Bulletin No. 15. July, 1898.

UNIVERSITY OF IDAHO AGRICULTURAL EXPERIMENT STATION.

MOSCOW, IDAHO.

I. Report for Fiscal Year ending June 30, 1898, with Financial Reports for 1897--98.

II. Miscellaneous Information.

F. B. GAULT, Director.

MOSCOW:
NORTH IDAHO STAR PRINT.
1898.

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BULLETINS.

The regular bulletins of the Station are sent free to all who request them.

Bulletins issued since the close of the fiscal year, June 30, 1897:

11. Smuts and Rusts of Grain in Idaho, and the Most Approved Methods of Dealing With Them.
12. Sugar Beets in Idaho.
13. Meteorology.
14. Twelve of Idaho's Worst Weeds.
15. Annual Reports 1897-1898, and Miscellaneous Information.

REPORT OF THE EXPERIMENT STATION OF THE UNIVERSITY OF IDAHO.

UNIVERSITY OF IDAHO.

PRESIDENT'S OFFICE.

JULY 1, 1898.

The Experiment Station of the University of Idaho was established by the Regents of the University in 1892, the federal fund for the support of the same becoming available for the fiscal year of the government ending June 30, 1893.

It seemed advisable to the Regents to establish substations in various portions of the state, thus subserving in a general way varying agricultural conditions. Accordingly, a substation was located at Grangeville in the pluvial region of North Idaho, another at Nampa in South Idaho, in the low arid section, and the third in Idaho Falls, in Eastern Idaho, as a representative of the high arid conditions.

The several communities donated land to the University Regents for station purposes. The deeds of conveyance contained provisions that when the University of Idaho ceased to operate the farms as U. S. Agricultural Experiment Stations the same should revert to the grantors. These lands were put into condition for agricultural purposes as rapidly as possible; fences were built; houses, barns and sheds were constructed, and other essential improvements made.

The arid lands were found expensive to prepare for effective station operations. While the settlers in these localities may be able to open up their farms with comparative ease and lightness

of expense we found, under the conditions surrounding us, the reclamation very expensive.

Farm machinery, tools, implements and all the accessories of first class management were provided. The returns upon the farm side were very unsatisfactory, the crops usually being poor. This was not due in any marked degree to the natural conditions of the several sections as there are no more prosperous farming communities in the west than those contiguous to the points named above.

The experimental results were also of little value. Generally speaking the men in charge of the substations were all well qualified and attentive to the interests in charge.

But a variety of causes combined to make the substation work expensive, and unsatisfactory. One of these substations was 450 miles away, another 750 miles; the third was only 100 miles distant, but was reached solely by a stage line over a range of mountains, communication being slow and often uncertain by reason of impassable roads.

The substations kept the station poor. Nothing could be done by the scientific staff in the way of investigation as there was never any money left with which to buy apparatus especially adapted to such work. So the station laboratories stood still. The staff was employed at teaching and paid from funds for scholastic purposes. Some desultory variety tests were attempted upon the campus but little of value was determined therefrom.

Thus the station, impoverished by the substations, dragged itself along, unable to accomplish much of public interest or permanent value. The publications fell behind as there was nothing to publish.

Late in the spring of 1896 came a ruling from the Department of Agriculture to the effect that the substations were not a valid charge upon the Hatch Fund; that the station is essentially a part of the institution to which attached and its operations

must be connected in close connection therewith; and no part of the federal funds can be applied to the maintainance of permanent substations in sections of the state remote from the central station. In other words the Hatch Fund must be applied to the support of the station and the station is where the institution is. The state may maintain substations if it wishes but the government aids only in support of stations.

Steps were taken at once to conform to this ruling. Many complications existed and progress was necessarily slow.

The Regents in their biennial report to the Governor and Legislature, December, 1896, set forth the attitude of the federal department toward substations, giving the ruling complete. The Board at their meeting in November, 1896, resolved to abandon the substations, and directed the President of the University to close up affairs at once, giving him wide discretionary power in adjusting matters, and also determined to reconvey the farms to the original grantors. All of this has been done in a way that seems to have given general satisfaction in our own state and has gained the official commendation of the Department of Agriculture.

Meanwhile the station proper was not neglected. The University needed a farm for the station.

Accordingly the President of the University submitted the needs to a meeting of the representative citizens of Moscow, held in May, 1896, explaining the changed condition of station affairs and the immediate necessity for a farm of about 100 acres. The matter was received with cordiality, a committee appointed and subscriptions were secured, the citizens of Moscow and Latah county contributing liberally, nearly all the members of the faculty contributing generously.

As a result of this public spirit the station now possesses ninety-four acres of land located just a half mile west of the University building.

This land lies in a compact domaiu at the head of one of the principal streets of Moscow, commanding a fine view of the city and the University and possesses almost every physical feature to be found in the famous "Palouse country."

There being no buildings or improvements upon the tract the station has had to begin at the beginning. Bad tillage left us a heritage of wild oats which affords a practical lesson in eradicating the great weed pest of this section.

During the season of 1897 the land was farmed with a view to securing a practical idea of the conditions involved. The crops were taken by the wild oats, though a large supply of hay and feed was obtained for the teams of the station. The Chemist and Physicist secured valuable soil data and the Botanist made a careful study of the plant life upon the farm and contiguous territory. During the present season a great amount of work is being done, the results of which will be preserved and deductions made public in due time.

The wild oat question is still an obstruction, requiring ingenuity and persistent effort to wrest the crops from destruction.

A careful study of the wild oat, its propagation, value as a food, injury as a weed, and methods of extermination will probably appear in time as a part of the station publications.

The original organization determined by the Regents provided that the Professor of Agriculture should be Director of the Experiment station, it being assumed that he being a scientific man would be competent to supervise and direct such interests.

In a large institution where the director could have a staff of his own, independent of the faculty, that plan doubtless would be effective. But in a small institution this organization was fatally defective. It gave the organization two heads, with a divided authority and a shifting responsibility. Moreover the Director, being a professor, was a co-ordinate with the station staff in all faculty matters, but in station work was a superior officer.

A competent, tactful, generous minded man could easily reduce to a minimum the difficulties inherent in an adjustment of functions so fraught with dangerous possibilities, but in this instance the friction was not allayed and the staff was in constant embarrassment and uncertainty.

The charter of the University in referring to the powers and duties of the president provides: "He shall have authority, subject to the Board of Regents, to give general direction to the instruction and scientific investigation of the University."

To comply with the law of the state relating to the University, to systematize the business of the institntion, to unity the station operations and to co-ordinate all the scientific departments, the Board of Regents in January, 1897, united the office of Director of the Experiment Station with that of President of the University, where it will probably remain, as the law contemplates, and the interests of the institution manifestly require.

Dnring the year the bulletins of the Experiment Stations were placed in the general library and reading room under the supervisison of the Librarian of the institution and a card index made up for the various publications of the several states. In this way every station publication is now easily available to the station staff and to the general reader. The files have now been completed except a very few of the earlier bulletins of some of the stations. Probably no new station has a more complete file of the bulletins than ours.

The reports of the several departments are made a part of this report and need no comment in this connection.

The position of agriculturist has been vacant throughout the entire year, the duties of that division having been assigned, for the time being, to the superintendent and horticulturist, Mr. Huntley.

The station staff will hereafter have two such officers instead of one—an agriculturist and a horticulturist.

