Polytechnic Grounds as Seen from the Hills in the Rear
DEVELOPMENT OF AMERICAN AGRICULTURAL EDUCATION

America was inoculated with the germ of this better kind of education when the first agricultural society was organized, away back in the ending of the eighteenth century. But the soil of the country was so rich that the farmer prospered without special training, and the little germ had a long and tedious task before it “Leavened the whole lump”. Only the classical education prevailed throughout our institutions of learning. The rural father with three sons reasoned about in this manner: “Thomas is a very likely boy, polished in manner and quick of speech. We will send him to college and adorn a pulpit with him. James is a heady, substantial fellow, quick at figures. We will give him a business education and make a merchant of him. And ‘Bill’—well, poor ‘Bill’ never was very bright. We will surely have to make a farmer of him.”

In order that the history of this educational system may be understood, we will consider it under four heads, each of which has had a marked influence on the complete development; namely:

Agricultural societies, Agricultural schools, Agricultural experiment stations, and Farmers’ institutes.

Agricultural societies have had a wonderful influence in moulding the thought of the Nation along industrial education lines and have ever demanded the best there is for the “common people.” The greatest of farmer societies, the one that has done most for the development and liberal education of the rural classes, was organized in Washington, D. C., in the year 1867, under the name of the “Patrons of Husbandry.” It is commonly known as the “Grange.” This was the first secret order to admit women to membership on a full equality with men and in it men and women working shoulder to shoulder have ever stood for the highest and best education for the country boy and girl. They have especially demanded a liberal training for young women in the sciences and arts of the home, and it is almost entirely due to their determined efforts that the schools of Domestic Arts are so easy of access, and so thorough today. Many other organizations, such as the Farmers’ Alliance and the various state agricultural and horticultural societies, have added their share toward the promulgating and spreading of agricultural training.

The agricultural school system of our country, like the Chinaman’s house, was bulwarked from the top
downward. The college came first, then the secondary and elementary schools. This accidental plan, if it may be called a plan, possessed the advantage that the colleges developed a class of trained teachers that were able to rapidly build up the lower schools of agriculture to a remarkably efficient grade. Organized agricultural education began in Europe before it did in America. The old continental lands, with their great population, began to be exhausted and strenuous nature demanded that the tiller should study to improve the productive power of the soil, or starve as an alternative.

In 1853, the New York Legislature passed a bill providing for systematic instruction in agriculture to be accomplished by the establishment of an industrial school and college of agriculture. In 1860, at the town of Ovid, the institution thus provided for was established under the name of the New York State Agricultural College. This institution was soon afterward abandoned by the state, and the buildings converted into an asylum for the insane. In 1855, the Michigan Legislature passed a bill providing for higher education in agriculture, and as a result of this, on May 31, 1867, at Lansing was celebrated the fiftieth anniversary of the establishment of the Michigan Agricultural College, the oldest of its kind in America.

During President Buchanan's administration the first effort to foster a national agricultural education was made but the bill providing for the same failed to pass. The effort thus begun was continued till it bore fruit a few years later. By an act of Congress approved by President Lincoln on July 2, 1862, a grant of land was made to each state in the Union, to the amount of 30,000 acres for each senator and representative in Congress to which the state was entitled by the census of 1860. The proceeds from this land was to constitute a perpetual fund, the principal of which was to remain forever undiminished, and the interest arising from said land to be inviolably applied by each state which would avail itself of the benefits of the act to support and maintain "A college where the leading object shall be, without excluding other classic and scientific studies, and including military tactics, to teach such branches of learning as are related to agriculture and mechanic arts, in such a manner as the legislatures of the states shall respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." No part of these funds was to be used for the purchase, erection or maintenance of buildings. The state must provide suitable buildings before availing itself of the benefits of the act. The schools established under this law are known as the "land grant colleges".

On August 30, 1890, Congress passed an act "To apply a portion of the proceeds from the sale of public lands to the more complete support and endowment of the colleges for the benefit of agriculture and the mechanic arts established under the act of 1862." This act allowed $15,000 to each land grant college for the year 1890, this sum to be increased $1,000 each succeeding year till $25,000 annually was reached. This law is known as the "Morrill act" from its originator, the Hon. Justin Morrill of Vermont, and the fund thus created is known as the "Morrill fund". On
March 4, 1907, Congress amended the provisions of the Morrill act by allowing $5,000 additional for each land grant college for 1908, and increasing the amount $5000 each year till the total annual fund reaches $50,000. This appropriation will reach the maximum in 1918, the $50,000 annually being in addition to the interest accumulating from the land grant fund. In 1900, 1902, and 1903 Congress passed additional acts granting the use of any national funds when the proceeds from the sale of public lands were not sufficient to make up the Morrill fund.

