare with the percentages represented by the standard weights of ear corn and shelled corn, as established by law in Illinois?

References—Nos. 22-28 inclusive; 5; 18; 17; 51; 52.

Fourth Month.

THE SOIL.

I. BASIS FOR PLANT AND ANIMAL GROWTH.

II. ORIGIN OF SOIL AND CHANGES IN SOIL.

1. Factors affecting changes in the soil.

- A. Water.
- B. Temperature.
- C. Air.
- D. Wind.
- E. Soil organisms.

III. CLASSES OF SOIL BASED ON TEXTURE.

- 1. Clay.
- 2. Sand.
- 3. Silt.
- 4. Gravel.

IV. QUALITIES OF VARIOUS CLASSES.

- 1. Water capacity.
- 2. Warming up in spring.
- 3. Drainage.
- 4. Working quality.

The aim: to establish a definite idea as to what the soil is and to establish a basis for noting differences in soils. The soil should be regarded as the chief asset of the state. Most of the necessities of life come from the soil. The study this month may be correlated with the work in home geography. Some field observations of the different kinds of soil should be made in the community. Note that many of the changes that are going on all the time in the character of the soil are under the control of man. Study the areas in the United States that have been abandoned because of the loss of fertility. Are there places in the community where the soil has been rendered useless because of washing or other changes?

Obtain samples of clay, silt, sand, and gravel. What is the prevailing kind of soil in the community? Show by experiment some of the differences between fine soil and coarse soil. Fill one can with gravel and another with fine sand; pour water into each until it is full. Which holds more water? Give reasons. Can you account for the difference between clay and sand as to temperature? Does the color of the soil affect the productive qualities? Study the growth of crops on the different kinds of soil in the community. Many simple experiments may be devised to show the differences between any two kinds of soil.

References—Nos. 3; 5; 7; 8; 16; 65 66; 74; 77; 82.

Fifth Month.

PHYSICAL AND CHEMICAL PROPERTIES OF THE SOIL.

I. PHYSICAL PROPERTIES.

1. Tilth.

A. Factors affecting the tilth of the soil.

a. Organic matter.

b. Kind of soil.

c. Cultivation.

II. CHEMICAL PROPERTIES.

1. Elements in the soil.

2. Limiting factors.

3. Fertilizers.

A. Manure.

B. Limestone.

C. Phosphates.

D. Green manures.

The aim: to teach that the soil must be properly cared for and that plant food must be added from time to time or it will wear out.

The word "tilth" should be introduced and used through the month. The effect of organic matter on soils can be noted by observation. Note the differences between the working qualities of sandy soils and clay soils. The terms "physical" and "chemical" should be clearly distinguished. Note the differences between soils that have been cultivated through the season and those that have been idle and uncultivated for some time.

Review the ten elements that are necessary to plant growth. Relation of plant and animal organisms as to content should be noted. We need the same elements to sustain life that the plant must get from the soil to sustain life. The soil is necessary, then, to support all life. The meaning of

limiting factor should be emphasized by many common illustrations. The limiting factors may be different in different parts of the state. The three elements that are most needed are nitrogen, phosphorus, and potassium. In parts of the state where soil is sour, limestone is the factor which limits plant growth. Study the effect of limestone on the soil. Put some soda in a little vinegar and note what happens. This action is similar to the action of limestone on the acid which is in sour soils. Study the plants that grow on sour soils. Use the litmus paper test to test the soils of the community for acid. The children can bring samples to school. Mark the areas of sour soils on the map of the district.

Emphasize the fact that soils must be replenished with plant food if they continue to produce large crops. Review the sections of the country that have been abandoned because the plant food has been exhausted. Get the bulletins from the experiment station and note the data that has been obtained on the experiment field nearest to your school. This study need not be very extensive. A few of the conclusions that have been reached concerning the need of types of soil in this state will be of great value.

References—Nos. 5; 7; 8; 65; 66.

Sixth Month.

I. WATER IN THE SOIL.

1. Kinds.

- A. Surface.
- B. Capillary.
- C. Hygroscopic.

2. Capacity of soils.

- A. Clay vs. Sand.
- B. Black vs. Light.
- C. Sod vs. Tilled.
- D. Drained and Undrained.

3. Saving moisture.

- A. Mulch.
- B. Drainage.

II. AIR IN THE SOIL.

1. Value.

2. Factors influencing the amount.

- A. Water.
- B. Organic matter.
- C. Structure of soil.
- D. Texture of soil.

The aim: to teach the value of air and water and ways of increasing the amount that may be available to the plant.

The factors mentioned in the outline concerning water should be studied with this question in mind: how can we best retain the moisture which comes to the soil as rain? Show the three kinds of water by experiment. The plants can not use much surface water or hygroscopic water. It is the capillary water and its conservation that needs to be studied. Fill glass tubes with sand, clay, and gravel; place the lower end of the tubes in water after tying a cloth over the tube to keep the soil in. Note the rise of water in the tubes. This is capillary water. Note the difference in the time required for the water to rise in the various soils.

Study the different kinds of mulch. Note the effect of strawing potatoes. Note fields that are drained and fields that are undrained. The difference in plant growth is due to the extra surface water. Study the effect of this water on the growing plants. Emphasize the need for cultivation of the soil to conserve the moisture. Conduct simple experiments to show the effect of soil mulches.

Note that the water content and the air content are closely related in any soil. Wet soils are poorly aerated. Emphasize necessity of air for plant growth.

References—Nos. 5; 7; 8; 66.

Seventh Month.

THE GARDEN.

I. VALUE OF THE GARDEN.

II. PLAN.

1. Value of definite plan.
2. Time to plan.
3. Factors to be considered in making plan.
 - A. Size of family.
 - B. Disposition of products.
 - C. Location of garden plot.
 - D. Climatic conditions.
 - E. Rotation of crops.

III. PLANTING DATES FOR VEGETABLES.

IV. THE HOT BED.

1. Construction.
2. Time to start.
3. How to use.
4. Transplanting.

V. CULTURAL REQUIREMENTS OF COMMON VEGETABLES.

1. Classes of vegetables.
2. Methods of cultivation.
3. Harvesting and storing.

The aim: to create a keener interest in the work which every boy and girl can do on the farm or in the city; and to teach some definite facts concerning the growth of the vegetables. The important place of the garden in the food production should be emphasized. The value of planning work will make itself evident in studying the garden. Much vegetable material is lost every year because the garden was not planned to meet the needs of those who planted it. A planting plan and list of planting dates for the locality should be made. This can only be approximate.

It may be possible to have a hot bed constructed at the school and to plant it and care for it through the spring. It will furnish the early plants for most of the children to use at home. There are many principles of plant growth and soil management that may be emphasized by the use of the hot bed. Review the study of the roots of the plant. Note the cause for wilting of transplanted plants. The pupils should harden off the plants that come from the hot bed. Experiments may be conducted to show the difference between plants treated in various ways. The value of conserving the moisture of the garden is a most important item in the care of the garden. Some study of the soil which is best adapted to gardens can be made. If there is time this month, review the study of some of the common insects which have been studied in the nature study classes below the seventh grade. The pupil will now see the value of knowing the habits of insects and the methods of controlling them. One or two of the common insects should be studied with great care. The potato beetle or the cut worm are typical of the insects of the garden. Have pupils report on observations made of the habits of insects.