The work is now too heavy for one man. The vast horticultural interests of the state require the attention of a skilled horticulturist. The horticultural experiments upon the station necessitate a specialist in those lines. Besides these considerations the supervision of the greenhouse will occupy no small part of an active man's time.

The horticultural building and greenhouse now nearing completion will greatly extend the facilities for horticultural work. The building consists of a greenhouse proper, 50 x 18, a potting room, a boiler room, an office and a class room 24 x 34. The greenhouse is glass and iron construction resting upon substantial masonry, with cement floor, perfect drainage and ventilation. The main part is a well constructed and well finished wooden building. The building is heated throughout by hot water.

Two barns each 20 x 50 have been built upon the farm, and lumber is already upon the ground for a farm house. Besides this, temporary sheds for the horses have been built upon the campus back of the university building and such additions made to the wooden armory building as to provide excellent tool room, shops, cellars, dairy, domestic economy and other work rooms.

Though the bulletins have fallen behind, four valuable bulletins are now ready for distribution and the whole series complete to July 1, 1898, has been apportioned to the station staff and data is being gathered for the same. These bulletins will embody the results of the investigations now in progress.

The finances of the station are now in good shape.

The station operations as now organized ought to prove effective of good results and afford invaluable service to the agricultural and horticultural interests of Idaho.

F. B. GAULT,
President.

REPORT OF THE DEPARTMENTS OF AGRICULTURE AND HORTICULTURE.

To the Director of the Experiment Station of the University of Idaho, President F. B. Gault,

SIR:—A brief outline of the work performed in agricultural and horticultural lines by the Department of Agriculture of the Experiment station during the season of 1897 is herewith presented, together with the plans in force for the season of 1898.

The station farm came into the possession of the experiment station too late last year to permit its use very generally for the purpose of experimentation. A late sowing of spring wheat, and a small plat each of sugar beets and carrots, were the only crops raised on this land.

The twenty-acre area comprising the University grounds had about six acres available for crop experimentation and was well occupied with grains, grasses and garden crops. About forty varieties of wheat were grown in small plats for the purpose of introduction to the locality, some of them proving to be duplicates with different names. A large number of varieties of oats and barley were likewise cultivated, besides other crops such as flax, hemp, chicory, Kaffir corn, sweet corn, field corn, buckwheat and millet, each, in most cases, limited to one variety.

Thirty varieties of grasses were cultivated in small plats for trial and comparison. Those promising best for endurance of dry conditions and quantity of yield were Bromus Inermis, timothy, Canary grass, tall meadow oat grass and orchard grass. Bermuda grass whose habit is of low thickened growth indicated

much promise for sheep forage. Most all the grasses lacked that most desirable quality or habit of making leafy growth in abundance at the base of the stems. This was attributed to the naturally very dry condition of the atmosphere during development, and is a characteristic habit of the native grasses.

All the clovers on trial thrived remarkably well. Both the common red clover and alsike clover easily made heavy growth. The University campus with a turf of blue grass has in it a considerable growth of alsike and common white clover, and the alsike, very noticeably, endured drouth much better than the white. The campus was not irrigated. Crimson clover, which is an annual, produced a very satisfactory crop. Alfalfa gave fairly good promise, but indicated rather light tonnage for general culture. One crop in a season is all that can be expected of alfalfa in this locality without irrigation.

Hair vetch, and sanfoin which is often known by the name esparset, both indicated excellent possibilities in ease of cultivation and heavy yields. Field peas gave superior returns. In fact all the leguminous plants proved themselves well adapted to the conditions here for a single crop, the later summer months being too dry as a rule, to favor the production of a second forage crop of any kind during a single season.

Root crops, including sugar beets, stock beets, table beets, carrots, parsnips, salsify turnips and radishes, were all raised successfully on small plats. The soil here requires to be handled with certain special care to favor the highest development of root crops. The subsoil is of such a compact nature as to require breaking up by deep plowing or cultivation to prevent obstruction to the roots in their downward growth. Unsymmetrical development of roots is likely to occur without such preparation. The surface soil, on the other hand, is naturally very loose and porous, and to insure uniformity in the germination of seeds it is desirable to use a land roller or some other implement of pressure to insure a con-

stant supply of moisture by capillary action during the period of germination.

A potato test having for its object the introduction of varieties, was begun by the cultivation of small test plats. As varieties were obtained from different sources, a number of them were found to be duplicates sent out under different names. The seed thus obtained, after proper selection and cultivation, will be used for purposes of experimentation on lines yet to be determined.

The vegetable garden received a fair portion of attention last season. Plants best adapted to cool conditions of soil thrive remarkably in this locality, excepting celery which requires more than the natural state of soil moisture to promote full development. Cabbage, cauliflower, lettuce and all vegetables of like nature make good crops under ordinary field methods of cultivation. Onions are successfully cultivated, and produce good bulbs if the seed is sown very early and dry conditions are secured during the season of ripening. Conditions for ripening are improved by working the soil away from the rows late in the season. This can be accomplished with slight expense by the use of a hand garden plow run next to the row, throwing the earth toward the center between the rows. Vines of cucumbers, squashes and pumpkins do not obtain length of growth here equal to warmer sections, but mature their fruit if planted early. Average seasons are most too short for ripening melons and cantaloupes, and too cool to insure fine qualities. Tomatoes, eggplant and peppers ripen their fruit under favorable conditions.

The young orchard on the university grounds, occupying about an acre, has continued in a thrifty condition. The small areas devoted to small fruit culture have, likewise, developed most favorably. These become immediately available for experiment purposes.

The experiments by the departments of Agriculture and Horticulture in force for the season of 1898 are being conducted on a

larger basis than was possible heretofore on a limited area. Tests of forage crops on a scale sufficiently extensive to render them very practical, have been begun. In these experiments are included three varieties of vetches, Kaffir corn, Jerusalem corn, milo maize, three varieties of sweet corn, field corn, two varieties of millet, oats, wheat, rye, teosinte, rape, a collection of stock beans, field peas, beets, carrots, turnips and artichokes. In connection with these experiments will be observed methods of preparing the land and seeding, the progress of growth and development, the yield, and the value of the various crops for forage.

There are being cultivated by the small plat system, fifty varieties of wheat, eighteen varieties of oats, eleven varieties of barley, and two of rye. Careful observations are noted, and it is the purpose in this connection to select seed of a few varieties of each for further trial on a larger scale. From so large a number it is reasonable to expect that grain growers will ultimately become benefited by the acquisition of improved varieties.

A potato test, similar to the grain test, is under way with two hundred varieties. Only a few of the varieties are expected to show superior merit. Such will be given more extended trial for the purpose of determining their value for general cultivation.

Experiments in the cultivation of beans will show their value as a field crop, and those of desirable qualities for garden use. The station recently procured the seed of many varieties imported from abroad, which are being carefully tested for introduction.

A plat of two acres of silverhull buckwheat is being raised for the seed, and to determine also if the crop has value as an exterminator of wild oats.

Sugar beets, consisting of eight varieties and strains, are being raised on subsoiled land. Their value for sugar from a chemist's standpoint will be determined in the chemical laboratory of the experiment station. Their importance as a product for the food of farm animals will also be observed.

In connection with many of the experiments with forage and other crops considerable energy will be put forth towards a solution of the problem of eradicating wild oats. The expensive practice of summer-fallowing is regarded as the only remedy by farmers who have struggled with this pest for many years.