The land grant colleges have naturally divided into two classes as they have been established by the various state legislatures—one, independent colleges where agriculture, the mechanic arts and domestic science form the basic studies around which the college courses are arranged; and the other where the colleges of agriculture have been made adjuncts to the state universities. Both plans have their staunch adherents and each has some points of advantage over the other. The first class is represented by such notable ones as the state agricultural colleges of Michigan, Iowa, Pennsylvania, Oregon, and others. The second class is well represented by the colleges of agriculture of Cornell University, of the State Universities of Wisconsin, Ohio, Minnesota, California, etc. The independent colleges are known under various names in the different states; for example: Washington State College, North Dakota Agricultural College, Texas State Agricultural and Mechanical College, Rhode Island State College of Agriculture and Mechanic Arts, Alabama Polytechnic Institute, Delaware College.

A great many of the land grant colleges have, in addition to their regular four-year courses, well established secondary courses in agriculture of one or two years' length. Also, most of them conduct short courses of from two to several weeks length each year, for farmers who have not the time for a regular course in agriculture, and many schools carry on at all times extensive reading and correspondence courses by which the farmer is instructed in his own home.

The system of secondary schools of agriculture has been developed only within the last two decades. It really came in with the new century on the great wave of industrial education which is now sweeping over the land. These institutions are of high school grade and are reaching much nearer the heart of the rural population than it would ever be possible for the land grant colleges to do. They are naturally dividing themselves into three classes, according to their manner of organization. Some are for congressional districts, as in Georgia and Oklahoma. Still others are county schools, as in Wisconsin.

These organizations are all supported by either state, district or county funds. This class of schools has developed rapidly all over the country, but it has showed its most marked growth in the South, where there is a crying need for a wide spread agricultural training in fundamental principles, that the cotton depleted fields may be replenished and new crops and rotations be studied till that great natural agricultural section may again take a leading place and be made to blossom as the rose. The great secondary schools for the negro that are springing up in the South land are accomplishing much for that benighted citizen, and they will incidentally become one of the greatest
factors in solving the so-called race problem. Tuskegee Institute, in Alabama, presided over by the great Booker T. Washington, and Hampton Institute in Virginia, are the most notable schools of industrial and agricultural education for the colored man. Not only do they give a scientific training to their students, but they are each year sending out a large class of well equipped teachers who are in full sympathy with the downtrodden condition of their race, and are helping to make agricultural training a major part in the common schools where the negro children get their little taste of learning.

For about two years there has been pending before congress what is known as the Davis bill, which proposes national co-operation with the states in founding a secondary industrial school in each congressional district, on much the same basis that the land grant colleges are now aided by the general government. In all probability this or a similar bill will become a law within a few years. With such a school in every district of the state, doubly supported by state and nation, the boy or girl who fails to get a good education in the things that will really count in life can blame only himself.

Another definite trend in the onward march of secondary education is to add an agricultural course to the regular high school curriculum, placing it on an equality with the classic and science courses. The Hon. E. Davenport of Illinois, one of our greatest authorities on agricultural training, in a recent address, stated that this would be the next step in the development of agricultural education. He argues against special schools, and for high-grade agricultural instruction in the prevailing system of high schools, for the reason, as he believes, that special schools of agriculture will tend to peasanitize the farming class, while proper agricultural training in the regular high schools will allow a free interchange of occupations and a natural drift from one class to another.

The value of agricultural instruction is becoming so well known that there is a rapidly increasing demand all over the country for its elements in the grammar schools. This work was at first taken up by a few enthusiastic teachers, under the name of "nature study." It was started as a diversion from the irksome grind of the daily routine, but it soon became so popular as to be adopted by many schools, and now nearly all the states have passed laws requiring more or less instruction in elementary agriculture in the higher grades of the common schools. Professor Spillman of the United States Department of Agriculture has calculated that if the Texas Agricultural College should succeed in graduating one agriculturalist every 25 years for each farm in the state, it would have to turn out about 14,000 diplomas to farmers each year. Other states could make very similar calculations. It can be seen from these figures that the colleges are no more than able to turn out trained teachers for the secondary schools, and experts to carry on scientific agricultural research. The duty of the agricultural training courses in the normal schools which is becoming of much importance, is to prepare properly trained teachers for the work in the elementary schools. According to statistics given in the May number of "World's Work," only a little over 21 per cent of the population of the United States is in attendance in
schools, colleges and universities of all kinds. Of these nearly 20 per cent are in the elementary public and private schools, and about one percent in the secondary schools. These figures preach an eloquent sermon on the necessity of giving adequate training in the great principles that underlie the science of agriculture while the pupil is yet in the grammar school.

The state experiment stations have been a powerful factor in stimulating and advancing the growth of agricultural education. When the first stations were established those in control began to look around for investigators trained in the science of agriculture, but there were none to fill the demand. Most of the early experiment station workers were scientists who had to get their agricultural training after entering the stations. There were no American books to direct them, and the European publications were not adapted to the needs of this country. Some of these early experimenters have bullded themselves up until they are reckoned with the greatest agriculturalists that the world has ever known.