Not enough vegetables are stored for the winter. The principal reason is that people do not know how to care for vegetables in order to preserve them for winter use. Study these methods. The cellar or pit and methods of canning vegetables should be studied.

The work in the school room this month should be correlated with the home garden. The home garden work furnishes an excellent basis for individual projects with small investment of capital.

References—Nos. 2; 48; 49; 131; 139.

EIGHTH YEAR.

Animal Husbandry.

PURPOSE OF ANIMAL STUDIES.

1. To acquaint the pupil with some definite facts about our domestic animals.
2. To quicken interest in animal life.
3. To establish ideals of animal production.
4. To emphasize the importance of growing more live stock.

One of the main purposes in the teaching of such subjects as Nature Study—so-called—and agriculture in the grades is to teach the child some facts about his environment that will enrich his life there. Because boys and girls do not know the possibilities of their own environment they often lose interest and long for a foreign environment about which they have heard fascinating stories. Those who teach in the rural schools, in many instances, know little of the live stock that forms so large a part of the farming interests of the community. The study of the pupils can be so directed as to be an advantage to both teacher and pupils, by using the available material upon this subject.

Boys and girls need to have their interest in animal life aroused. The fact that animals furnish us with so many of the necessities of life should be emphasized. The rapid strides that are being made in animal production tell in a most forceful way the need for a consideration of such a subject in our public schools. It is true that in many instances the science of affairs has outrun the science of the schools. It has been demonstrated that a cow can be made to produce more than thirty thousand pounds of milk in one year. If one farmer has been able to accomplish this result, the principles which guided him in his efforts should be taught to the boys and girls who are to be the farmers of the next decades. Since so many of these boys and girls do not continue in school after they finish in the rural schools, they must get these principles while in the grades or not at all. There are many of the principles of selection of live stock and feeding that can be effectively taught in these grades. By emphasizing some of these principles, so vitally affecting the production of food,

the importance of growing more and better live stock must make itself apparent.

There is not time in one year to teach a great mass of facts about the animal industry. These two general methods of study present themselves: the work may be outlined much as it would be if one were outlining a college course designed to present a detailed study of the subject and in following this outline, such facts as could be taught in the time given would be presented; or only a few of the important phases of the subject, which children in the eighth grade can appreciate, may be put into the outline and these phases taught with greater detail than would be possible under the first method. The writer believes that it will be better to teach a few important facts about animals and their relation to the life of the community, and to teach these facts in detail, than to make an attempt to cover a larger field with no detail. Hence in the following outline many of the phases of animal study, which would be expected to be in a college course, are not mentioned. Several home projects suggest themselves this year which are directly correlated to the study of animals. A few are outlined in this bulletin. Others may be substituted to meet the needs of special environment, or special home interests of individual pupils.

First Month.

THE ANIMAL AS A FACTORY.

I. IMPORTANCE OF ANIMALS FOR THE PRODUCTION OF NECESSITIES.

1. Food products.
 - A. Meat.
 - B. Milk.
 - C. Eggs.
 - D. Other by-products.
2. Other important products.
 - A. Hides for leather goods.
 - B. Fertilizer.
 - C. Energy.
 - D. Miscellaneous.

II. RAW MATERIALS NEEDED FOR THE FACTORY, AND ITS MANAGEMENT.

1. Food for the animals.
 - A. Farm crops as a source of feed.
 - B. Amount of feed consumed by the animals each year.
 - C. Importance of efficient methods of feeding.
2. Shelter for the animals.
 - A. The cost of shelter.
 - B. The importance of good care.

III. THE FACTORY—THE ANIMAL BODY.

1. The machinery.

A. The digestive apparatus.

B. The glands concerned in production of milk and other products.

C. Organs used in mechanical preparation of food.

2. Comparison of the animal as a factory with other factories.

3. Efficiency of the animal compared with the efficiency of the engine.

The aim which the teacher should have in mind this month should be to teach the child to look upon the animal as a necessary machine which is working every day in the production of something which is useful to man. It should be understood that the animals have been domesticated and brought to their present high production by selection. If the animals were allowed to run wild without the special care of man, it is scarcely conceivable that any cow would reach the production of thirty thousand pounds of milk in one year. The only use for milk in such an instance would be to keep the young alive and there would be no necessity for such a large production. Man, then, has seized upon the animal in the wild state, and not only has he domesticated many species, but he has made them yield to his demands to a large degree.

A study of the value of the animal products mentioned in the outline will be valuable. These values should be put into concrete terms that can be appreciated by the class. Perhaps the amount of milk, for example, may be considered in terms of gallons or pounds per person, rather than as millions of pounds, per year. Comparisons may be made with the production in other countries, where the production is much greater but the population is also greater. Show the increase in individual production by the animal factory, as necessity has called for increased production in the United States. Study the effect of the animal production upon the kind of life in the community. The habits of communities are fixed partly because of the facilities for crop production and animal production.

In comparing the animal with a plow factory or some other kind of a factory, it should be made clear that the animal depends just as much on the raw material that it gets as does the plow factory. The animal can not put out a first-class product unless it has first-class raw material. If milk is the product expected from the factory, then something must

be fed to the animal which contains the constituents of milk. Study the cost to the farmer of inefficient methods of feeding. Many illustrations can be cited. The feeding of hens for production is a good illustration. Some farmers keep a large flock of hens and feed them through the winter on corn alone, without warm quarters, and get no eggs. Others by using proper feeds and methods of handling are able to get a good egg production all winter when eggs are high. Many of the inefficient methods of the farm would not be tolerated in the plow factory because they would mean bankruptcy. The cost of care should be considered as an investment in the factory which is to produce food and clothing for the market.

The digestive apparatus should be studied as the machinery which is working to produce a finished product. It should be compared with the machinery of the plow factory. Some of the processes of digestion may be studied. The importance of keeping the system in good order by feeding the proper kind of feed should be emphasized. The selection of animals according to their ability to produce a finished product in large quantity is important. This ability depends in large measure upon the animal's ability to digest large quantities of food; so the selection of animals on this basis may be studied. A comparison of individuals should be made in the field. The class should study a dairy herd and note the barrel or digestive apparatus of each individual and compare this development with the production. There will not be time to study all the points of the score card which is used in selecting the animal. Important points will be suggested under the study of the various animals. The importance of a good digestive tract should be emphasized in every instance. As the output of the plow factory is regulated by the equipment of the factory, so the output of the animal will depend upon the machinery or equipment used for the manufacture of the product from the raw material available.

If there is time this month a study of the live stock industry of the local community may be made. The animals that are used in the community should be classified according to their use to the community. The value of the animals may be tabulated. This will necessitate a survey of the community. Such a survey will be valuable. It will give available material for supplementary problems in the arithmetic class. It may furnish material for composition work, without detracting from the aim as established in the composition class.

Second Month.

FEEDING OF ANIMALS.

I. PURPOSE OF FEEDING.

- A. For maintenance.
- B. For growth and repair.
- C. For by-products.
 - a. Milk.
 - b. Eggs.
 - c. Energy.
 - d. Fat production.
 - e. Wool.

