Studies for a Horticultural Building and Greenhouse.

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A. Necessity for College to have one.
   1. General need of such illustrative laboratories.
   2. Present greenhouse very inadequate; lack of funds prevented institution from building a better one; very much out of repair.

B. College should have a large and well arranged Horticultural Building. Complete in every respect; Horticulture is very important.

C. New structure should not be built in cramped position of old one. Should be built where all experiment plots will be near.

D. Slightly location can be found west of Main Hall near present botanical gardens. Here all sun features are favorable, giving south, east and west exposure.

E. No separate heating plant necessary.

F. Building should be connected with Greenhouse and Palm House.

G. Have adopted form of large square.

H. Description of structure.
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The horticultural course has for its object a method of instruction and practice as will enable the student to become acquainted with the general principles of plant culture and the application of these principles. The work is planned to give them such knowledge as will help to increase the comforts, beauties and profits of life on the farms. This course has to deal with the principles of Horticulture, Vegetable Gardening, Advanced Horticulture, Floriculture, Industrial Horticulture and several others.

In view of the fact that we have one of the largest agricultural institutions in the United States, if not in the world and perhaps soon to be the best and most widely known of any of its kind, we are in very great need of a new horticultural building with the necessary greenhouses, and have decided to write up for "Studies for a Horticultural Building as my thesis.

In looking over the various stations reports as collected by the Messrs. True and Clark of the
Agricultural Experiment Station of various states and territories, I find that we have a very poorly equipped building and greenhouses.

The way things are now we have not the room and accommodations for hardly one-fourth of the students that are required to take horticulture. The buildings for this department consist of a horticultural hall which is only a one story building 32 x 50 feet with a cellar, having museum, classroom and storage room with two small greenhouses attached, while the building only cost $4,200 with a total value of equipment and apparatus of only $18,879. The laboratory contains two offices, a work room and five propagating houses which are very inadequate, also having an incubator. The laboratory was built with a cost of $4,000.

Our buildings cannot be compared with those of other states. The Iowa and Illinois horticultural buildings are very well equipped, the latter having a building consisting of one hundred thirteen class rooms. Colorado also has very fine and well arranged buildings, the laboratory being built at a cost of $15,000, and is 52 x 64 feet, two stories and an attic. The California buildings is a structure 87 x 170 feet which is built of iron and glass with fine green-
houses costing over $18,000.

The Kansas State Agricultural College is in great need of a new horticultural building and greenhouses in which the one we have at present is very inadequate. We have practically no laboratory at all, we have but one class room, and this with the museum does not amount to as much floor space as a well equipped common school should have for their use. Why is this so? The building was erected when the college was small and are now very inadequate. People are beginning to see that we are in need of more and better methods for giving us the necessary knowledge concerning the best methods for raising and caring for the various flowers, vegetables, and fruits, at the least expense with the best results. In order to discover the best methods and always of obtaining these results we must have a large and well equipped building with large class rooms, laboratories, work rooms, libraries, and offices, all filled up with the necessary instruments.

These laboratories must have the very best and latest improved apparatus. The class rooms for the students are altogether too small. In a large institu
im of this kind we are in great need of
more room. If we are to give the student
the best results from his studies must
not have to feel that he has not the
proper instruments to do this. Our
Agricultural Building compare with the
same buildings of some of the other state
are as our carpenter shop compared
with the Sash and Door factories of
Topeka or Kansas City or to be lie ago. If we
are to maintain the name we have,
that we rank among the very first
as being one of the largest and best equip
Agricultural College in the world
we must have a new horticultural
building.

Our present greenhouse would not
be fit for a greenhouse in a little county
town of four or five hundred inhabitants.
In the first place it was inadequate. To
begin with it was not properly built.
This was partly due to a lack of funds.
People did not seem to think that horti-
culture would ever be what it is today
and that we would have near the num-
ber of students at our college that we
have at present, and probably that that
the present building was not large at that
time for a college.
The present greenhouses are very much
out of repair and are unfit for use in such an institution as this, the timbers being rotten and all parts very much decayed, while quite a good deal of the mica parts are very badly rusted and in fact it would be safe to say that they are about ready to be replaced by new ones, and these new ones should be of the steel kind and with all modern improvements so there will be no thought as to their decay. The rusting can be over come by giving them a thorough painting and a new coat of paint every year or so; and it will be found that they are cheapest in the long run, the first cost is greater than that of one built of wood. Then again, the large wooden nash bars are replaced by small iron ones thus obstructing so much light and are not as strong. Some say that the iron bars and other metal parts of houses are affected by heat and cold but this, to a great extent can be overcome by painting with a certain kind of paint which does away with this to a great extent.