In 1887, Congress passed an act making an appropriation known as the "Hatch fund," allowing $15,000 annually to each state "to aid in acquiring and diffusing among the people useful and practical information on subjects connected with agriculture." These stations were established in connection with the land grant colleges, and the work of the two institutions is generally directed and conducted by the same force of scientific agriculturalists. Most of the states have added largely to their station funds by legislative appropriations. Some have two or more central stations, and many have several sub-stations and experimental farms where research work is carried on very extensively. In 1906, Congress made a new source of revenue, known as the "Adams fund." This provided $5000 for each "Hatch station" for 1906, and an increase of $2000 annually till the yearly amount reaches $15,000. This fund can be used only in original investigation, and is kept entirely separate from the Hatch fund. Each year the United States Department of Agriculture makes a rigorous investigation of the land grant colleges and Hatch stations. All the work of the year, and the plans for succeeding years, is carefully gone over, and the accounts of each fund are inspected to the minutest detail. If all money is not accounted for exactly according to law, the college or station finds its next quarterly allowance held up till the matter is adjusted satisfactorily to the Department.

The stations give out the results of their researches in bulletins, circulars and reports. And while speaking of the state stations, we here deviate to mention specially that greatest of all agricultural institutions, the national Department of Agriculture, which is doing so much for the farmers of America. If all could be made to see the importance of the publications sent out by the states and nation, the results of the station and department research work would be much more quickly apparent. Each year in many a rural home enough information is burned in the "useless pamphlets that the 'book farmers' send out" to have, if carefully read and heeded, made several hundred dollars on the credit side at the annual reckoning. Practically all the documents in the science of agriculture that the world has known have been published in these despised lit-
THE POLYTECHNIC JOURNAL

ie bulletins. I am glad to note that the student mail box at the Poly-

technic is nearly always crowded with the best publications of the best ex-
periment stations in the country. It shows a growing demand among the agri-
cultural students for more knowledge than the short school courses can give. This spirit of getting all there is in a subject will follow them when they leave the school room, and they will soon realize that the "bulletin habit" is the best one acquired in the "Poly."

Besides having disseminated knowledge by their publications, the sta-
tions have aided largely in giving teachers and material for instruction in agriculture in the colleges and secondary schools. Practically all American agricultural text books have been written by men who have obtained their information in the station laboratory and many of the teachers are indebted to the same source for a large part of their preparation for their chosen profession.

The work of the Farmers' Insti-
tute, the last of the four prime factors named at the beginning as having helped to develop and extend agricultural education in America, will be mentioned but briefly. As the colleges and stations began to develop specialists in the various sciences of agriculture these men were sent out from time to time to get in touch with rural conditions and to aid the farmer with their advice. They held institutes in local school houses or public halls wherever a few interested people could be brought together. At first this instruction was not received by some in the spirit in which it was given. Ten or fifteen years ago, a few farmers thought it an insult to occupation for a "dude of a college feller" to presume to tell them anything. They knew all about their business already. Happily, many saw an opportunity to make up in part for what they missed in their school day, and the results they began to show by following the advice of the "book farmer" was soon apparent to the most egotistical of the "fogies."

The larger dollar signs of the neighbors who had heeded soon caused them to fall into line, and now the Institute, with its special instructors, is everywhere hailed with delight. The educational value of these meet-
ings can never be even approximate-
ly estimated. The latest phase of the Institute work is the "school on
wheels." Nearly all have read of the corn train sent out by the Iowa station about three years ago; or, of the wheat and dry trains sent out by Washington and Oregon; or of the dairy train in the Willamette valley, Oregon; or of the poultry train in Southern Oregon; or of the great general agricultural trains sent through out our own state. These trains, gen-
erously furnished by the railroads, and equipped and manned by the state colleges and stations, stop from one to three hours at each village and town along their route, and at each place specialists lecture and demon-
strate about the particular agricultural crops and features of the community. The farmers gather from miles around, and as the train makes about four stops each day, the num-
ber of persons reached is many times that of the local institute, and the actual results accomplished can only be told by the future.

In this paper, written in a disjointed way at odd moments, I have en-
davored to bring to the student some-
thing of what the great move for a
higher and better education for the rural classes is going to do toward the uplift of America. If you have been interested and will continue to keep in touch with this great movement, and to aid it in every way possible, I will be satisfied with the effort I have made.

OUR DEVELOPMENT
IN AGRICULTURE

Agriculture was mentioned in the original act establishing the Polytechnic School as one of the subjects which should be taught. The first trustees—those who had the shaping of the policy of the school, were unanimous in their opinion that agriculture should be given a large place in the curriculum. This is evidenced by their selection of nearly three hundred acres of land for the site and their choice later of a man as first Director, whose sympathies were known to be strongly with agriculture.

Before coming to California in 1900 and while on the staff of the College of Agriculture at Cornell University, I was imbued with the idea that agriculture could be successfully taught in secondary schools and that boys and girls should be given the opportunity to study agriculture before and without entering college. This idea had grown upon me so strongly that when called upon by the Polytechnic trustees to outline a plan for the school, I recommended that it be secondary in grade and that its main lines of teaching be agriculture, mechanics and household arts. At this time, 1902, the only secondary agricultural schools in the United States were operated by agricultural colleges and thus did not afford a fair precedent for an institution starting alone and on a new foundation. The real basis of establishment was the so-called Land Grant colleges which have courses in agriculture, mechanics and domestic science, and following them as a general model, the Polytechnic was begun as a school of lower or secondary grade. During the first year the full course of study was not outlined, and indeed, it was not until the third year that the complete course was announced, substantially as upon its present well defined lines. The faculty felt its way year by year and forecasted the future no further than was necessary for steady growth and the development of true “Poly” spirit.