II. CLASSES OF FEEDS.

- A. Basis of nutrient content.
 - a. Nitrogenous.
 - b. Starchy.
 - c. Fatty.
- B. Basis of bulk and content.
 - a. Roughages.
 - b. Concentrates.

III. FOOD NUTRIENTS.

- A. Meaning of nutrient.
- B. Purpose or function of each nutrient.

IV. BALANCED RATIONS.

- A. Definition.
- B. Method of balancing rations.

This month's work should continue to emphasize the fact that the animal is a factory, which is alive and which must be kept up every day by feeding some raw material. The aim of the month should be: to teach some of the elementary principles involved in the choice of feed for definite products. The fact that the animal must be maintained and be allowed enough rations to repair the body as needed, before any by-products can be manufactured by the animal, should be made clear at the beginning of the study. The by-products should be studied and classified according to their content. There can be no element in the end product that is not in the raw material that is fed to the animal. Much time should be spent in studying the constituents of the common by-products and in establishing some type rations for their production. Connect certain common feeds with certain by-products in such a way that when the child thinks of corn, for example, he will also think of fat production.

The elements that are found in the plant and animal body have been presented in the seventh year's work. They may be reviewed at this time. The difference between starchy food and nitrogenous food can be made clear.

A few of the common feeds should be classified. Pupils should know that alfalfa and bran are high in nitrogen, and good feeds for the production of growth. The fact that corn and potatoes are high in starch content and are good for fat production and for energy production can be made clear. These facts concerning ten of the common feeds can be taught this month and the children will have some basis for finding out about other feed if they have occasion to do so.

The difference between roughages and concentrates should be studied. The common feeds which grow in the locality should be classified according to this basis. The need for both kinds of food should be made clear. The cow is a good example of an animal whose body is so constructed as to need large quantities of roughage.

Not much time can be spent in the study of the food nutrients. The function of water, ash, fat, starchy compounds, and protein should be noted. There is not time to go into detail in this study. Pupils of this grade are not ready to study nutrition in detail. But a study of the main purpose of such feeds as bran and alfalfa, which are high in nitrogen, and of such feeds as corn and potatoes, which are high in carbohydrates, can be made clear.

The fact that a balanced ration is necessary for efficient feeding should be taught. There is not time to teach the details of balancing rations in such a way that boys and girls of this grade will be able to balance rations for the feeder's use. Since this is true, the time should be spent in studying the meaning of the term, and the way in which balanced rations help the feeder. Comparisons may be made with the factory which is making plows. The raw materials must be supplied in definite proportions or there will be a waste in the production of the finished product. Some type rations may be presented and used for reference or notebook work. The notebook should show a type ration for dairy cows under stated conditions, for horses working under ordinary conditions, for laying hens, for fattening hogs, and for growing animals. These rations can be studied after the food nutrients have been studied. They should be used as reference through the review of the month's work. Care should be taken on the part of the teacher to have these type rations correct. It is better not to study any rations than to study rations that are not practicable.

Third Month.

TWO IMPORTANT BY-PRODUCTS.

I. MILK.

1. Importance of milk as a food.
2. Production of milk in locality; production in U. S.
3. Composition of milk.
4. The Babcock test.
 - A. Importance to the dairyman.
 - B. Laboratory work in using the test where possible.
 - C. Home project. Data from cows at home.
5. Products made from milk.

II. EGGS.

1. Importance of eggs as food.
2. Value of the eggs produced in U. S.
3. Composition of eggs.
4. Fertile and infertile eggs.
5. Causes of loss of eggs.
 - A. In the home.
 - B. In the market.
6. Home project in egg production.

Much time might be spent in the study of the products of animals. The outline as presented suggests milk and eggs as two type products which are commonly used all over the United States and which boys and girls should know about. The study of meat might be taken up in the same way. In some sections of the state some attention may be given to wool. But milk and eggs are of great importance and are good subjects for this month's study. Perhaps the time will be so limited that only one of these products can be studied this month. If so, choose the one which seems to be of greatest importance in your community.

The aim of the month: first, to teach the child the value of the product; and second, to teach some practicable method of increasing the production of the product. The latter aim may be accomplished much better by the aid of the home project, in connection with the work in the school room, than by the study of the subject without any laboratory work.

The importance of milk as a food can not be overestimated. Milk should be compared with other foods as to food value. Charts may be obtained from the U. S. Government which show this relation very clearly in graphic outline. The production of milk in the locality should be tabulated. This will require a survey of the community outside of school hours. It can be directed by the teacher, and the data thus secured will be of much value as suggested in connection with the first month's work. If at all possible, a Babcock tester should be

in the school room. Perhaps one can be borrowed from one of the farmers in the community. If there are none in the community there should be one in the school. Any boy or girl of this grade can learn to test milk for butter fat. In most communities there is a creamery where information can be obtained which will aid in this study. Perhaps a visit to the creamery on some Saturday will be possible. If it is possible to study the Babcock test with a tester at hand, the pupils should bring milk from the cows at home and data should be so tabulated that it can be used at some other time for supplementary problems in the arithmetic work. The relation of the test to the industry can best be noted by comparing the production now with the production before the advent of the tester. Some mention may be made of the advanced registry records that have been made by cows of the various breeds. The world's records in milk production and in butter fat production are easily available and can be studied as an ideal to set up before farmers who are producing milk. The use of the test as a basis for selling milk and milk products should be considered.

The relative value of the products made from milk may be considered. If the tester is used, cream, cheese, buttermilk, and skimmilk can be tested for butter fat. This result will show the relative value as far as the one element—butterfat—is concerned. The value of skimmilk as a growth producing food, especially for chickens and pigs, should be considered.

The study of eggs as an animal product may be taken up in much the same way as the study of milk. Some attention should be given to the causes of loss in the various places where eggs are kept for any length of time. This study should lead pupils into a knowledge of methods of increasing the output of good eggs. The importance of producing infertile eggs for the market should be emphasized. Comparatively few people realize the importance of disposing of the cocks as soon as the breeding season is over. Yet the presence of the male in the flock during the warmer months is the cause of more loss of eggs than any other one factor. People should be educated to stop this leakage. It is a simple project to rid the flock of the male, but will not be carried out until people realize the necessity of doing it. Here is an opportunity this month to fix an important fact in the minds of the pupils which will be of value to the community. The care of the eggs in the home should be studied. This will include a study of incubation of the egg. The degree of temperature necessary for incubation should be considered. The indica-

tions of decomposition should be noted. Blood spots, rots, germ development should be studied by candling eggs. The methods of candling in the grocery stores and the importance of such work should be emphasized.

If pupils are doing some work at home, as suggested under the home project plan for poultry, the work in the school room can be made more complete. If practicable, the class can be directed in a study of the incubation of the egg, by having each pupil take notes from a careful observation of an incubator, when the time comes to hatch in the spring. This will be mostly home work and will be of value after a study of the egg has been made as suggested above.

References—Nos. 90; 98; 99; 100; 103; 201; 123; 135.

Fourth Month.

DAIRY CATTLE.