It is safe to predict that the present green houses will not last more than three or four years at the outside. If they are repaired they would last but a few years longer and the repairs would cost more than the value of the buildings at
the smallest cost, and while the cost of repairing would be so great it would be
more profitable in the long, run to build new buildings, thus putting the repair
money to better use and enabling us to
have adequate room and other conveniences.

The College should have a large and
modern agricultural building, one
that is complete in every respect as re-
garding the amount of classroom, labor-
atory, work-rooms, offices, with the

proper museum and libraries, togeth-
er with modern and up to date instru-
ments to use.

When the new building is erected it
should not be built in a craggy position
as the old one was, nor in a position where
the experimental plots are far away as
some are at present, so that the plots
cannot be under immediate vision
of the buildings, as they are at present.
The plots should represent the various
slopes, that are required for the different
kinds of fruits and also, that they are
the easiest gotten at when the time came
for harvesting the crop. The plots used
especially for experiments should be so
arranged, that they are the nearest, as
they are the ones that are to receive the
most attention.

With regard to location, I think the
most favorable position is on the northeastern
of the Main Hall, or near where the present
botanical gardens are now situated. This
slopes, and also has every good protection.
In this ground we have the south-east
and southwest slopes for exposure also
at the south part of the field we have
a slight north slope, thus presenting
a very favorable location for a new build
Another item which seems to be
quite in favor if ever we should have the
benefit of a new horticulture building
and greenhouses is that we will not
have to have a separate heating plant
as the ground is so situated that there
is proper drainage back to the present
plant. This is quite an item and will
cut down the cost to a noticeable degree
as when it comes to putting in new
boilers and heating apparatus it is quite
an expense in itself and as this factor
already have we do not have to let that
part stand in the way and the amount
of money that would have to be used for
that purpose can be used in making a
better equipped building.

Altho' the horticultural building could
be separate from the greenhouses, I think it is best to have them connected also the greenhouses with the palm house, thus making a compact and handsome building wherein everything is handy, and can be looked after in very much better shape.

The plan I have adopted leaves an open space in the middle, that is of considerable size which could be constructed into a small basin in which there could be put some aquatic plants where they could be easily studied. By this arrangement they could easily be protected. The wind and other disturbing elements could not harm them.

I have chosen for a desirable plan the four of a large square with two rows of greenhouses running south from the horticultural building and then a palm house running across the south and parallel to the horticulture building thus forming a very nearly a neat little square, in which may be built a basin thus improving this space also the building.

As to the construction and use of greenhouses there is much to say but I don't think it important enough to take up space here. In the past fifteen twenty
years not only has there been a marked change in the methods of building green
houses but there has been a great increase in their use. This increase has been
quite large in the neighborhood of large cities but there has been a greater amount
of building in the vicinity of small towns and cities even in the sections remote
from settled communities, improved means of transportation making it possible
for growers of flowers and fruits to locate where they can secure land and
fuel at the lowest expense and from which points the products are often shipped
hundreds of miles. As we have an
ideal locality and as I said before are
in need of a new building I think
we should have one that is thoroughly up
to date in every way and am going to give
some of my thoughts concerning the same.
In some places greenhouses are profitable
for the farmer in that they may
use them in connection with his other
work tending to them in the part of the
year he is not busy with this other work
thus having profitable work two years round.
In many states there have been
many very extensive ranges of greenhouses.
and horticultural buildings erected which are used for the production of vegetables and cut flowers during the winter months. As the owners become specialists they not only find the work remunerative but are able to occupy the portion of the year which is not required for their other work.

For such purposes a form of house best suited is the even span, this should not be less than twenty feet if it is to be a single house but if several are to be together they may be narrower in width and of any desired length. If several houses are erected they may be placed side by side with division walls in common but for most crops the extra expense will be more than repaid by the benefit that will be derived when the houses are placed far enough apart to prevent shading of the house by its neighbor as well as from light and even ventilation that can be secured through the side walls. For roses, however, the three-quarter span roof is generally preferred while cucumbers where a slight slope to the south can be secured a wide side hill house will be found adapted to the growing of vegetables, cabbages, violets, etc., and it will in addition be comparatively cheap construction.
While the modern iron frame construction is in many ways desirable and will often in the long run prove more economical, it necessitates just cost will prevent it from being commonly adopted for ordinary greenhouse purposes.