Secondary agricultural instruction is the last great step to put our leading industries into pedagogical form for the benefit of the youth. Household arts and the various trades and mechanical pursuits had been taught for several years in schools of secondary grade in the larger cities. The mechanic arts, especially, have been the cause of expending large sums of money by private persons, and by boards of education in order that the city boy, who could not attend college, might be taught a useful and manly occupation. The Polytechnic School is the pioneer West of the Rocky Mountains in offering a like training in agriculture to the country boy and the city boy, too, if he wants to get a taste of the beauty
and wholesomeness of country life. Moreover, the Polytechnic is the pioneer in this country of secondary schools established by the State as independent institutions to teach agriculture and other industries.

The influence of agriculture at the Polytechnic is felt throughout California as is proven by the increasing desire in many localities to place agriculture in the curricula of local high schools. The State University has this year placed its approval upon such introduction by offering entrance credit to high school students for two agricultural subjects, viz: horticulture and dairying. Others will be added in subsequent years as the demand increases and thus agriculture "has come into its own" and is counted equal in dignity and educational value with mathematics and the classics. This recognition of agriculture by the head of our educational system will hasten its introduction into other secondary schools and add greater glory and promise to the Polytechnic.

LEROY ANDERSON.

THE VALUE OF SOIL STUDY

"The best of the field work has been in the making of plots"

The most important phase in soil culture is fertility.

By chemical fertility is meant the plant food of soil and is usually referred to as the fertility. This should not be considered alone. The physical fertility, that is, the light, heat, air, and moisture, is just as much a part of the ability of soil to produce crops as is the plant food in the ordinary sense of the word. Fertility, then, is both a chemical and a physical condition. It is just as great as the least of any single factor that helps to make these conditions.

This condition is not often recognized in practice. For example, a field is devoid of humus and therefore gets insufficient warmth and air, and consequently produces a poor crop. The farmer makes a blind rush to the nearest and cheapest source of commercial fertilizer, without due regard to what its contents are (one fertilizer is as good as another, most farmers think) and in applying it to the soil injures as much as he improves it. Or it may be only potash that is lacking. The farmer, in ignorance, applies a "complete" fertilizer, paying a high price for a lot of unnecessary ingredients.

The use of fertilizers is often unnecessary. The addition of plant food in the form of commercial fertilizer is sometimes imperative, but all the fertilizers in the world can not take the place of efficient soil culture.

Fertility is found to be largely in proportion to humus content. The "first aid to the injured" when poor soils are considered, should invariably be a supply of humus. Did you ever see a single cover crop plowed under and the ground not benefited by it? Practice it consistently and note the effects.
Laboratory Work in Soils

The study of the relation of various soils to different kinds of crops is important. There are soils and soils, some of which are suited to one crop, some to another. How very, very often we see a misfit, as it were, of a crop and the soil it is growing upon. How often a farmer plants an orchard on soil unsuited to it and then tries valently to make the two work and fails. Why didn't he in the beginning get the right crop for his land or the right land for the crop he wished to grow? Why didn't he? Well, he was undoubtedly ignorant of these conditions, but he should see clearly the value of a course in soil study and give his son a chance.

The United States is an agricultural nation. No one doubts the importance of farmers in the nation's welfare, but a great many seem blind to the fact that the primary foundation of successful agriculture is an understanding knowledge of the soil conditions. To get this clear understanding of the conditions it is necessary to consider the nature, the relations and fundamental principles in regard to the underlying reason why. The realization of the importance of soil study, and especially the "reason why" for many effects, is new. Herefore men began with the effect and floundered about trying to find the cause, but now we begin with the cause and remain upon safe ground while we trace the effect.

* * *

The soils class of 1908, under the instruction of Professor Edwards, has studied two books, "The soil," by King, and "Fertilizers," by Voorhees. Both books are up-to-date, practical works. Aside from the book lessons Instructor Edwards has given the class a short course in mineralogy. Of the field and laboratory work a few of the most important experiments were, finding the hydroscopic moisture, the apparent and real specific gravity, and the capillarity of soils, the acid soluble content and the flocculating effect of lime in soils; and the different physical conditions of local soil at various depths.

The best of the field work has been the making of plots in which were planted peas, corn and barley, each differing in the kind and amount of fertilizer used and in the preparation and cultivation of the soil. Blank
plots were also made, which helped to illustrate the moisture content as affected by tillth or mulch, or the absence of them.

The work in the book on soil has briefly been as follows: The nature of sunshine and atmosphere and their work; water and the part it plays; the cycles in nature; living forms, their importance to the soil; the nature, texture and composition of soils; nitrogen in the soil and its volume; moisture, light, heat and air of the soil, and drainage, irrigation, tillage and fertilizing as they should be practiced.

The context of Voorhees' book briefly is: Natural fertility of soil and sources of loss; functions and use of fertilizers; the kinds, as nitrogenous fertilizers, phosphates, superphosphates, potash and miscellaneous; methods and systems for purchase and application; fertilizers used for different crops, as garden, orchard or cover crops. The study of each topic has been very limited as it must necessarily be in a course covering so much of importance and interest in so short a time. The aim has been to impress particularly the underlying principles connected with the use of fertilizer materials.