I. TYPE.

1. Wedge shape.
2. Form compared with beef type.
3. Relation of type to production.

II. MAJOR BREEDS. (Holstein; Jersey; Guernsey; Ayrshire.)

1. Origin.
2. Color.
3. Milking qualities.
4. Quality of milk.
5. Peculiar characteristics.
6. Adaptability to conditions.

III. IMPROVEMENT OF HERDS.

1. Pure bred sires.
2. Selection in individuals.
 - A. Choosing by the Babcock test and scales.
 - a. Use of test in the herd.
 - b. Some records that have been made.
 - c. Value of short records compared with yearly records.
 - B. Conformation.
 - a. Mammary development.
 - b. Barrel capacity.
 - c. Head.
 - d. General appearance.

IV. FEEDING THE DAIRY COW.

1. Review of constituents of milk.
2. Need for protein in ration.
3. Need for roughage.
4. Value of growing protein in form of legumes.
5. Some type rations.
6. Practical rules for feeding.
 - A. Kind of feed.
 - B. Amount of feed.
 - C. Method of feeding.

The dairy cow is the most economical producer of food among the food producing animals. Special emphasis should be given to the study of the cow. The aim this month is to teach the child some new facts about the types and breeds of cattle; and to create a keener interest in the production of milk as a staple article of food.

The dairy conformation should be contrasted with the beef conformation. The pupil should understand that the end product of the dairy cow as a factory is milk and not beef. There is no necessity for extra flesh on the dairy cow. The triple wedge shape may be represented graphically.

There is not time to study all the breeds of dairy cattle. The four principal breeds may be studied following the outline suggested above. Emphasis may be put upon the breed or breeds that are most common in the community. The pupils should be able to recognize the breeds and to tell something definite about their qualities. Records of the breeds may be compared. These data may be secured from the bulletins that are put out by the various cattle associations. The question is frequently asked: What is the best dairy breed? The answer to this question, if there is an answer, is to be found in the study of the adaptability to conditions.

The value of the sire in improving the herd should be emphasized. The two methods of choosing the individual cow—by conformation and by test—should be discussed and given their relative importance. If possible the Babcock test should be used on the herds of the district and data secured for comparison. This work will necessarily be done outside the regular school work. The data will be of value in the classroom. Cooperation of communities in improvement has led to better conditions in many parts of Illinois. The work which has been done in the state by the bankers' associations and by other industrial associations should be discussed.

While there is not time to go into detail in the study of rations here, more than to review the principles studied in the second month's work, some study can be made of the practical requirements of the dairy ration. The growth of protein in the form of alfalfa should be encouraged. This has been studied by farmers and put into practice much to the advantage of the dairy industry in this state. The boys and girls should be taught the reason for the advantage. Some study can be made of the digestive system of the dairy cow as compared with the digestive system of the horse or hog. The need for plenty of roughage will then be apparent.

References—Nos. 87; 90; 96; 135.

Fifth Month.

POULTRY.

I. TYPES.

1. Meat.
2. Egg.
3. Dual purpose.

II. PRINCIPAL BREEDS.

1. Of meat type—Langshan; Brahma; Cochin.
2. Of egg type—Leghorn; Ancona; Minorca.
3. Of dual purpose type—Plymouth Rock; Wyandotte; Rhode Island Red; Orpington.

III. CARE OF FLOCK FOR EGG PRODUCTION.

1. Choice of individuals.
2. Value of pullets over older birds.
3. Need for warm comfortable quarters in winter.
4. Rations for egg productions.
 - A. Need for protein.
 - B. Physical characteristics of feed needed.

IV. CARE OF FLOCK FOR MEAT PRODUCTION.

1. Choice of breeds.
2. Market requirements.
3. Capons and caponizing.
4. Rations for fat production.
 - A. Value of corn and milk in the fattening ration.
 - B. Methods of poultry dealers who fatten birds.

The aim of the month: to classify the more important breeds of chickens and to get some facts which will tend to increase production of poultry products. No mention is made of any poultry but chickens. Only a few of the breeds are studied this month. There would not be time to do more than learn the numerous breeds and varieties and more attention should be paid to the common breeds of the community. Some detailed study should be made if possible in the selection of the individual for egg production and for meat production. The index by which one may be able to select the layers from the flock is not only of interest but of value to producers. The facts can be put into immediate use. Such data can be got from the bulletins and books mentioned in the reference. Some of the rations of the community should be studied. Compare them with type rations that have been worked out for egg production. What are the factors which limit egg production in the community? Can these factors be eliminated with little or no expenditure of money? The value of keeping pure bred flocks may be discussed in this connection. Capon raising is being recognized as a definite industry. It fur-

nishes an opportunity for farmers to increase their profits with little extra work. Boys and girls can carry on home projects in this field with little capital. Such projects should be encouraged. The processes involved in caponizing and feeding capons are not difficult. They lend themselves to work outside of the school room which will be of profit only when carefully directed. There are ample data on this subject. Pupils of the eighth grade can easily grasp the data that is published. Such work will encourage the boy to make more of his own environment, rather than to long for the factory of the city. Study the profits that are possible from an average farm flock of chickens. Data from the community can be obtained which will show what the flocks of the patrons are making from year to year. Compare the poultry yard profits with the profits from other sources on the farm. Encourage the home project in egg production through the winter months when eggs are selling at high prices. Review the need for feeding rations which contain the elements that are to be found in the finished product. Since eggs are albuminous products the need for feed high in protein can be emphasized. Study the methods of producing green food for the winter. The need for variety in the ration should be emphasized in the study of all rations. The care and expense of caring for a flock for egg production may be compared with that which is necessary for meat production. The combination of the two phases of the poultry industry should be discussed.

References—Nos. 5; 97; 101; 102; 103; 123; 138.

Sixth Month.

THE HORSE.

I. TYPES.

1. Draft.
2. Light.

II. BREEDS.

1. Of draft type—Percheron; Belgian; Clydesdale; Shire.
2. Of light type—Standard Bred; Thoroughbred; American Saddle Horse.

III. SELECTION OF THE INDIVIDUAL.

1. Conformation.

- A. Head as an indication of quality.
- B. Importance of general appearance.
- C. Character and quality in the horse.
- D. Method of telling the age of horses.

2. Unsoundnesses.

A. Of legs and feet.

B. Other major unsoundnesses.

IV. RATIONS FOR THE HORSE.

1. Common feeds grown for horses.

2. Study some type rations.

3. Compare digestive system of horse with that of the cow.

The aim of the month: to teach the names and characteristics of the more important breeds as outlined. There is not time for a discussion of all the breeds. Another aim should be to make the boys and girls more alive to the features or characteristics that make one horse better than another. Pupils should be able to recognize good horses when they see them. There is not time for the teaching of the score card in connection with any animal study in this grade. But the main points of the score card may be emphasized so that the pupils will have something definite to look for when they have opportunity to observe. The value of observation on the part of all the pupils should be emphasized in the study of animals. Special reports of observation work outside of school hours may be required.

Some of the major unsoundnesses of horses may be discussed. The pupils should look for these defects when they are observing horses. Study the changes that take place in the development of the teeth which indicate the age of the horse. Boys of the eighth grade when they have finished this month's work should be able to tell the age of a horse by looking into the mouth. This will require some effort on their part outside of school, after they have learned the method of telling the age by the teeth.