In the vegetable garden this year special attention is being given to onion and celery culture, though many other garden crops have been planted for trial and observation.

A large area on the station farm will be devoted to horticultural investigations. Over forty varieties of fruit trees, the beginning of extensive variety tests, were planted this season. The horticulturist, with the assistance of the students in the course, propagated a large number of fruit and forest trees during the winter and spring months. These have already formed a considerable beginning in nursery work.

An enlarged plan of flower and ornamental gardening insures abundant resources in this division of horticultural investigations.

Very respectfully submitted,

F. A. HUNTLEY.

REPORT OF THE DEPARTMENT OF METEOROLOGY.

PRESIDENT F. B. GAULT,

Director of Station Council,

DEAR SIR:—I herewith submit the following report for the Department of Meteorology. During the past year meteorological records have been taken at Moscow and Nampa. The Department is indebted to Mr. E. G. Nettleton for the Nampa records for 1897. The department has published bulletin No. 13 which gives the more important meteorological records taken by the Experiment Station of the University. This bulletin gives the Moscow and Nampa records from 1894 to 1897 inclusive, and the Grangeville records from 1894 to 1896 inclusive. The bulletin covers the maximum, minimum and mean monthly temperatures, rainfall, melted snow and total monthly precipitation, and mean monthly barometic pressure and the range of the barometer for each month, the mean and lowest relative humidity for each month, condition of weather, and the earliest and latest killing frosts.

Soil temperatures have been taken on the University campus during the past year.

In the autumn of 1897 the department made mechanical analyses of twenty-three samples of Idaho soils. The work as outlined above will be continued during the coming year. Apparatus for determining soil moistures will be installed during the present summer.

Respectfully submitted,

J. E. BONEBRIGHT,

Meteorologist.

REPORT OF THE DEPARTMENT OF BOTANY.

PRESIDENT F. B. GAULT,

DEAR SIR:—The first part of the year 1897-98 was spent in making a tour of inspection through the southern and northern parts of the state, in the interests of horticulture and agriculture. Accompanied by the Horticulturist of the station I began inspection of orchards, fields, and gardens in the vicinity of Pocatello about the middle of July. Thence working westward along the Oregon Short Line and Utah Northern Lines of Railroad we visited in succession, Blackfoot, Shoshone, the Snake River below Shoshone Falls, Mountain Home, Boise, Nampa, Payette and Weiser. Returning thence to the Northern part of the state, we visited Hope and a few orchards on Lake Pend d' Oreille, Sand Point, Rathdrum, Cœur d'Alene, and Harrison on the Cœur d' Alene Lake. In the intervals between the inspection of different orchards and fields for fungus and insect pests (the zoologist not being in the field that year), considerable time was spent in making notes upon weeds, obtaining photographs of all the most noxious through Prof. Huntley, and collecting specimens of them as well as of the indigenous plants for the college herbarium and for exchanges. As partial results of this work, two bulletins by the writer are now in the printer's hands; one on "Smuts and Rusts in Idaho," and the second on "Twelve of Idaho's Worst Weeds," while much material for future papers still remains undigested in the herbarium. Amongst the insects injurious to cultivated plants the most important were the Codlin Moth, the Wooly Aphis, the Green Aphis, the San Jose Scale, and the Tent Caterpillar. As the Zoologist of the station is now in the

southern part of the state investigating the insects injurious to vegetation, I shall not dwell upon this subject. Serious fungous diseases are as yet remarkably few. Whether this is due to the unsettled condition of the conntry, the scarcity of old orchards, and the few main lines of railway, or whether it is due to the dry condition of the atmosphere and lack of rains through the summer months, are points of dispute that only time can settle. There is no doubt that the latter cause is largely accountable for the almost total absence of many infectious diseases; such as Pearleaf Blight, and Black-Knot of Plum and Cherry. That the dry climate will not prove a total preventive of such diseases, however, is seen in the presence and spread of Apple Scab, the Powdery Mildew of the Apple, and the Leaf Curl of Peach. A week's trip to Kendrick, Juliaetta, and Lewiston this year has demonstrated this to the writer's satisfaction, for in several orchards these diseases were there well entrenched.

I shall now enumerate the main diseases, both known and unknown to the writer, that have been observed the past year in the state, the localities where found, and the generally accepted treatments for the same, such as fungicides, cutting off diseased parts, or destruction of whole plant. These preventives and cures are given on evidence of others, for my time has heretofore been so entirely taken up with class room duties that no opportunities have been given for any original work. Now that, by the action of the Board of Regents at its last session, I have been relieved of all work save in my own department, I have hopes of accomplishing much more field work in the lines of spraying and original investigation than I have been able to do heretofore. I may preface my remarks by this most peculiar fact, that though the Black-Knot (Plowrightia morbosa), Shot-hole Fungus (Cylindrosporium Padi), and Plum Pockets (Exoascus Pruni), exist in great quantities on their wild host, the choke-cherry, not a single indubitable example of their presence on the *cultivated* trees has

come to the writer's notice. Something which resembles the black-knot has been found on one tree near Lewiston; while a disease on the leaf of the prune, called commonly "Shot-hole Fungus" and found in every county of Idaho where the prune grows, is not this disease at all, and may prove to be a new one. Thus far only "sterile spots" have been found, and until any fructification appears, no definite information can be given of its name and life history. This last remark applies also to a disease on the cultivated grape near Lewiston, about which the writer hopes to gain more information the ensuing year. The comparative absence of the Apple Scab (Fusicladium dendriticum) and Pear-leaf Blight (Entomosporium maculatum) have already been mentioned.

ORCHARD AND GARDEN DISEASES IN IDAHO, AND APPROVED REMEDIES.

Alfalfa.

The leaf-spot (Pseudopeziza Medicaginis) has been seen on this host at Lewiston, Shoshone, Boise, and other localities in the state, but in no case severe enough to cause a loss of the crop. When severe, cut the crop, allow it to dry, and then burn the hay. The roots will not be permanently injured.

Apple.

For several years the writer has been on the lookout for Apple Scab (Fusicladium dendriticum) in Northern Idaho, but the search has been luckily unavailing until the present month, July. From a recent visit paid American Ridge and Juliaetta, it is apparent that this disease is increasing rather alarmingly, and that from being almost unknown in the state it is to be found in almost every orchard in this fine fruit district to a greater or less extent. Its ravages are most extensive in and about Juliaetta, but it is to be found sparingly on American, Pix and Bear Ridges

of the Potlatch district. In some of these orchards it is very rare, occurring only on one or two apples of 20 or 30 trees, and seeming to force the conclusion that it is only just entering in. While noting its presence here, it may be interesting to some to know that not a single example of scab was to be found anywhere about Lewiston. This absence is apparently to be laid to the excessive dryness of the summer atmosphere in this neighborhood, and not to its not having been introduced; for the Lewiston orchards are much older than those of the Potlatch district.

This disease manifests itself in little greenish-black spots on the apple, which are surrounded by narrow, light colored, more or less star-shaped borders, caused by the rupturing of the epidermis as the disease grows and forces itself up just below the "skin" of the apple. It also attacks the leaves, manifesting itself first by lighter green, puckered spots, which in time become dark colored as the spores ripen to float away upon the wind. This disease is highly infectious, for let one of these little spores light upon leaf or apple, and let there be supplied moisture from rain, dew, or fog, when it immediately commences to germinate, pushes its spore-tube into the tissues, and begins a "scab" spot.