In the soils course, as a whole, the object has been to awaken in the student a desire to understand the many phases of scientific soil culture. It is impossible to get much of so important and so broad a subject into two small books, but if through them a student learns to observe and study these principles as he sees them in nature and apply them practically, he will be repaid a thousand fold.

The failure in growing crops is not so often a minus quantity in the soil as a minus quantity in the man.

E. E. Y.

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**APPROPRIATIONS MADE**

**BY THE 1909 LEGISLATURE**

There is given herewith a list of appropriation bills passed by the Legislature of 1909 for improvements at the California Polytechnic School. The bills became law by the addition of Governor J. N. Gillett's signature April 12th:

**Purpose**  
**Amt.**  
Dining hall with kitchen .... 10,000  
Farm cottage .................. 2,300  
Development of water supply and irrigation system .. 6,000  
Sewer system .................. 6,000  
Poultry department and equipment .................. 2,500  
Refrigerating plant and other creamery equipment .. 4,000  
Repairing and Furnishing dormitory buildings .... 2,500  

Total .................. $54,300
AGRICULTURE AT THE POLYTECHNIC

Instruction in agriculture at schools of a secondary grade is something comparatively new in the United States. In fact, agricultural instruction at some of our state universities is still in rather a crude state. While the idea of education in agriculture is not so new, its development has been slow—until recent times—and it is only of late years that agriculture is coming into its own. But even now a great many people do not realize what benefits may be derived from a course in agriculture. What is there to study about farming? We can all plow, and we know the proper time to put in the grain, and when the hay is ready to cut, etc., etc. and so on all the way down the line of farm operations.

But in our study of agriculture our aim is to get track of all these things and study the why of things. The student of agriculture can tell you under what conditions of soil and season and crop to plow shallow and when to plow deep and why. He can tell you at what particular stage of the grain it should be cut to make the most nutritious hay and still be palatable. He can explain numerous things which many of us do just because it is customary to do them that way, and is able to take advantage of many conditions a less trained and observing man would let go by.

But above all, the man who understands agriculture has a realization of h's calling, a pride in his work and a self respect that can be exceeded nowhere. Agriculture is the leading industry of this country, and every effort is made to get the student to understand its relative importance and its relation to the development and welfare of other industries.

The course in agriculture at the California Polytechnic School not only teaches the most advanced and up-to-date methods of agriculture but is entirely practical. Things which are taught in the classroom are demonstrated in the laboratory and in the field. Students are taught and encouraged to do things. From the very first, the work is so arranged as to retain interest and encourage independence of action, and once a man is thoroughly interested, the rest is easy. Many of the third year students are carrying on work and experiments in the laboratory, the field or among the animals which is not required in order to complete their course, and
shows their interest in their chosen line of work. The creamery, the green-house, the grain experiments which the school is carrying on in connection with the state experiment station, the herds of animals—all furnish excellent fields for work of this kind. Members of the Senior class have just now finished a swine feeding experiment, covering over two months, and besides procuring data on general rate and cost of gain have also worked out to some extent the value of creamery by-products and grass in pork production as compared with grain.

The first year students in agriculture, in addition to their academic studies, take up soil and fertilizers, botany and plant propagation, poultry, and farm buildings. This is followed the next year by work in dairying, horticulture, animal husbandry and agricultural chemistry, while the more complex subjects of irrigation, advanced agricultural chemistry and animal husbandry, entomology and physiology are retained for the third year.

In addition to this special agricultural work the student has academic work much the same as regular high school work with the exception of languages, including physics, mathematics, English and history. In the third year the student has an opportunity to take some elective work, and can devote extra time to any phase of agriculture in which he happens to be especially interested.

Aside from the regular courses, the school offers opportunities for special work along many lines. Quite a number of men have already taken advantage of this, and special work has been given in chemistry and soils, dairying and horticulture. There is more demand all the time for scientific instruction along some special line for the busy, practical man who cannot take a long course, and this demand, the Polytechnic with her trained instructors and excellent equipment is well prepared to meet. Preparations are already under way for short courses to be given in the coming school year. There will cover work in dairying, animal husbandry, poultry culture and probably horticulture and soil.

In other parts of this journal may be found illustrations of some of the school equipment, some of the methods of work and perhaps descriptions of some of the courses. In addition to over three hundred acres of land, the school has shops, laboratories, green-houses, barns, etc,—all maintained with the sole object of instruction. The student puts the principles taught in the class room into actual practice. He learns the beauties of agriculture and work becomes not mere drudgery, but something which accomplishes results. Above all, the student gains that knowledge of the worth of his calling, the interest in his work and that confidence in himself which goes to make a success of any undertaking.

C. W. R.

Our New Creamery Building
CROSS POLLINATION OF FRUITS

Cross pollination consists in applying pollen from a distinct horticultural variety, that is, one which has grown from a distinct seed, and not in using pollen from another tree of the same grafted variety which is no better than from the same tree. Fruit from self-fertilization is uniform in shape but not so desirable as that from cross pollinated varieties because that operation tends to enlarge and sometimes produces a different flavor. The seeds of the cross pollinated varieties are always larger and firmer than the self-pollinated. Pollen is carried by bees and other insects, and never by wind, as some suppose.