The notebook should show this month, as each month, pictures of the various breeds of horses. These can be obtained from farm journals and will help to fix in mind the characteristics of the different breeds. Articles on the care of the horse may be clipped from journals and put into the notebook. Not much time need be spent in the study of rations this month. Compare the type rations with those that are being fed in the community.

A survey of the number and kinds of horses to be found in the community will be of value. Such data may be used in connection with the composition work. The importance of keeping purebred horses and of community cooperation should be studied. The results that have been obtained in some communities are available in the reference material mentioned.

References—Nos. 87; 88; 93; 94; 107; 136; 137; 140.

Seventh Month.

MEAT-PRODUCING ANIMALS.

I. BEEF CATTLE.

1. Principal breeds. Shorthorn; Hereford; Galloway; Aberdeen Angus.
 - A. Distinguishing characteristics of breeds.
 - B. Adaptation to conditions.
2. Care and feeding of beef cattle.
 - A. Buildings required.
 - B. Kinds of feed used for fattening.
 - C. Some type rations for beef cattle.
 - D. Experiments that have been carried on.

II. SWINE.

1. Common breeds. Poland China; Berkshire; Hampshire; Duroc Jersey; Chester White; Tamworth; Yorkshire.
 - A. Characteristics of breeds.
 - B. The fat type breeds and their adaptation to Illinois.
2. Care and feeding of hogs.
 - A. Common practices in Illinois.
 - B. Type rations. Value of legumes.
 - C. Experiments in feeding pigs. (Exp. Sta. Bul.)
 - D. The use of the self feeder.

The aim this month: to teach some facts about the source of our meat supply and the importance of keeping up the supply of live animals. It will not be possible to give as much time to beef cattle as to dairy cattle. There is not the need for so much detail in the study of this class of animals, at this time. The breeds may be considered and pictures cut from farm journals to show the characteristics of the various breeds of cattle and swine. A survey of the community as with other animals will be of value here. Review the study of feeding. Make some effort to summarize one or two important bulletins from your experiment station which show the results of feeding experiments. Establish some definite type rations for reference. Compare these with the rations that are being fed. In what ways can the meat production of the community or state be increased? Study the market reports in one of the daily papers during the month. Plot curves to show the rise and fall of the market. What factors have affected the market during the month? Find the average price of cattle and hogs on the market for the month.

If possible visit some farm where cattle and hogs are being fed. Emphasize the fact that a large part of the profit from the feed yard is in the hogs that follow the cattle. In the study of methods of feeding meat-producing animals, the

growth of the animal should be given much prominence. Without proper growth there can not be well fattened animals. Emphasize the fact that different rations are required for growth from those that are used for the production of fat.

Some of the class may be able to do some home project in connection with this month's work. The project should be started earlier in the year. There has been much effort put forth on the part of industrial companies to organize pig clubs and calf clubs. Information concerning these may be had in many of the reference bulletins. Data may be secured by writing to your State experiment station. An outline of such projects as may be carried on in further meat production will be found elsewhere in this bulletin.

Reports by individuals in the class on the methods of the modern packing house will be of interest. A list of the by-products of the meat packing industry should be consulted. Compare these practices with the practices of the earlier periods in our history. Note that all of the animal is used in the manufacture of some product.

References—Nos. 88; 108; 109; 111; 118; 120.

Eighth Month.

SHEEP.

I. PURPOSE.

1. Meat production.
2. Wool production.

II. IMPORTANT BREEDS OF SHEEP.

1. The fine wool breeds.
2. The downs or medium wool breeds.
3. The long wool breeds.

III. THE SHEEP INDUSTRY AND ITS RELATION TO THE LIFE OF THE COMMUNITY.

Review.

The aim of the month's work is: first, to fix in mind the value of the sheep industry, especially for the production of wool for clothing; and second, to summarize the year's work.

This is not a sheep raising state as some other states are. Most attention should be given to the importance of the industry. Some study may be made of the history of sheep, of the methods of handling them on the ranges, of their adaptability to Illinois conditions.

In reviewing the year's work, some attention may be given to farm arithmetic which will involve data that have been studied through the year. Such supplementary problems may be got from farm arithmetics, or formulated from the

data which has been brought into the school room by those who have made surveys of the community or by those who are doing home project work. The problems should be designed to fix in mind the value of the animal as a factory working for our benefit, and the difference between right handling and wrong handling of animals. The study of feeding problems will help to establish ideas and ideals concerning production.

The work that has been done during the year in the home should be summarized. Directions for the carrying on of such projects as will extend through the summer months should be given in very definite form before the close of the school year. Reports of these projects may be given at the regular meeting of the agricultural club, if there is one in the community.

References—Nos. 5; 108; 111.

PART TWO.

Home Projects.

The study of agriculture is wider than the study of any textbook on the subject. The work in the school room must be supplemented with laboratory work if the pupils are to get the most from their study. The home project, especially in the rural school, offers an opportunity to connect the work of the farm with the work done in the school room. Such work should be directed with the idea of increasing the child's educational, economic, and social interests.

The suggested outlines may be supplemented with other details than those mentioned, to meet the special conditions of the community or home. Other projects may suggest themselves as being of greater value than those mentioned, because of local environment. Home project carefully directed will emphasize the wholesomeness of the rural environment.

I.

Egg Production.

FACTORS TO BE CONSIDERED:

1. Selection of pullets.
2. Housing facilities.
3. Rations.
4. Records of production.

Ten or twenty pullets that have been well grown should be selected from the farm flock and separated from the other poultry. If the farm flock does not furnish good specimens, send to some breeder of the breed wanted and purchase early pullets. It will be economical to pay a good price for pullets that have good blood in their veins, and that have been well grown, rather than select poorly grown specimens that have many mixtures of blood. The pullets will lay more eggs during the year than the older birds. They should begin to lay in October or November. This project may be started early in the fall as soon as school opens. Some study of the method of selection and the points to be considered in selecting pullets for layers should be made, before starting the project at home.

The house in which the pullets are to be kept should be easily cleaned; it should be warm. Perhaps a part of the regular poultry house can be partitioned off for this small flock. Pullets can not lay in winter if they must use up their energy keeping warm out of doors.

The ration should be made up to meet the demand of growing pullets until they are fully developed. Plenty of protein and green food is necessary. Alfalfa is a splendid green food during the fall. The winter ration should contain meat scrap, oyster shell, plenty of fresh water, mash, and a mixture of grain. Sprouted oats may be used for green food.

Records of cost and production should be carefully kept. This data will be of value if kept in detail. Pupils should see the need for business methods. Leaks in the business should be noted. Means of increasing the efficiency of the flock should be worked out by each individual. Formulate problems from the data obtained from the records.

References—Nos. 102; 5; 103; 123.

II.

Capon Raising.

FACTORS TO BE CONSIDERED:

1. Selection of birds.
2. Caponizing.
3. Housing.
4. Rations.
5. Records.

Boys and girls of the seventh grade can easily learn to caponize cockerels. The demand for soft roasters of this type, just after the holidays, is growing. The price of capons is much higher than the price of other birds. Capons should be made to weigh ten pounds each by the first of February. The breeds that are best for caponizing are the quick maturing breeds that are not of the egg producing type. Plymouth Rocks, Orpingtons, and others of this type are best. Good strong cockerels weighing about two pounds should be selected. They may be caponized early in the fall. The operation is not a difficult one. By getting a bulletin describing the tools and methods one can become proficient with a little practice.