The best preventives for apple-scab have by many experiments been proved to be Bordeaux Mixture and Ammonircal Copper Carbonate, the latter applied near the period of ripening to prevent the coloration that comes from ingredients of the former spray. Many, however, use the Bordeaux Mixture entirely, and if the apples when ripe show the Bordeaux upon them, they are dumped for a few minutes into a vat containing vinegar and water. This immediately takes off the coating of Bordeaux, and they can then be put out to dry. This is unnecessary unless the fruit is to be sent at once to market, for it has been proved that the amount of poison left upon an apple after several times spray-

ing is in no case sufficient to injure any one. The sprays should be applied several times, beginning just before the buds open in the spring. Copper sulphate solution can take the place of the Bordeaux for this *first* application with very beneficial results, but its application subsequently will kill the tender leaves. The second spraying should take place just after the flowers have dropped their petals, and it is during this spraying and subsequent ones that Paris Green can be added to the Bordeaux with great benefit, the same spray then serving for an insecticide as well as a fungicide. This is particularly the case where one has to combat the Codlin Moth. For lack of space I refer the reader to many good books and spray calendars which treat of the composition and preparation of Bordeaux Mixture and Ammoniacal Copper Carbonate, and what should be the addition of Paris Green.

In some localities about Kendrick, Juliaetta, and Lewiston, and to a less extent in many places in southern Idaho, the Powdery Mildew (Podosphæra Oxyacanthæ and Sphærotheca Mali) is found. In a few cases the disease is so bad as to cover the young leaves and shoots of many trees in the orchard. Under its influence the leaves curl, dry up, and drop off. The disease is best controlled by spraying with "Cupram" (the ammoniacal solution of copper carbonate), beginning early and making several applications. Of the two mildews, Sphærotheca Mali appears to be the more common.

Blackberry.

Once in Lewiston and once near Boise examples of the Blackberry Rust (Puccinia Peckiana) have been found in its Uredoform, known as Caeoma nitens or C. luminatum. This remarkably noticeable fungus, which covers the lower surface of the leaves with a golden powder, can only be eradicated by the digging up and burning of all infected bushes.

Corn.

A few examples of Smut (Ustilago Maydis) were seen in the southern part of the state. See Bulletin No. 11.

Currant.

In Moscow the Powdery or Gooseberry Mildew (Sphærotheca Mors-uvæ) has spread apparently from the gooseberry bushes to the currants. See treatment under gooseberry.

Gooseberry.

On this host the above mentioned mildew is making itself very obnoxious in and about Moscow, and in many other localities in Latah county. It first appears as a white powder (conidial stage) investing fruit, leaves and young twigs, while later in the season, near the end of June, the dark-brown fruiting or perithecial stage appears; when the berries wither, crack open, and fall off. Almost the entire station crop will be a failure for this reason. This fungus is best treated with some of the copper compounds, or with a solution of ½ oz. potassium sulphide ("liver of sulphur") to one gallon of water. This spray should be applied about every two weeks in the early part of the season, commencing before the buds start in the spring.

Grape.

Though the Powdery Mildew is found on the grape along the Snake River, and is said to have appeared at times about Lewiston, it has not been seen by the writer within the state.

In a few instances about Lewiston has appeared a disease to the vine and leaf which is as yet unknown. "A discoloration sets in and the grapes do not mature." It is hoped that more may be known of this trouble before the close of this growing season.

Oats.

Loose Smut (Ustilago Avenæ) is quite common. See Bulletin No. 11 of this station.

Pea.

In Moscow a few places have been found where the Pea Mildew (Erysiphe Martii) thrives. This fungus is closely allied to that upon the gooseberry, but owing to the smoothness of the leaves and fruit of the pea, it can be best combatted by dusting on sulphur while the dew is still on the plants. No aggravated cases, such as occur in some localities, have been seen.

Peach.

Perhaps the most serious disease of the peach in many localities of the United States is the Fruit Rot, due to a fungus called by botanists Monilia fructigena. It first manifests itself in little yellow or reddish spots, in which the mycelium of the fungus grows rapidly causing a brownish discoloration of the flesh. Gradually the fungus absorbs the juices of the fruit, till as the season advances the "skin" puckers and is drawn tightly over the stone. It attacks peaches, apricots, cherries, plums, apples, and pears, but thus far it has been found by the writer only on the two first named, and only in the vicinity of Juliaetta and Lewiston. Fruits attacked by this disease become "mummies," and are liable to remain on the tree all winter, to scatter the spores as the Spring advances. It may be known by the shriveled skin and flesh adhering to the stone, while on the little crests thus formed an ash-colored or sugary-looking spore mass forms.

The following treatments are recommended. 1. Invariably gather all the "mummies," and thus take away the main cause of infection. 2. Spray well with copper sulphate solution, 1 lb. to 25 gallons, before the buds begin to swell. 3. Follow this by one or two sprays of Bordeaux mixture or copper carbonate before the

buds open. 4. Just before the fruit ripens follow with two or three applications at intervals of 5 to 7 days.

In conclusion I may add that this disease has not become sufficiently injurious to warrant this treatment at present; but it will bear watching, for it may easily become epidemic should the conditions for its rapid spread, such as warmth with moisture, prevail at season of ripening. Though this is the time when its inroads are most easily seen, it attacks the green fruit and even the flowers and young twigs.

Though the mildews (Sphærotheca pannosa and Podosphæra Oxyacanthæ) occur in many localities in the state upon the peach, in no cases within the writer's knowledge could they be pronounced serious. This cannot be said to be the case with the Leaf Curl (Exoascus deformans), for about Lewiston and Juliaetta it threatens to entirely defoliate the trees. The thickening, curling, enlarging and discoloring of the leaves under this pest are too well known to the raiser of peaches to need description. Suffice it to say that this disease forms within the tissues of the leaf, and it is therefore doubtful whether spraying will much relieve the trouble. Efforts will be made next year to find out whether any benefit can be derived from this treatment. Collecting and burning the leaves as the disease appears and before the spores have been formed is apparently the only remedy. Where all of the trees of an orchard are diseased *all over*, as are many about Lewiston, it is probable that recourse to the axe and grubbing-hoe will be found the best means of extirpation.

Pear.

The only disease of any importance attacking the pear in Idaho is the "Fire Blight." This is so called on account of the seared appearance given leaves, stems, and fruit by the fungus, as if the tree had been exposed to a fire. The trouble is one of bacterial origin, and therefore cannot be treated by sprays, as can most of the other diseases. At least it has not been thus far success-

fully treated by them, and the only cure discovered is that of cutting off the diseased limbs and immediately burning them. This is especially necessary when the disease is first seen, for otherwise the bacteria will be conveyed from tree to tree through a whole orchard through the instrumentality of wind, but more especially through bees, flies, and other insects. As the bacteria cannot gain an entrance through the parts covered by bark, they must of necessity enter through wounds due to the pruning knife, stings, or burrows of insects; or else they find a ready avenue for attack through the uncovered stigma of the flower. For this latter reason the blight is more readily found in early spring affecting the flowers, giving rise to the "flower-blight," by the blackening of which the disease can be early noticed and combatted.