Self-pollination takes place, on matter whether or not foreign pollen is present.

The failure to fruit with self-pollination is due to sterility or pollen and not to mechanical causes, the impotency being due to the lack of affinity between the pollen and ovules of the same variety. Varieties that are absolutely self-sterile may be perfectly fertilized if crossed.

Cross-pollination of fruits must be taken into consideration to a great extent when planting an orchard. By neglecting to use this method, which nature has given to strengthen the productiveness of our crops, we make a serious mistake.

Many pear varieties are self-sterile, but under very favorable conditions they will yield, so if cross-fertilization were followed more extensively, the same climatic conditions and the same soil would produce much larger crops than formerly.

Experienced horticulturists have even tried to make a classification between self-fertile and self-sterile varieties of pears, but conditions were never favorable for making a strict distinction between the two; nevertheless, it is evident that cross-pollination does away with the unevenness of crops, and the continuous falling off of fruit.

With apples it is the same, but not to such a great extent. Some varieties, namely, the Newtown, the Bellflower and the White Winter Pears, are very weak unless crossed with stronger varieties. The best example of poor reproduction is seen in the instances of many orchards in the largest apple country west of the state of Missouri, where are planted in solid blocks of one variety Bellflowers, or Newton Pippins, on account of prices and the favorable conditions for their production. The center of these blocks are as a rule very poor, but the outside rows, which are surrounded by other orchards of a different variety, or the same variety from a different nursery, give a good crop due to the cross-pollination taking place.

The best plan to do away with sterile trees is to alternate them in rows with other varieties. In this way the Bellflower bears more abundantly, the apples set stronger and resist unfavorable conditions, while the Newtown varieties take on a Bellflower shape and likewise resist unfavorable conditions.

Many other varieties of fruit require cross-pollination, being partly or wholly incapable of setting fruit when limited to their own pollen.

O. B. J.
The Polytechnic Journal

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Committee of Agricultural Club in Charge.
C. W. Rabe1 J. Lee McDowell
Oswald B. Judd.

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As this edition of the Journal is almost entirely devoted to agriculture, a word of explanation may be in order. A few months ago the representatives of the Agricultural Club approached the Journal staff with the proposition that they be allowed to get out an edition of the Journal in the special interests of the agricultural department of the school.

The staff, which consists of members of all the departments, gave its consent, at the same time according a like privilege to the other departments if they wished to avail themselves of it. However, the "Ag" students are the only ones to attempt such a task this year.

In this number, the regular departments are reduced to the minimum in order to leave as much room as possible for the special items, but we believe that our readers will consider themselves gainers rather than losers. Because they are farmers, the editor-in-chief, the business manager and several of the other members of the staff may be prejudiced, but they firmly believe that the importance of the agricultural course can scarcely be overestimated. They bespeak your closest attention and thought for the contents of this issue of the Journal.

We wish to take a few lines at this time, however, to refer briefly to the general work of the school. Instruction is given in three courses: mechanics and agriculture for the boys, and household arts for the girls. The school is of secondary grade and the regular academic subjects are given in each course in connection with the special studies.

At present the courses are three years in length. Plans, however, are already under way for the addition of a fourth year's work, an improvement which we understand is scheduled for execution within a year or two at most.

The mechanics have well equipped shops and laboratories for iron and wood working; for the study of electricity, steam and electrical machinery, and for such other subjects as chemistry, physics and mechanical drawing.

The household arts course is one of the best equipped of its kind on the coast. Besides the academic branches, the girls receive practical work and scientific instruction in such subjects as dressmaking, millinery, cooking, home sanitation, planning and furnishing the home, laundry work, sloyd, etc. In all of the courses the forenoons are devoted to recitations and lectures, while the afternoons are largely occupied with work in the laboratories, shops and fields.
JUNIOR BARBECUE

The Junior class proved themselves royal entertainers on the night of April 17, by giving a barbecue to the faculty, students and friends of the school. The event was held in the school cannon, which was lighted for the occasion with Japanese lanterns. The meat was cooked to perfection, the bonfire was big and bright, the games were snappy, and everyone had a fine time.

SENIOR MAY PARTY

On the evening of May 1 the Seniors gave a May party to the rest of the school. A May pole was erected on the lawn in front of the dormitory, and attached to it were the colors of the three classes. Electric lights were strung on wires about the lawn, showing to good advantage the colored streamers of the pole and the light dresses of the girls as about sixty boys and girls wound and unwound the May pole to the music of the orchestra.

Refreshments were served and the latter part of the evening was occupied in dancing.

ATHLETICS

Athletics have come to a close for this year, with Polytechnic in the front row when it comes to victories. When the baseball season ended, we had won three games out of five, although Santa Maria won the championship of the league.

Our track team was most successful of all. It made a fine showing in the inter-scholastic meet at Santa Barbara, taking second place. Ventura came out in the lead, and Santa Paula and Santa Barbara took third and fourth places.