The iron frame house may be carried up on a brick foundation and posts may be set in the ground to which the side posts can be attached. Iron rafters are placed every six or seven feet and are placed cantilevering the iron plate holder and a ridge upon which the rafters rest. With this frame construction much lighter side boards can be used than in wooden houses as nearly all the strain and weight of the rafters is frame by the iron iron posts and rafters.

The house will also be much more durable as the portions that are most likely to decay in a wood construction have been replaced by iron thus making a much more desirable building. Wooden frame houses are used posts of Cedar or Cypress should be set at intervals of from to six feet. The height will depend somewhat upon the height of vegetation to be grown and whether this is in or near glass side walls.
four feet will be ample while in places where latticed frames one half a line will be too narrow. The walls can be formed of short and a block siding with a tolerable thickness of building paper between. If ventilating sash are to be placed in the side walls there should be a small sill arranged for them to close upon, various forms of glazing may be used if they should be so arranged that they will provide a firm bearing for the sash bars, and for the running off of the water upon the inside as well as on the outside of the house. In wood framed houses rafters are now seldom used, the usual plan being to depend entirely upon sash bars, which rest upon one or more lines of gut or pipe or similar purpuse. The usual size of the sash bars is about an and quarter inches to two and a half, and drip gutters in the sash bars are desirable.

One and sometimes two continuous lines of ventilators at the ridge should be provided and connected with slanting so that a line fifty or one hundred feet in length may be covered with one machine. It should be noted wide a single row of ventilator sash is used, it should vary from twenty-four to thirty inches. For most purposes it is desirable to use glass at least 14 X 18 inches and if roses are to be grown 16 X 24 inches would be much better. The sitting the glass
A good grade of putty or mastic is used under the panes. If it is to be lapped it is held in place by means of glass points or trade. In many places, however, butted glass is preferred. The size generally being 16 x 16. The square form is desirable, as it prevents the turning view between them. When the glass is butted it is customary to use wooden crape over the rashi bar which are screwed down upon the pane. This makes a warm and water tight joint and prevents the ready resetting of broken panes. In a three quarter span house the south wall should be about the same height as the walls of an even span house but the north wall should be about one half higher in the long span of the south construction is used, but both may be of the same height when the short span to the south house is used.

The usual height of the ridge is seven feet above the walls except in long span to the south in which the distance from the level of the south wall to the ridge is measured and the ridge is so situated that the gash bars on the south side will be twice as long as those upon the north.

Neither raised benches or solid beds may be used, the former being the most commonly employed for flowers and the latter for vegetables. In the construction of these raised benches it is desirable to use either gaspils
Angle iron for supports although constructed of wood they will last a long time when supported upon bricks or cedar blocks. In order to secure proper drainage there should be cracks of one half inch to one inch between the boards used for the bottom of the benches. In some cases tile slate bottoms are used and with iron frame wall will form a very durable bench such as should be used in the new greenhouses. The former practice was to place many benches along the center of the house separated by walks but in order to bring the benches into the more desirable parts of the house the plan of having walks along the side of the house and arranging for three or four beds, from four to five feet in width in the center, with solid beds a similar arrangement has been followed except that the beds are somewhat wider. Where sub-irrigation is to be used the bottoms of the beds on benches are made practically watertight and one or two lines of drainage tile are placed lengthwise of the house. The water is turned on at one end there a hose and filling the tile makes its way out three the joints.

In regard to heating needs not need to have separate heating plant, but some small device may be used in connection, such as air in heating small ranges of greenhouses
as the cost iron hot water boilers will prove economical and prove satisfactory being more durable than wrought iron boilers especially the latter be made in the form of box coils from gas pipes. One thing against them is that in screwing them together more or less threads are left exposed and as a result may not last only a few years but with a heavy pipe their durability is much longer.

For our purpose in which are used both hot water and steam tubular boilers could be very much better and may be employed with very good satisfactory effect if heating the entire shell is filled with tubes. Although the tubes are made of wrought iron they are thicker than those commonly used in boilers coil and the tubes are riveted rather than screwed into the boiler heads, will be quite desirable and a greater saving of pipe may be secured in the amount of pipe by the heating system being carried under pressure and there is hardly any limit to the size of the plant in which hot water under pressure may be used although many florists prefer for ranges of size that will to be used at night fireman desirable. While it will require rather more attention than a hot water system steam as a resulting method of heating greenhouses
has some advantages.