To be convinced that this trouble is becoming serious in Latah and Nez Perce counties, one has only to take a day's ride in any direction through the main fruit-belt and observe its presence in almost every large pear orchard. It is probable that altitude and heat have little to do with its advance, for Moscow, American, and Pix Ridges, and Lewiston seem equally afflicted. Some varieties seem much more subject to its attacks than others, but as this matter has not received sufficient attention, it will be reserved for some future bulletin.

Potato.

Potato scab (Oospora scabies) is the only disease to this crop thus far seen. To prevent this by no means common disease in Idaho, the following suggestions have been offered, based in great measure upon experiment. Avoid replanting in ground where scabby potatoes have grown the previous years; use only clean fertilizers and well-rotted manure; soak the tubers just before planting one hour or an hour and a half in a solution of corrosive sublimate, one ounce of the poison to 8 or 9 gallons of water; or roll the potatoes before planting in sulphur.

Rose.

The Rose Mildew (Sphærotheca pannosa) is quite common on cultivated roses, especially those growing in moist or shaded localities. It curls the leaves and dwarfs the shoots, impairing the vitality of the plant. Sulphur dusted upon the plants or blown on with bellows is very efficacious.

Strawberry.

There are two diseases due to fungi found upon this host in Idaho, though neither of them have thus far proved very serious.

Of these the first is the Leaf Spot or Sun Scald (Sphærella Fragariæ), appearing as little purple spots, changing as the season advances into a reddish-brown color, and finally the center becoming a light brown as the tissue dies. These spots are ordinarily about an eighth of an inch in diameter, and are occasionally so numerous as to derange the functions of the leaf, causing it to be of no physiological value. This fungus has been successfully combatted by spraying with Bordeaux mixture, but more especially by mowing the leaves, after the crop has been gathered, and burning them.

The second disease is the Mildew (Sphærotheca Castagnei), which attacks the leaves and stems, but more especially the fruit, forming a light white growth (mycelium) in spots over the whole plant and resembling cobweb. Some varieties are much more subject to its attacks than others. In the station patch the Sharpless and Shuckless are the worst affected at this writing. The remedies most commonly advocated for this disease are, spraying with copper fungicides in the early season, or scattering sulphur upon and amongst the plants.

Any experiments of this nature on the station plots this year would have been to no avail unless a powerful insecticide, such as Paris Green had been added to the spray, for the strawberries have been so badly infested by the Leaf-Roller (Phoxopteris) as to destroy fully ½ or ⅔ of the foliage.

Tomato.

The most serious disease of the tomato in Southern Idaho is as yet unknown to the writer. It is probably a bacterial one, as the characteristics of the "blight" seem to point in that direction. No fresh specimens have been sent to the station, and therefore no diagnosis has been taken; but it is to be hoped that material will be forwarded soon that may lead to its identification. What may be the effect of too much alkali in the soil, or too much or too little water given the plant, are also problems that are likewise unknown. Planting seed known to come from healthy plants, and avoidance of replanting in the same spots, may assist in lessening the trouble.

The raising of tomatoes on the high-lands of the Palouse country, and away from the warm, low lands of the Snake, Clearwater, and Potlatch rivers, is always precarious. The cold nights, the presence of frosts almost every month in the year, and the lateness of the season, render tomato culture, save for pickling, a failure four years out of five. It is the rarest thing that tomatoes have ever ripened well on our station. And yet the same attention is needed to raise good "pickle-sizes" as to raise the ripe vegetable. Therefore attention should be directed to combatting the "Black-rot" or "Black-end," a disease which is very common about our station as well as in most localities in North Idaho. Spraying with Bordeaux mixture and raising the tomatoes off the ground by means of trellises would undoubtedly assist greatly in the prevention of this disease or combination of diseases.

Wheat, Oats, and Grasses.

I shall place these together, for much the same diseases attack them all. For the Smuts and Rusts of grains, see Bulletin No. 11 of this station. The only other fungous diseases of a serious nature seem so far to be limited to the wild grasses. Of these the

Giant Wild Rye (Elymus condensatus) is very subject to the Ergot (Claviceps purpurea); while the Brome Grasses (Bromus mollis and B. Hookerianus) meet their foes in the Mildew (Erysiphe graminis), which is especially bad this year in this locality, and in the Smut (Ustilago bromivora). As the first two grasses are only eaten by stock when there is little other forage, any damage resulting from these three diseases is probably very slight.

In conclusion let me add that study along these lines will be prosecuted during the present summer and the succeeding spring and summer, and it is hoped more valuable results obtained. The completion of the Northern Pacific line down to Lewiston during the present growing season will be no slight adjunct in in this work, as it will allow the writer and other station workers to visit different altitudes, and consequently different crops, throughout the year, without neglecting their classroom duties.

During the year several hundred plants have been added to the herbarium from collections made last summer and the present spring, especially in the line of fungus diseases on cultivated and wild plants. No exchanges have been effected this year through this mass of duplicate material now on hand, owing to lack of time. This subject also will receive more attention the ensuing year.

Considerable additions have been made to the department during this time in the way of dissecting microscopes, books, drawing boards for use with camera lucida, mounting material, microtomes, and all the numerous apparatus needed in a well-equipped botanical laboratory.

Respectfully submitted,

L. F. HENDERSON,

Botanist.

REPORT OF THE DEPARTMENT OF CHEMISTRY.

PRESIDENT F. B. GAULT,

Director of the Experiment Station.

SIR:—The work of the Department of Chemistry for the fiscal year ending June 30th, does not differ materially from that indicated in my former reports. No strictly new work has been undertaken but plans and analyses already under way have been modified to meet new conditions.

Owing to the limited assistance afforded the department, nearly all of the analytical work of the station was performed during the summer vacation or early fall, when the scholastic work of the department was light.

The past summer, the analysis of a carefully selected series of soils was made, collected from the University farm. In all, 25 samples were taken and submitted to a thorough chemical and mechanical analysis, the Department of Physics making the latter. The land having recently come into possession of the University, it was thought best to make such analyses, to indicate the results of special cultivation and fertilization of the soil as may be shown by future treatment. The present analyses will not be published.

A large number of varieties of peas, grown by the Station, as they came into maturity for table use, was analyzed. Only the sugar content was determined, but results most interesting were obtained. The study of the sugar content of strawberries and other local fruits as they matured, together with those obtained in the local markets, begun in 1896, was repeated and continued last summer. Much of this work was new, there being no record

of similar analyses available, at all reliable, for this Northwest. The variety and quantity of the work accomplished during the year is indicated below:

Strawberries	36.
Peaches, cherries, currants, etc	23.
Sugar beets	41.
Soils	31.
Drinking water	10.
Mineral water	2.
Ash of native timber	5.
Paris green	3.
London purple	1.
Washing fluid	1.
Ochre	4.
Coal	3.
Phosphate rock	1.
Silver spoons	1.
Vinegar	2.
Black pepper	1.
Tea	1.
Table oil	1.
Sunflower seed	1.
Cream Tartar	2.
Breakfast food	1.
Miscellaneous (partial analysis only)	10.
Total	181.

The above analyses represent about 1250 separate determinations.

A sample of so-called "solid silver spoons," sold upon our streets and eagerly purchased by the unsuspecting public, proved on examination to contain 97.56 per cent. of iron and 2.18 per

cent. of tin. In many other ways the department has exposed fraud and adulteration in articles consumed by our citizens.

In addition to the above, a report was prepared to the government covering the sugar beet experiments for 1897; also a paper before the State Horticultural Society.