In the Santa Maria league meet the three schools entered were Polytechnic, Santa Maria and San Luis Obispo.

The score stood as follows: Polytechnic, 74; Santa Maria, 39; San Luis High School, 9. There were few records broken, but Polytechnic won the relay in very fast time.

POLYTECHNIC Y. M. C. A.

The Young Men's Christian Association of the California Polytechnic school was organized April 29th, '09.

The officers elected were: President, Ernest E. Yates; vice-president, Charlie Sheppard; secretary, Floyd Patterson; treasurer, John Taylor.

The prospects for a good, strong association are splendid. When we consider the value we will all do our best to make it a success. We have the unqualified support of the faculty and will undoubtedly get material support from the business men of San Luis Obispo, and from the parents of all students in the school.

We must aim to have every man in the school a member of the association. Other schools very nearly do this, and there is no reason why we should not. The best way to accomplish it is for every one interested to join and then get some one else to do so.
"Churning is Done Nearly Every Day in the Week"

COURSE IN DAIRYING

Dairying at the Polytechnic has taken quite an advance the last few months, since the completion of the new Creamery building.

The Creamery is a two-story building. Up stairs are a laboratory, class and reading rooms, while down stairs are the churn, separator and engine rooms, besides cold storage rooms, receiving room, etc.

The dairy course covers all the important and minor parts of dairying. Problems which come before the dairymen are brought up, and solved not only in a scientific but a practical way. The power which is used to run the apparatus is procured from a steam engine, which the students operate by turns. Thus they come in touch with all sides of the creamery business.

The book part of the dairy course covers three periods a week, and one afternoon is spent in the laboratory. As subjects are taken up in class, experiments are done in the laboratory along that line. Some of the subjects which are taken up are "Testing of milk and cream," "Fermentations in milk," "Separating of milk," "Churning," "Cheese Making," etc.

The work follows along in about the above order. Whole and skimmed milk are tested for fat by the Babcock method. Pasteurizing is done, noting the difference in the keeping quality of pasteurized and unpasteurized milk. In the separation of milk, different makes are used. The efficiency and capacity of the separators are worked out. Samples of the skimmed milk and cream are taken from time to time during the separating. This skimmed milk and cream is then tested and the efficiency of the separator obtained. Experiments are done along the line of artificial and natural ripening of cream; also the making of natural and artificial starters. Churning is done nearly every day of the week. In making butter, it is made along the lines of a large creamery. There are two churns in the churn room, both of which are combined
The Babcock Test

Churns and butter workers. After the butter is made, it is taken out and stored in the refrigerator room. All the butter is tested for the per cent of moisture.

In this way the student gets an idea of how much moisture is being worked into the butter and what per cent of overrun there is.

Cheese making is also an important part of the course. Several different kinds of cheese are made, principally Cheddar and California full cream.

After completing the course the student is able to do most any work in the creamery or dairy line. If he goes into the creamery business he knows what problems are liable to come before him, and he will be able to meet them.

K. B.

A Corner in the Separator Room

POULTRY DEPARTMENT

Poultry growing is an adjunct of every properly conducted farm, and of every rural home. Probably no class of live stock is more widely distributed, nor is any other so universally reared as poultry. Its right to recognition as one of the four main branches of agriculture has been firmly established and it is being taught in our agricultural colleges with all due respect to its position.

The California Polytechnic School has established and is maintaining one of the best poultry courses to be found on the Pacific Coast. It is a required subject of all the regular agricultural students and the coming year the department hopes to establish a short course during the winter months for the benefit of special students who wish to make poultry husbandry a specialty.

WM. E. COLEMAN.

A Section of the Poultry Yards
The study of horticulture is taken up by the second year agricultural students during the second and third terms. This gives good satisfaction, as it gives a fine chance for the observation of the growth of the fruit and leaf buds, and the season's growth that produces most of the fruit.

Considerable practical work is done as well as studying from the textbook, notes and bulletins.

A number of afternoons have been spent in planning and setting out an experimental orchard, which is composed of several different kinds and varieties of fruits, including twelve varieties of apples, five pears, five cherries, six plums, six peaches, one nectarine, three apricots, two figs, two quince, two prunes, one persimmon, three almonds, three olives, ten grapes and a number of orange and lemon. The trees and vines were shipped from the nursery in one large bundle, wound with twines, with the exception of the orange and lemon, which were balled. As soon as they arrived they were heeled in and set out in their proper places as soon as possible, and pruned up before the buds had started out.

Some more practical experience was obtained in the old orchard, where the different methods of grafting were practiced. Several of each of the different kinds of grafts were made, such as the whip, saddle, veneer, side, l'laying, inarching, cleft, bark, and T-shaped incision of the bud. Then preparations for spraying were mixed up and the trees sprayed, to keep down the harmful insects, such as the codling moth, plant lice, wooly apple aphids, etc. Some pruning was also done in the old orchard, where interfering and dead limbs were taken out.

The eucalyptus grove was also trimmed up, which consisted of taking all the side branches off the main trunks to about six feet high, and the ferk taken out.