In estimating the amount of radiating surface that will be required, it is customary to estimate that one square foot of

floor will be sufficient for one square foot of glass, if the house is to be carried at 60° with

hot water, and that it will answer for four

fifths at 50° or 40° respectively, are required

with steam heat one foot of radiating surface

will be ample for five and one half feet of

glass in houses to be heated at 60° seven

and one half if 55° is to be maintained, and

only one foot of radiating to nine square feet

of glass will be required in houses that

are to be heated to 40°. The above figures

are found substantially correct in sections

where the usual winter temperature does not drop below zero, and where

the houses are well built and with a comparatively small amount of exposed

wall surface. Where the temperature

drops much below zero, where the

construction of the house makes it dif-

ficult to heat they will need to be slight-

ly modified.

The arrangement of the pipes where

steam is used, is quite similar to that

in a hot water system, the principal dif-

ference being that the size of both flow

and return pipes is smaller. The return
pipes need not be larger than one and one-quarter inches, and in small houses very good results can be obtained with such pipes, while as a rule, a two-inch supply pipe will answer for a house 20 x 30 feet, except where high temperature are desired. In the steam system there should be an automatic air valve at the lower end of each of the coils and for controlling the heat values are necessary both the supply and drain pipes, while in the hot water system, only a valve is necessary although it too will be desirable in case there should be occasion at any time to cut off the coil in order to make repairs upon it. In the steam coils it is also well to have several of the pipes provided with valves so that one or more of them may be cut off to control the heat as is often the case.

Description of the drawings drawn to represent some of my ideas concerning a new horticultural building for the College. Drawing number one is a plan of the grounds, consisting of a fifty acre plot of grounds on the south west corner of the grounds. This drawing represents the various buildings that have stand upon the grounds, also chosen location for the new building if we ever have one. The place chosen is at the
wath end of the grounds about midway between the road on the west and east lines of the forty. It would be just west of the present Botanical Gardens. This also shows the prospective location of the connecting road, one running straight south to the north road, another running from about halfway between the main building and the south road up by the west road of the Domestic Science building north nearly to the gymnasium then across to the new building, another runs from the buildings south west and another comes along the hedge cutters at the north side of the building. These roads divide the lot into sections, for the various plots to conduct the experiments. Another thing that is shown is the contour lines, thus showing the best locality for the building and various things to be grown.

Drawing number two shows the roof plan of the whole building with greenhouse and potter room. The front designed as representing the north shows rough plan of the Horticultural building. The east and west wings and center portion are to be two stories high, while the part between them is only to be about eighteen feet high. The building is to be one hundred thirty feet long by sixty-six feet wide. Running south from each of these
SECTION A GREENHOUSE

Scale 1/2" to 1'
15'
The wings are two greenhouses, which drawing shows number three shows cross section. Slaving, the method, raising windows, tenders and lightning, watering, methods. The greenhouses are to be twelve feet wide by one hundred feet long. Connecting these greenhouses is a large palm house running east and west twenty-eight feet wide of the center is to be built a large octagonal doory. All of this is to be built by half frame structure and of glass. The upper portion of dome is to be built by curved rafters with appropriate railing upon the top. In the vacant space within the building a large bower may be built for aquatic plants.

Drawing number four in a plan representing the first floor showing the different class rooms and windows also showing the cloak rooms, stair way halls, sliding the cloak rooms. Also shows the windows and museum cases. Also shows the two doors and doors of the various rooms. The two doors and doors of the various rooms, the two doors and doors of the green house are rooms on the north of the green house are rooms on the south of the green house are rooms. These just north of are two walls rooms. Leading from there are doors that take you to the hall where the two museum cases are situated also to the two museum cases are situated also to the two museum cases which are along the south wall are the stairways which lead up to the second floor.
Drawing number five is a plan representing the second floor and various rooms. At the south side of the east and west wings are the laboratory, and from them is a door leading into the offices. Just north of these are two more large classrooms. On the south side of the hall of the part that is not to be full two stories are two work rooms. And in the center part that is full two stories are eight large museum cases. And in the north part of the building there are two Mae rooms. Between the stories and workrooms is the hall leading to the class room. I think this drawing represents an ideal horticultural building which is suited to the needs of the Kansas State Agricultural College and of which we are greatly in need. The drawing speaks very clearly for themselves hence did not go into details very much. The drawings are all drawn to scale. Thus representing the various parts as they are expected to be. It will probably be some time before this building is attained, but even the less the college needs are very badly as ever we can see, I have tried to show as best I could the needs of a new building, also what might be considered an ideal plan for a new building.

Floris