Capons should have range and should be fed a growing ration during the fall months. If they begin to lay on fat too soon they will not complete their growth and will not make desirable birds for the market. Corn is the principal ingre-

dient of fattening rations. Skimmilk or buttermilk will add to the quality of the flesh.

A profit of one dollar each is possible with good stock and good care. This is a very important branch of the poultry industry and should be given more prominence on the farm. Boys and girls need not go to the factory in the city to seek employment. By using the capons as factories and feeding them raw material to produce a high quality of flesh as a finished product they have become manufacturers in their home.

References—Nos. 101; 139.

III.

Milk Production.

FACTORS TO BE CONSIDERED:

1. Selection of cows.
2. Rations fed to cows.
3. Amount of milk produced.
4. Quality of milk produced.
5. Length of lactation period.
6. Cost of production of milk.
7. Records.

This subject furnishes an excellent basis for home work. Most farmers have one or more cows that are being kept for milk production. The pupil should select two or three cows for this project. The aim of the project should be to obtain an accurate account of what each cow is producing through the year and to establish a basis for eliminating the boarders from the herd.

The amount and kind of feed should be noted. This will not necessitate as much labor as it would seem. Since cows are fed about the same kind of feed through the winter season and since the amount does not vary, careful weighings may be taken each week and estimates be made of the total amount fed.

The milk should be weighed each day or, if this is not convenient, it should be weighed three consecutive days each month and the amount multiplied by ten to furnish data for the month. Samples of the milk should be taken at each milking during these three days. The milk should be tested for butterfat. If there is a Babcock tester in the school or somewhere in the district, the samples can be tested without much inconvenience or expense. If there is no tester in the community, the milk can be taken to a creamery to be tested.

The data sheet should show the following factors:

1. Pounds of milk produced (daily, weekly, or monthly).
2. Total weight of milk produced during the lactation period.

3. Length of lactation period.
4. Cost of feed fed during the time the cow was tested.
5. Cost of feed fed while the cow was not giving milk.
6. Total amount and cost of feed for the year.
7. Estimated cost of keep other than the feed.
8. Estimated cost of labor.
9. Cost of production of:
 - One hundred pounds of milk.
 - One gallon of milk.
 - One pound of butter.
10. Profit or loss of each individual.

Write a description of each individual, emphasizing the points to be considered in selection of a dairy cow, as studied in the classroom.

References—Nos. 90; 96; 99; 110; 141.

IV.

Baby Beef Production.

FACTORS TO BE CONSIDERED:

1. Selection of calf.
2. Time of year to feed.
3. Kind and amount of rations to feed.
4. Age to market.
5. Records showing cost of production and profit.

This project should be started early in the fall or early in the spring. If it is started in the spring, a calf should be chosen at birth. If begun in the fall, a calf at weaning age or about seven months of age should be chosen. The calf should be one of the beef breeds of cattle. If it is chosen in the spring, the weight of the calf should be taken at least once a month until it is weaned in the fall. If the calf is allowed to run with the dam until fall it will not need grain rations until weaned. The feeding of grain should be begun gradually. Bran and whole oats make a desirable grain ration to start feeding. Shelled corn may be introduced gradually until the ration is composed of equal parts of each. Calves at this stage of growth should have good clover or alfalfa hay and silage. If they are fed what they will clean up without waste, they should grow into marketable animals by April of the following year.

This project is one that should interest a boy and one which does not take a great deal of time. The aim of the work should be to establish some data showing the cost of production of beef. The record should show:

1. The amount of feed fed daily and the total amount for the feeding period.
2. Cost of the feed.

3. Cost of one hundred pounds of beef.
4. Selling price.
5. Cost of keep and labor.
6. Estimated value of the manure to the land.
7. Profit or loss.

If different rations are fed by different ones a comparison of the relative values should be made. The importance of selecting calves of proper type and conformation will be evident if many calves are fed and records are kept.

References—Nos. 109; 111; 118; 120; 136.

V.

Pork Production.

FACTORS TO BE CONSIDERED:

1. Selection of pig.
2. Rations.
3. Age to market.
4. Records.

One or more pigs may be selected in the spring. Care should be taken to select individuals with good conformation. The pigs may be let run on clover or alfalfa pasture after weaning. They should be given some supplementary feeds during this period. Shorts and skimmilk make a good supplement to the growing ration. Corn is the main fattening ration of this state and will naturally be used as a fattening ration. But it should be supplemented with some feed high in protein, as alfalfa, to give best results. Note the results of feeding experiments, from the bulletins mentioned in the reference. The pigs may be marketed at about eight months of age, depending upon the condition.

The records should show the following items:

1. Amount of feed fed (daily and for whole period).
2. Weekly gain in weight.
3. Cost of feeding.
4. Estimated cost other than feeding cost.
5. Selling price per pound.
6. Weight at end of feeding period.
7. Cost of production of one hundred pounds of pork.
8. Profit or loss.

The self feeder may be used with profit in this project. Tankage, corn, and alfalfa hay may be fed during the fattening period, feeding the grain in the self feeder. See designs for home-made feeders.

References—Nos. 92; 106; 115; 117; 122.

VI.

Gardening.**FACTORS TO BE CONSIDERED:**

1. Selection of plot of soil.
2. Plan and arrangement of garden.
3. Time of planting.
4. Cultivation.
5. Harvest.
6. Insects and their control.
7. Record.

A small plot of soil which is well drained should be selected. Sandy soil which will warm up early in the spring is most desirable. The soil should be prepared in the fall and covered with manure during the winter. The plan should be made during the early spring in order to have everything in readiness to begin planting as soon as the weather will permit. The following plan is one that has proved desirable for this kind of home work. It is only suggestive and may be changed to meet the local conditions.

10 ft. x 30 ft.

1.	Parsnips.
2.	Parsnips.
3.	Chard.
4.	Lettuce.
5.	Radishes.
6.	Peas.
7.	Peas.
8.	Onions.
9.	Onions.
10.	Beets.
11.	Beets.
12.	Carrots.
13.	Head lettuce.
14.	Head lettuce.
15.	Cabbage.

16.	Cabbage.
17.	Beans.
18.	Beans.
19.	Beans.
20.	Tomatoes.
21.	Tomatoes.
22.	Tomatoes.

In the above plan, the first twelve rows should be one foot apart, and the remaining rows two feet apart.

Planting Directions for the Above Garden Plan.

Vegetable.	Suggested varieties.	Amount of seed (approximate.)	Time to plant (approximate.)
Parsnips.....	Hollow Crown.....	One-tenth ounce....	April 9th.
Chard.....	Lucullus	One-tenth ounce....	April 9th.
Lettuce.....	Black seeded Simpson..	One-fifth ounce....	April 1st.
Radishes.....	French Breakfast.....	One ounce (several plantings).....	April 1st.
Peas.....	Nott's Excelsior.....	One-fifth pint.....	April 1st.
Beets.....	Blood Turnip.....	One-fifth ounce....	April 9th.
Carrots.....	Chantenay.....	One-tenth ounce....	April 9th.
Head Lettuce..	Big Boston.....	Twenty plants.....	April 15th.
Cabbage.....	Early Flat Dutch.....	Twelve plants.....	April 15th.
Beans.....	Stringless Green Pod...	One-half pint.....	May 1st.
Tomatoes.....	Ponderosa, Earliana...	Eight plants.....	May 15th.
Onions.....	White Bottom.....	One quart sets.....	April 1st.