The transfer of the Sugar beet experiments, for 1898, to this department, in order to more thoroughly co-operate with the department at Washington, D. C., necessitated a reorganization of our methods, the formulating of new plans, entailing a larger amount of correspondence. The prospective results are most encouraging. During March and April, 400 pounds of sugar beet seed, largely furnished by the government, were distributed to 63 farmers who are growing beets under contract and according to directions sent out from this department. The experiments cover 27.25 acres. This is exclusive of two acres grown upon the University farm to test the results of different methods of cultivation.

The publications of the department include three Press bulletins covering four pages each,—No. 9, "Sugar Beets in Idaho, 1893-1897;" No. 10, "Directions for Sugar Beet Culture;" No. 11, "Insects affecting Sugar Beets." There is now going through the press a regular bulletin, No. 12, on "Sugar Beets in Idaho," intended for general distribution. Another on "Miscellaneous Analyses," is in preparation. Some co-operative work has been done for the other departments of the Station.

The work immediately in hand and which will occupy the time of the division next year is the examination of cattle foods; native and cultivated grasses of which we have made quite a collection; sugar beets; the continuation of the soil survey of the state; the analysis of various other products that may be sent to us for examination; and the preparation of a bulletin on "Sugar Beets in 1898," and on "Stock Foods," already assigned.

The crowded condition of the department from the scholastic side has necessitated the removal of the Station laboratory to the

annex where very complete and convenient quarters have been fitted up and provided with excellent facilities for analytical work. An assistant chemist, Mr. Thorn Smith, B. Sc., formerly first assistant chemist of the Michigan Station, has been engaged to do the analytical work and assist in instruction in dairy, agricultural, and domestic chemistry.

In closing this report, I desire to express my personal obligations to you for the uniform courtesy and support always extended the department and the hearty interest and approval manifested in the practical results obtained, both from the scholastic and experimental side.

Respectfully submitted,
CHAS. W. MCCURDY,
Chemist.

REPORT OF THE DEPARTMENT OF ENTOMOLOGY.

To The Director:

I beg to submit the following report of the work of my department for the fiscal year ending June 30, 1898.

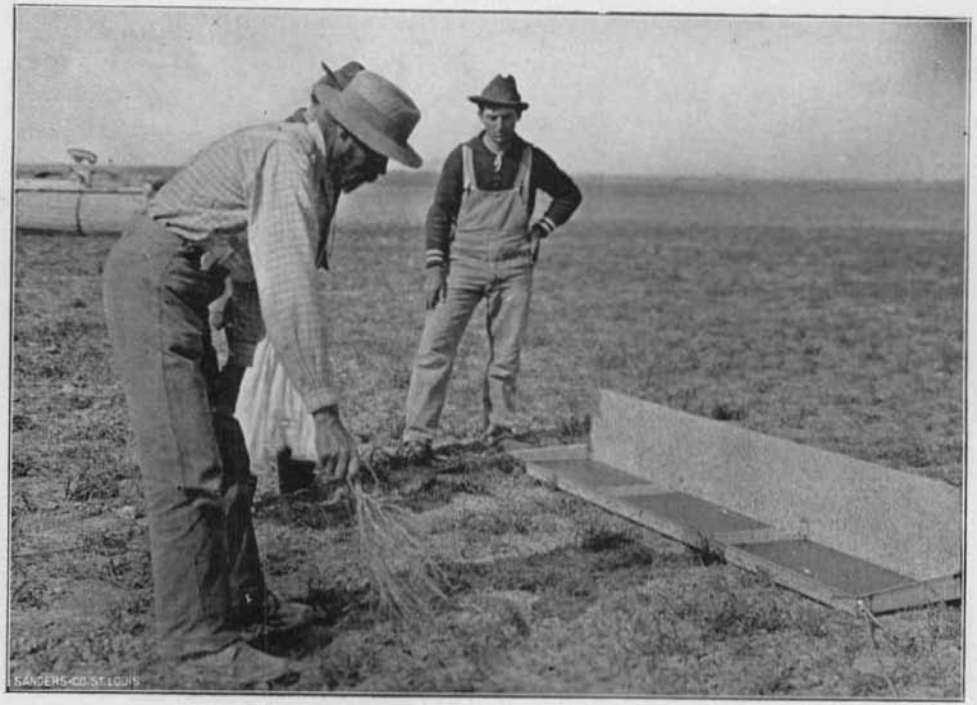
During the entire growing season of 1897 after the opening of the fiscal year I was absent on leave. In 1898 the work of my station department began with the opening of spring, and occupied my entire time after May 19. Investigations at Lewiston occupied May 20-28, and at Juliaetta May 30-31. At this time the Secretary of Agriculture requested the Director to send me to Market Lake to investigate complaints of a grasshopper outbreak there. This was done and I spent June 4-8 at the place. A report on the conditions existing at Market Lake is given below. The remainder of June was spent in field work in South Idaho at the following places: Idaho Falls, June 9; Blackfoot, June 9-11 and 24; Pocatello, June 12 and 23; Soda Springs, June 13; Montpelier, June 14; Paris, June 15; Fish Haven, June 16 and 17; Minidoka, June 25; Albion. June 25-27; Hailey, June 28-30. The remainder of the trip extended into the next fiscal year. Many observatious were made on the injurious insects of the the state, collections were obtained and numerous photographs taken. Of the material accumulated at this time and previously, part can be prepared for a bulletin this fall while much of it will require supplementing by further study and observation. I have embodied in this report the results of several miscellaneous investigations.

Grasshopper Investigation.

During the summer ot 1897, grasshoppers were somewhat troublesome and destructive in the immediate vicinity of Market Lake, Fremont County. In May of this year the people of the town became alarmed by the large numbers of the insect that were hatching, and appealed to the Secretary of Agriculture, at whose request I was sent by the Director to investigate the outbreak and see what could be done. Arriving June 4, I was assisted by residents of the town, especially Messrs. Mart Patrie and Samuel Hart, to examine the infested localities. These were two in number: one three miles south of town, where the young grasshoppers were hatching in favorable spots over an area of some 80 acres; the other northwest of town about five miles in the northwest part of the old lake bed (now dry and used for hay land), having an area somewhat larger, perhaps 120 acres. At this time the insects were very small and about a fifth of the eggs were still unhatched. While they were pretty numerous, they did not at all cover the surface of the ground except rarely in small spots. They had not as yet moved far in any direction from the place of hatching. They were found chiefly in areas slightly too low and presumably too moist for sagebrush to grow. On account of the smallness of the specimens I did not at the time ascertain the species to which they belong, but I am informed by Mr. W. D. Hunter, the government agent, who saw them later when they were full grown, that it is the species referred to in the government publications as the "Pellucid-winged Locust"—*Camnula pellucida* Scudder.

The method chiefly depended on at Market Lake to destroy them has been to drive them together by partially flooding the land with water from the irrigating ditches, then to throw on straw, and in the cool part of the day to burn it. Where the land is level and under ditch this is without doubt an efficient and inexpensive means of destroying them, at least while young. It

Plate I.



COLLECTING YOUNG GRASSHOPPERS WITH "HOPPER-DOZER."

is not necessary that the water be put on until it stands on the surface; merely wetting the soil drives them to drier quarters. While small they will not cross even a narrow ditch containing water, and complete protection in the early part of the season is secured by encircling a field with such a ditch, unless eggs have been laid in the field.