The text book that is studied is the fourth edition of "California Fruits, and How to Grow Them," by Edward J. Wickson, A. M., dean and professor of agriculture in the college of Agriculture of the University of California. This treat of fruit growing in California, the development and present greatness of the fruit industry of the state, the methods that have shown the best results in propagation, planting, pruning, cultivation and ir-
irigation of the different commercial fruit varieties of California, with lists of varieties best adapted to the different districts of the state, the modern methods of budding and grafting, preservation of the different fruits and protection from insects, diseases, animals, birds, wind, and frost.

Notes are given from time to time by the instructor on the origin of different fruits, choice of varieties for fruit growing, grafting, propagation of trees and vines, pruning and a few lectures are given on entomology.

As different subjects are taken up the students are given assignments to look up bulletins and different books that deal with the subject and report on it in class.

Each one of the students is given his choice of some Californian fruit upon which to write a five thousand word article, telling the history, propagation, cultivation, uses, etc.

F. H. H.

THE AGRICULTURAL CLUB

On November 6, 1906, a committee meeting was called in the sitting-room of the dormitory by Mr. J. E. Roadhouse, for the purpose of drawing up a constitution for a proposed Horticultural Club in connection with the regular class of horticultural work. The club was principally organized for the young men taking the agricultural course, and its purpose was to bring together its members and disseminate knowledge of horticulture, both past and present. The club elected its officers, formed its committees and held its meetings regularly every first and third Tuesday evening of each month.

The club, being small, met in Mr. Roadhouse's sitting-room, and many talks of interest were given by different members of the club. These meetings were usually followed by some light refreshments, appropriate to the topic of the evening, which made the club a most sociable affair. Membership was kept up until the summer vacation of 1907. In the spring of 1908 a new constitution was brought up and the club changed its name to the "Agricultural Club," and proposed to provide literary entertainment, supplement class work and further the agricultural interests of the school.

This gave a larger field of work, and many interesting talks and lec-
articles have been given for the benefit of the members of the club. To give an idea as to the subjects touched upon and their usefulness to the students, we will give a few of the topics talked upon:

"Extensive Farming," "Intensive Farming," "Dairy'Ing and Its Problems," "Poultry Raising on the Farm," and many more just such interesting subjects.

At one meeting Dr. Rocque lectured on the "Bureau of Animal Industry," at another time Mr. Mainwaring gave an interesting account of the work done in the forest reserve. Other outside speakers have appeared before the club. In the horticultural line, the enemies of trees, fruits and garden are considered, and means to combat them are explained. The handling of a farm in order to gain the most profits is also considered, and, in fact, every item of interest to agricultural students is looked into.

Another aim of the club is to discuss the current events along agricultural lines, and to keep up with the progress made in each of its many branches.

For the year ending in 1909, the club has gained in membership, and the interest shown by the students and faculty in its behalf has made for it an important and lasting place in the school.

H. L. H., '09.

**STOCK JUDGING**

Getting a Line on Action

It is comparatively easy for the average farmer, with his knowledge of the general conformation of animals, to pick out a good horse from a bunch of poor ones, but it is a different proposition for him to pick out the best horse from a bunch of good ones and give good reasons for his choice.

A man to be competent to judge in the show ring requires years of practice in handling animals; he must be able, at a glance, to pick out the good and the poor qualities, the strong and the weak points, and to place the animal in its proper place along with its fellow competitors.

While it is not possible for every farmer to become a show-ring judge, he should be able at least to pick out from a bunch of livestock of any type the animals which will come the nearest to fulfilling his requirements; and it is with this idea in view that the course in stock judging at this school is given.

The school owns a goodly number of prize drafters, a string of Jersey, Ayrshire and Short-horn cattle, and several pens of good hogs, which, together with the stock of the neighboring farmers to which we have access, supply an abundance of judging material.

Two afternoons a week are given over to this course in judging. During this time the student has practice
in using the score card, which is carried on very similarly to scoring in the show ring. He is given an animal to look over and score according to his own judgment, and after he has filled out his card the instructor goes over the animal, calling upon the students to express their opinion upon the qualities of the different parts of the animal, and he scores it as he thinks best.

In this work the student becomes acquainted with the different parts of the animal, he gets a good idea of what the standard calls for or what an ideal animal should be, and he cultivates the habit of forming opinions of his own without the help of some one else.

The student also has practice in comparative judging. Here he is given a string of animals all similar in type, from which, after a short examination, he picks out the animal which he thinks heads the class. He then singles out the next best, and so on, placing each animal in its proper place, according to soundness, symmetry, conformation, style or action, as the case may be, and at the same time giving the reasons for his placing.

As the course proceeds he is given practice in judging the weights and ages of animals, he is shown where the most common ailments are to be found, and something of their cause and prevention. He becomes familiar with the breed characteristics, thus knowing under what circum-

A Study in Porcine Quality

stances the Holstein would be more satisfactory than the Jersey, or the Berkshire than the Poland China.

Upon completing the course in stock judging a man goes back onto the
farm with a better knowledge of animals; he sees them in a different light and is not nearly so apt to be misled in his business transactions with his friend, the "professional stock dealer." 

J. L. M., '09.
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