Directions for the culture of the vegetables mentioned above may be obtained from any book on gardening. The early vegetables may be followed by other vegetables such as cucumbers, celery, or late beans. Data from home garden projects in which the above plan was followed show that this sized plot should yield from fifteen to twenty dollars worth of vegetables. The home work in gardening should be designed to stimulate an interest in gardening. Much wholesome food can be produced on small areas if attention is given to the culture of such vegetables as those mentioned in the plan.

References—Nos. 2; 131; 139; 142.

VII.

Corn Growing.**FACTORS TO BE CONSIDERED:**

1. Soil.
2. Seed selection.
3. Cultural methods.
4. Records.

This project may well be made an acre corn growing contest among the boys and girls of the community. There are such contests being organized in many parts of the state. They have in most instances proven successful. The project should be started in the fall. The soil plot may be chosen at that time and if fall plowing seems to be advisable it can be done early. By selecting the plot early in the fall it may be well manured and replowed in the spring. The seed should be selected in the fall from the field if there is good corn of a desirable variety growing on the farm. If the corn grown on the farm is not up to the standard, it will be well to send to a seed company and get the best seed that can be purchased. The importance of a good seed bed should be emphasized. It will be well to encourage the ones who attempt this project to add some commercial fertilizer to their plot. It will not cost enough to make the purchase price prohibitive and the results should show an increase in production which will more than pay for the fertilizer and labor in adding it. If there is little nitrogen in the soil an application of barnyard manure will increase the growth materially.

The record of the project should show :

1. Size of plot.
2. Cost of preparation and planting.
3. Growth made by the plants during the first six weeks. (Measure typical plants weekly.)
4. Yield.
5. Total cost of production.
6. Selling price and profit.

Other facts than those mentioned may be required on the record. The data thus obtained will be of value in teaching the culture of corn at some future time to other classes. If this project is encouraged and properly directed, increased yields should result. The average yield of the boys and girls' contest in one state exceeded the general average of the state by fifty bushels.

VIII.

Canning Fruit and Vegetables.**FACTORS TO BE CONSIDERED:**

1. What to can.
2. When to can.
3. How to can.
4. Record.

Every year efforts are made by schools and other organizations to increase the amount of fresh food grown in the home garden. Not so much attention has been given to the saving of this food after it has been grown. Much fresh food stuff is wasted unnecessarily. String beans, tomatoes, beets, corn, peaches, berries, and many other kinds of fruit and vegetables should be preserved by canning. If this were given as much attention as the growth of these products, families could have fruit and vegetables from the garden every day in the year. The canning clubs have done much to encourage the canning of fruit and vegetables. By encouraging this project and furnishing literature for instructions every teacher can do something toward food conservation that will be worth while. The record kept by the pupil should contain such items as will show the economic value of preserving food in this manner. It should also show data which enumerate other values of canned goods, food values, convenience, and desirability of having vegetables and fruit all through the year.

Bulletins can be secured which give definite instructions for canning both fruit and vegetables. Descriptions of home methods and of canning outfits may be gotten from these bulletins.

References—Nos. 144; 145.

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Textbooks for the Grades.

1. Grim.....Elementary Agriculture. Allyn and Bacon.
2. Benson and Betts.....Agriculture.....Bobbs Merrill.
3. Noland.....One Hundred Lessons in
Agriculture.....Row, Peterson.
4. Burkett, Stevens & Hill. .Agriculture for Beginners. Orange Judd.

Textbooks for Secondary Schools.

5. Waters.....Essentials of Agriculture. Ginn
6. Benson and Betts.....Agriculture.....Bobbs Merrill.

Reference Books, Bulletins, Circulars, and Pamphlets.

7. Cunningham and
Lancelot.....Soils and Plant Life.....Macmillan.
8. Clute.....Agronomy.....Ginn.
9. Masters.....Plant Life on the Farm.....Orange Judd.
10. Bailey.....The Nursery Book.....Orange Judd.
11. Crissey.....Story of Foods.....Rand McNally.
12. Pammell.....Weeds on the Farm and
Garden.....Orange Judd.
13. Pamphlet.....Development of Apple from
Flower.....A. I. Root.
14. U. S. Farmers' B.,
No. 157.....Propagation of Plants.
15. Pamphlet.....The Childhood of Fruit
Trees.....Greening Nursery.
16. Pamphlet.....Plant Food.....German Kali Works.

Field Crops.

17. Myrick.....Book of Corn.....Orange Judd.
18. Shammell.....Corn Judging.....Orange Judd.
19. Coburn.....Alfalfa.....Orange Judd.
20. Livingston.....Field Crops.....Macmillan.
21. Wilson and Warburton. Field Crops.....Webb Pub.

Farmers' Bulletins on Field Crops. (U. S. Department of Agriculture.)

22. No. 229.....Production of Good Seed Corn.
23. No. 253.....Germination of Seed Corn.
24. No. 614.....Hogging Down Crops.
25. No. 660.....Weeds and How to Control Them.
26. No. 313.....Harvesting and Storing Seed Corn.
27. No. 409.....School Lessons on Corn.
28. No. 537.....How to Grow an Acre of Corn.
29. No. 318.....Cowpeas.
30. No. 704.....Grain Farming in the Corn Belt.
31. No. 339.....Alfalfa.
32. No. 372.....Soy Beans.
33. No. 455.....Red Clover.
34. No. 485.....Sweet Clover.
35. No. 578.....Making and Feeding Silage.
36. No. 507.....Smuts of Wheat, Oats, Barley, and Corn.
37. No. 35.....Potato Culture.
38. No. 52.....Sugar Beets.
39. No. 210.....Quality and Culture of Wheat.
40. No. 324.....Sweet Potatoes.
41. No. 295.....Potatoes and Other Root Crops as Food.
42. No. 431.....Peanuts.
43. No. 315.....Legume Inoculation.
44. No. 250.....Prevention of Loose Smut in Oats.

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Bulletins from Illinois Experiment Station.

- 45. No. 76.....Alfalfa on Illinois Soil.
- 46. No. 87.....The Structure of the Corn Kernel.
- 47. No. 94.....Nitrogen Bacteria and Legumes.
- 48. No. 144.....Growing Tomatoes for Early Market.
- 49. No. 173 (circular).....Onion Culture.
- 50. No. 176 (circular).....Practical Helps on Landscape Gardening.

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- 51.Corn and Its Culture.....Am. Ag. Chem.
- 52.Corn Production.....Nat. Fert.
- 53.Wheat.....Nat. Fert.
- 54.Seed Corn.....Int. Har.
- 55.Sweet Clover.....Int. Har.
- 56.Studies in Alfalfa.....Int. Har.
- 57.Crops that Pay (illustrated).....Am. Ag. Chem.
- 58.Truck Farming.....German Kali Works.
- 59.Cotton Culture.....German Kali Works.
- 60.Sugar Beet Culture.....German Kali Works.
- 61.Strawberry Culture.....German Kali Works.
- 62.Grow a Garden.....Int. Har.
- 63.Home Canning.....Int. Har.
- 64.Forage Crops (illustrated).....Am. Steel and Wire.