In the present case water could not be applied to all the infested land, and not much straw was to be had, so it seemed advisable to try the "hopper dozer," and I had one made, which we tried June 7. This was constructed on the general plan recommended by Dr. Riley (Div. of Entomology, Bulletin 25, pp. 45-48.) As there are frequent occasions in this state when such a machine could be used to good advantage, I give an illustration of it and add the dimensions here: Length 7½ feet; width, 15 inches; height in front, 2 inches; at ends, 3 inches, at back, about 13 inches. It requires when made of this size the whole of one of the commercial sheets of galvanized iron, which measure 8 feet by 30 inches. For use with larger hoppers a width of 20 inches would be preferable, in which case a light cloth frame 2 feet high should be fastened upright at the back of the pan to prevent the insects from jumping over.

The ordinary method of using this machine is to put in an inch of water, add a quart or so of coal oil, and draw it along by ropes attached to the ends. It was speedily found at Market Lake that this method was entirely ineffective, as the hoppers were so small that very few would jump high enough to get into the pan. Another plan was therefore adopted, which was to draw the "dozer" up to a spot where the young hoppers were abundant and then drive or "shoo" them up to it. In this way they jumped in very rapidly, and the machine was quite successful. Plate I shows the process, but owing to the small size of the insects they are not seen except where they are floating in

the oil. From our experiments it seemed that two persons with this machine could destroy a bushel of these little hoppers in an hour. Scarcely more than a third of these would remain in the pan, but of those that jumped out, abundant observation proved that not one made more than six or eight jumps till death overtook him.

This experiment was conducted in a wheat field lying just south of the hatching ground first mentioned. The young hoppers invaded the field before water could be brought in ditches to keep them out, and by June 7 nearly half the thirty acre field was eaten bare. It was the only place up to this time where any material damage had been done.

I am informed by the government agent, Mr. Hunter, that the hoppers, now mature, have done considerable injury and are depositing eggs in the same locality, which makes the outlook rather unfavorable. In sparsely-settled communities, where no outside aid in the way of bounty for collecting, etc., can be offered, the suppression of a grasshopper outbreak is a serious and difficult matter. There is no easy way to accomplish it. It is not surprising, therefore, that in such places the people show a marked inclination to await the arrival of that mysterious old divinity, Natural Causes, who always takes charge of things when he gets ready and does away with the trouble.

The Box Elder Bug.

This insect, shown in fig. 1, is a blackish bug with narrow bright red markings on the back. While it lives mainly on the box-elder, it does not seem to have much effect upon the vitality of the tree and would not deserve notice did it not have other more objectionable habits. These are two—hibernating in houses, where it remains active all winter, crawling upon the occupants and making itself a general nuisance; and, second,

puncturing growing fruit in summer to extract the juice, which causes the attacked specimens of fruit to become distorted and unsalable.

The bug winters only in the adult or mature form, which is shown in the figure. According to recent observations made in this department, the pairing of this species begins about April 17. One week later the first eggs were found, on April 24. The eggs are red, oval in shape, with one end distinctly turned up and flattened. They are attached by the side, singly or from two to five together, to the bark of the box-elder. Several were also found on the dry, last-year leaves of the strawberry at a distance of 50 yards from the box-elder grove. It is doubtful, however, if the young can mature on any other food than box-elder sap. The period of egg-laying and hatching is quite prolonged. The first young to hatch were found May 12. The newly hatched specimens are bright red in color, quite flat, with a much shorter and broader outline than that of the adult. They continue quite red until they reach full size, when the dark wing-covers make them appear more blackish.

FIGURE 1.

At Lewiston the first hatching is much earlier, as specimens already mature were found on May 24. In all parts of the state there is a succession of broods all summer, the exact number not being determined as yet.

At the University we have had a special opportunity to study this bug as a pest indoors. A fine grove of box-elders some five years old stood about 100 yards from the main University buildidg. Large numbers of the bugs would always be found in winter about the outside of the lower windows, especially on the side

next the grove. On days of moderate warmth, even in mid-winter, the insects began to crawl about. It seems extremely appropriate that the Zoological Department was most accessible of all to them, and they gave it their principal attention. From October to April they were never absent from recitation and I regret to confess that on many occasions they contributed the most interesting part. By a liberal use of insect powder (pyrethum) about the windows it was possible to keep them somewhat reduced in numbers, and to some the powder was less objectionable than the bug. A great advantage was gained by having the janitor go out early in the forenoon before they had become active and gather them from about the windows with a brush and dust-pan, and burn them. This was on the suggestion of the Director. On account of the bugs and for other weighty reasons, the grove was removed this spring, and we shall doubtless have no more trouble.

The damage this insect does to fruit is by puncturing it with its sharp proboscis for the purpose of extracting the juice, as has been above stated. This is done, it would seem, only by the larger, and perhaps only by the mature bugs. It is never done to amount to anything except within a few hundred yards of a box-elder grove. There are undoubtedly a number of causes which produce deformity and irregularity in fruit, but a considerable per cent. will be found to be due to this insect wherever it is present.

The box-elder bug is not an easy insect to kill with any kind of insecticide. Moreover it would be a laborious operation to spray not only the orchard but the box-elder grove too. It seems in most cases far preferable to eradicate the box-elder and be saved any further trouble. I recommend this drastic measure, however, for those cases only where the bug shows itself to be decidedly hurtful. Many groves of box-elder are comparatively free from it.

Kerosene Against Mosquitoes.

In September, 1892, Dr. Howard published in Insect Life (v. 12-14) an account of an experiment made by him in the use of kerosene against mosquitoes, by pouring the liquid on the surface of pools of water containing larvae or "wigglers."

The success of this method depends upon the spreading of the oil to make a film over the surface of the water, and upon the structure and habits of the larvæ, which are obliged at frequent intervals to come to the surface and take fresh air for respiration. This air is taken in through a small tube at the posterior end of the body, having at its extremity a circle of minute hairs which spread apart on the surface and prevent the water from entering. Oil on the surface, being much more penetrating, enters the air-tube and suffocates the insect, if it does not indeed act as an internal poison.

Professor H. E. Weed of the Mississippi Experiment Station reported (Ins. Life, VII, 212, 213) a somewhat similar experiment, where kerosene was poured into certain large tanks of water on the station grounds. The success of both experiments was quite marked, although the surface to be covered by the oil was only small in each case, and it has been generally conceded that on large areas the method would be of less certain value.

At Market Lake in early June I found conditions such as to admit of a trial of the remedy on a large scale. The Snake river immediately east of this town forms large expansions with little or no current, some of which are almost large enough to be termed lakes. These are great breeding places for mosquitoes, which become so numerous toward midsummer that people living south as far as Blackfoot and Idaho Falls assert most positively that every south bound freight train brings them a host of Market Lake mosquitoes. At the time of the experiment, June 8, there were a great number of larvae in the shallow margins of the

sloughs. The real point at issue was to determine whether the kerosene method could be successfully and economically applied in this particular place to do away with the mosquito plague, and also to determine if possible how large a pond could be successfully treated. Operations were commenced by experimenting with a common tomato can. Dipping it up half full of water, about 30 larvæ were obtained. Two drops of kerosene were then added. In a few minutes the wigglers showed uneasiness and were several times seen to twist about and bite at the air-tube; however, after half an hour none were dead nor apparently injured. Two more drops of oil were then added and ten minutes later all were lying dead at the bottom but two, which were making some weak movements.