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- 66. Lyon, Fippin & Buckman.....Principles of Soil Management.....Macmillan.
- 67. Pamphlet.....Farmyard Manures.....Am. Steel and Wire.

Farmers' Bulletins (U. S. Department of Agriculture).

- 68. No. 245.....Renovation of Worn Out Soils.
- 69. No. 278.....Leguminous Crops for Green Manuring.
- 70. No. 342.....Conservation of Soil Resources.
- 71. No. 192.....Barnyard Manure.
- 72. No. 406.....Soil Conservation.
- 73. No. 614.....An Efficient Farm System for the Corn Belt.

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- 74. No. 115.....Soil Improvement for Worn Out Hill Lands.
- 75. No. 123.....Fertility in Illinois Soils.
- 76. No. 193.....Summary of Soil Investigations.

Illinois Experiment Station Circulars.

- 77. No. 82.....Physical Improvement of Soils.
- 78. No. 86.....Science and Sense in Inoculation of Legumes.
- 79. No. 110.....Ground Limestone for Acid Soils.
- 80. No. 124.....Chemical Principles of Soil Fertility.
- 81. No. 130.....A Phosphate Problem for Illinois Landowners.
- 82. No. 155.....Plant Food in Relation to Soil Fertility.
- 83. No. 157.....Soil Fertility.
- 84. No. 167.....Illinois System of Permanent Fertility.
- 85. No. 168.....Bread from Stones.
- 86. No. 181.....How Not to Treat Illinois Soils.

Animal Husbandry.

- 87. Curtiss.....Judging Live Stock.....Lea and Febiger.
- 88. Plumb.....Types and Breeds of Farm Animals.....Ginn.
- 89. Bull.....Principles of Feeding Animals.....Macmillan.
- 90. Eckles.....Dairy and Milk Products.....Macmillan.
- 91. Van Slyke.....Testing Milk and Its Products.....Orange Judd.

ANIMAL HUSBANDRY—Concluded.

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- 92. No. 22.....Feeding Farm Animals.
- 93. No. 170.....Principles of Feeding Horses.
- 94. No. 487.....Judging Horses as a Subject of Instruction in Schools.
- 95. No. 51.....Standard Varieties of Chickens.
- 96. No. 106.....Breeds of Dairy Cattle.
- 97. No. 236.....Incubators and Incubation.
- 98. No. 363.....Use of Milk as Food.
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- 103. No. 528.....Hints to Poultry Raisers.
- 104. No. 201.....Cream Separator on Western Farms.
- 105. No. 142.....Principles of Food Nutrition and Nutritive Value of Foods.
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- 108. No. 129.....Market Classes and Grades of Sheep.
- 109. No. 142.....Short Fed Steers.
- 110. No. 146.....Alfalfa vs. Timothy and Alfalfa vs. Bran for Dairy Cows.
- 111. No. 147.....Market Classes and Grades of Meat.
- 112. No. 150.....Feeding Farm Work Horses.
- 113. No. 159.....Balanced vs. Unbalanced Rations for Dairy Cows.
- 114. No. 154.....Milk Required to Raise a Dairy Calf.
- 115. No. 168.....A Study of the Development of Growing Pigs.

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- 121. Pamphlet, Nos. 1-4. Why Use Pure Bred Sires? Wis. Live Stock Br.
- 122. Pamphlet.....Making Money from Pigs... Int. Har.
- 123. Pamphlet.....Poultry is Profitable..... Int. Har.
- 124. Pamphlet.....First Aid to the Stockman. Wis. Live Stock Br.
- 125. Pamphlet.....Amateur Bee Keeping..... A. I. Root.
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- 128. Pamphlet.....Stencils Vitalize School Work.....Int. Har.
- 129. Pamphlet.....How to Make and Run a Hot Bed.....A. I. Root.
- 130. Catalogue.....Handbook of Trees and Hardy Plants.....Thos. Meehan.
- 131. Catalogue.....The Garden Book.....Nat. Cash Reg.
- 132. Charts.....Lecture Charts on Various Subjects.....Int. Har. (Loaned).
- 133. Pamphlets.....Eradication of Farm Weeds. Am. Steel and Wire.
- 134. Bulletins.....Publications of Illinois Public Health Dept.....Springfield, Ill.
- 135. Farm Journal.....Hoards Dairyman.....Hoards Dairyman Co.
- 136. Farm Journal.....Breeders Gazette.....Breeders Gazette.
- 137. Farm Journal.....Prairie Farmer.....Prairie Farmer.
- 138. Booklet.....Capon and Caponizing by Geo. Beovy.....Cedar Vale, Kansas.
- 139. U. S. Farmers' Bulletin, No. 818..The Small Vegetable Garden.
- 140. U. S. Farmers' Bulletin, No. 779..How to Select a Sound Horse.
- 141. U. S. Farmers' Bulletin, No. 743..Feeding the Dairy Cow.

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142. Booklet.....Vegetable Gardening..... Row, Peterson.
143. Booklet.....Corn Growing..... Row, Peterson.
144. U. S. Farmers'
Bulletin, No. 839..Canning by Cold Pack Method.
145. U. S. Farmers'
Bulletin, No. 841..Drying Fruits and Vegetables.

Key to Abbreviations and Addresses of Publishers.

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|--------------------------|-------------------------------------------------|--------------------------------------|
| Am. Ag. Chem. | American Agricultural Chemical Co. | 92 State St., Boston, Mass. |
| Am. Steel and Wire. | American Steel and Wire Co. | Chicago, Ill. |
| | Allyn and Bacon. | 1006 S. Michigan Ave., Chicago, Ill. |
| | Atlas Cement Co. | 30 Broad St., New York, N. Y. |
| | Bobbs Merrill Co. | Indianapolis, Ind. |
| | Breeders Gazette Co. | Chicago, Ill. |
| | Ginn and Co. | 2301 Prairie Ave., Chicago, Ill. |
| | Greening Nursery Co. | Monroe, Mich. |
| | German Kali Works. | New York, N. Y. |
| | Hoards Dairyman. | Ft. Atkinson, Wis. |
| Int. Har. | International Harvester Co. | Chicago, Ill. |
| | Lea and Febiger. | Philadelphia, Pa. |
| Nat. Cash Reg. | National Cash Register Co. | Dayton, O. |
| Nat. Fert. | National Fertilizer Co. | Chicago, Ill. |
| | Prairie Farmer. | Chicago, Ill. |
| | Orange Judd Publishing Co. | New York, N. Y. |
| | Root, A. I. and Co. | Medina, O. |
| | Row, Peterson and Co. | Chicago, Ill. |
| | Thomas Meehan and Sons. | Germantown, Philadelphia, Pa. |
| | Rand McNally and Co. | Chicago, Ill. |
| Wis. Live Stock Br. | Wisconsin Live Stock Breeders Association. | Madison, Wis. |