A shallow pond some forty feet wide and five hundred feet long where the rise of the river had overflowed a meadow, was then selected for further experiment.

In the bottom of a clean can a small hole was made, large enough to deliver oil in a very small stream, scarcely more than a rapid succession of drops. This was used tied on a stick so as to scatter oil about a foot from the bank, the carrier walking at a slow pace. The film was quickly seen to spread 20 feet and more. Examination in three quarters of an hour showed that the film had become almost imperceptibly thin and that no aquatic insects showed any effect from it. The same experiment was repeated in a new place, after enlarging the hole in the can so that fully twice as much oil would pass through. The result was the same as at first. Then a quantity, estimated at two tablespoonsful, was poured in every three feet along the shore. Many water beetles were killed by this, and those not immediately killed were unable to descend and floated helplessly on the surface, usually on their backs. After an hour an examination along several feet of the shore line showed but one dead "wiggler."

The conclusion from this experiment is that kerosene to be effective against mosquito larvæ must cover the surface to a perceptible depth, a mere film will not answer. As the usual market price of the oil in small quantities throughout Idaho is thirty to thirty-five cents a gallon, the cost will be prohibitive except in thickly settled communities and on small bodies of water, where the remedy will doubtless be of marked usefulness.

An interesting scientific question opened by the experiment is whether the larvæ of different kinds of mosquitoes (there are several kinds in the United States) do not differ from each other in the structure of the air-tube, so that some are killed by a thinner layer of oil than others. The larvæ at Market Lake are certainly harder to kill than one would expect from the reports of experiments above cited. No studies to settle this question have yet been made.

Putnam's Scale.

This insect is a near relative of the San Jose scale, and is referred to here mainly for the purpose of indicating the differences. A bulletin on the San Jose scale is in preparation and will be published sometime this fall.

Until the publication by the government last year of Prof. Cockerell's special bulletin on the subject, most entomologists were unable to distinguish the true San Jose scale from one or two of its nearest allies that are much less hurtful. Now, however, the matter is greatly simplified. In our state, so far as known, only one of these allied forms occurs, Putnam's scale (*Aspidiotus ancylus* Putnam). This is occasionally found in the lower altitudes along with the San Jose, but it has a much wider range in altitude, having been found this summer at Blackfoot and Malad City, whre the elevation is nearly 5,000 feeet, while the other species does not exist in Idaho above 2,700 feet at the highest. Putnam's scale is usually found on poplar, quaking asp

and similar shade trees, but also more rarely on pear, apple, etc. It does not unless very rarely become at all numerous, so as to form a crust on the branches. Comparing the scales themselves, Putnam's shows three principal differences:

1. It is considerably darker in color.

2. The highest part (exuvia) is not in the center, but quite noticeably nearer one side.

3. The exuvia is dark orange red in color, instead of lemon yellow.

As this insect is not more than a tenth as injurious as the San Jose scale, and will ultimately be quite widely spread in our state if it is not already, the importance of a wide publication of these differences will be readily seen.

Respectfully submitted,

J. M. ALDRICH,

Entomologist.

FINANCIAL STATEMENT.

1897.

The Agricultural Experiment Station of the University of Idaho in account with the United States Appropriation.

RECEIPTS.

To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1897, as per Act of Congress approved March 2, 1887		$15000 00

DISBURSEMENTS.

By Salaries, per Abstract	1	$5347 66
By Labor, per Abstract	2	2835 28
By Publications, per Abstract	3	208 83
By Postage and Stationery, per Abstract	4	220 44
By Freight and Express, per Abstract	5	674 34
By Heat, Light and Water, per Abstract	6	540 48
By Chemical Supplies, per Abstract	7	62 59
By Seeds, Plants and Sundry Supplies	8	286 62
By Fertilizers, per Abstract	9	20 00
By Feeding Stuffs, per Abstract	10	141 11
By Library, per Abstract	11	905 35
By Tools, Implements and Machinery, per Abstract	12	1326 15
By Furniture and Fixtures, per Abstract	13	113 43
By Scientific Apparatus, per Abstract	14	1259 02
By Live Stock, per Abstract	15	100 00
By Traveling Expenses, per Abstract	16	174 85
By Contingent Expenses, per Abstract	17	34 00
By Buildings and Repairs, per Abstract	18	750 00
Total		$15000 19

AUDITORS' CERTIFICATE.

We the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Agricultural Experiment Station of the University of Idaho, for the fiscal year ending June 30, 1897; that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000, and the corresponding disbursements $15,000, for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving no amount unexpended.

And we further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 2, 1887.

SIGNED:

J. H. FORNEY,
Pres. Board of Regents.
F. E. CORNWALL,
Sec. Board of Regents.
WARREN TRUITT.
} Auditors.

(Seal of Institution.)

ATTEST:

W. L. PAYNE,
Treas. Board of Regents.

1898.

RECEIPTS.

To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1898, as per Act of Congress approved March 2, 1887		$15000 00

DISBURSEMENTS.

By Salaries, per Abstract	1	$5159 49
By Labor, per Abstract	2	4617 16
By Publications, per Abstract.	3	806 25
By Postage and Stationery, per Abstract	4	323 80
By Freight and Express, per Abstract	5	477 31
By Heat, Light and Water, per Abstract	6	393 92

By Chemical Supplies, per Abstract	7	88 32
By Seeds, Plants and Sundry Supplies	8	872 74
By Fertilizers, per Abstract	9	
By Feeding Stuffs, per Abstract	10	205 98
By Library, per Abstract	11	67 52
By Tools, Implements and Machinery, per Abstract	12	283 93
By Furniture and Fixtures, per Abstract	13	26 00
By Scientific Apparatus, per Abstract	14	119 05
By Live Stock, per Abstract	15	
By Traveling Expenses, per Abstract	16	426 40
By Contingent Expenses, per Abstract	17	382 13
By Buildings and Repairs, per Abstract	18	750 00
Total		$15000 00

AUDITORS' CERTIFICATE.

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Agricultural Experiment Station of the University of Idaho, for the fiscal year ending June 30, 1898; that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000, and the corresponding disbursements $15,000, for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving no amount unexpended.

And we further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 2, 1887.

SIGNED:

J. H. FORNEY,
Pres. Board of Regents.
F. E. CORNWALL,
Sec. Board of Regents.
WARREN TRUITT.
} Auditors.

(Seal of Institution.)

ATTEST:

W. L. PAYNE,
Treas. Board of Regents.

SUPPLEMENTAL STATEMENT.

Credits from sales and sundry incem, 1896, '97, '98		$1669 94
Expended in Buildings, 1898	$1268 06	
Applied to Salaries	395 83	
Balance	6 05	
	$1669 94	

Abstract of Inventory.

IDAHO EXPERIMENT STATION.

July 20, 1898.

Office Furniture, Files, Records in office of Director	$ 300 00
Property of Chemical Department	1310 00
Property of Botanical Department	274 02
Property of Entomological Department	321 45
Property of Physical Department	987 24
Property of Agricultural and Horticultural Departm'ts	3156 09
Greenhouse and Horticultural Building	2500 00
Barns, Sheds	1000 00
Farm and Improvements	5000 00
Building Material on hand	99 91
Total	$14,948 71