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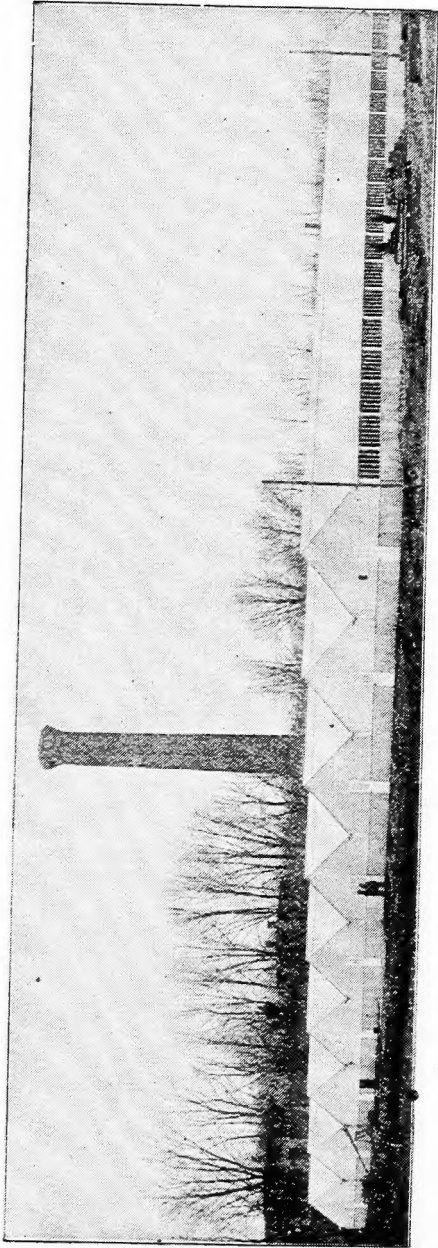
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THE GIFT OF

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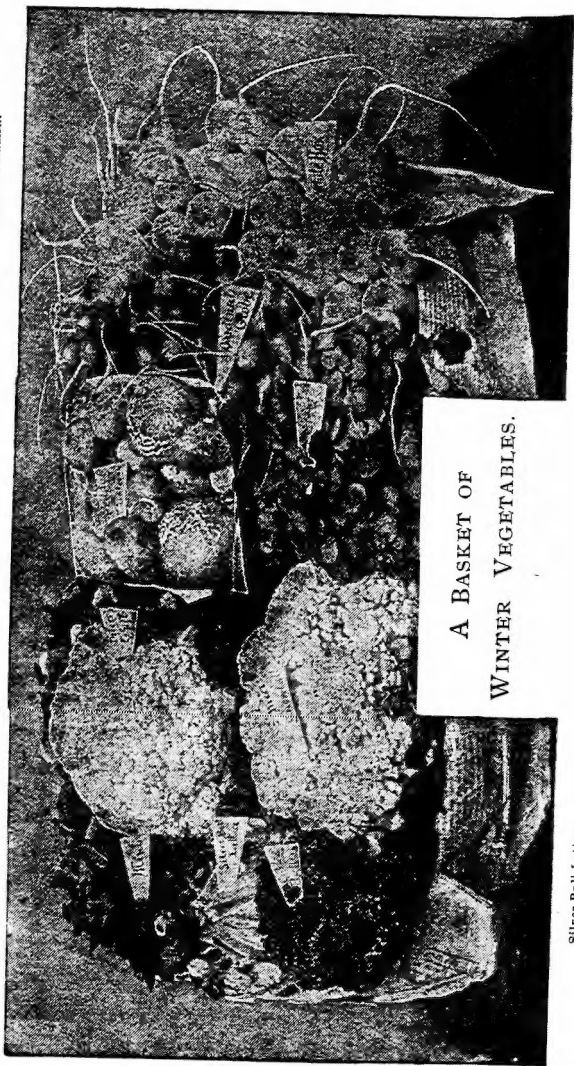
This picture shows a one-acre greenhouse belonging to the firm of Henry A. Dreer, seedsmen and florists, at Riverton, New Jersey. There appear to be nine structures, but as there are no partition walls it is really one house. There is another house of the same size on the grounds, and also many other large glass buildings.

Mint.

Cauliflower.

Mushrooms.

Cardinal Globe Radish.
White Box Radish.



Silver Ball Lettuce.
Curled Parsley.

Water Cress.

DREER'S
VEGETABLES UNDER GLASS

A LITTLE HANDBOOK TELLING HOW TO
TILL THE SOIL DURING TWELVE
MONTHS OF THE YEAR

PHILADELPHIA
HENRY A. DREER, Incorporated
714 Chestnut street

1896

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HENRY A. DREER.

PREFACE.

The old house of Henry A. Dreer begs leave to offer to the American public a little book on winter gardening ; on vegetable culture under glass.

It is assumed that the best way to tell how to do things is to tell how things are being done by successful gardeners ; to deal meagerly in theory and largely in fact.

So we have woven with our own long experience a series of recent field observations ; notes made by our own people ; pictures taken with our own cameras ; and, in places, the literal words used by practical gardeners in describing their processes and in giving their conclusions.

To keep our business abreast of the times it is necessary for us to constantly note what the world is doing. In this little work we present a few pages from our note books to the horticultural public.

HENRY A. DREER,
Incorporated.

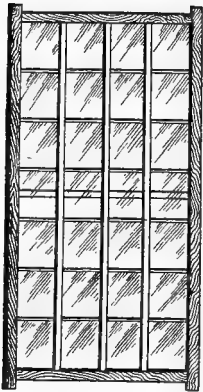
Philadelphia, October 1, 1896.

What business man, except a soil worker, will "stop and talk" with a stranger? Who but a farmer or fruit grower or gardener will tell of his experience so fully and so freely, and so entirely without hope of gain? Who else will so frankly reveal his business secrets for the benefit of his fellows? Who else so clearly recognizes the fact that the world is large enough for all mankind?

PART I.

CHAPTER I.

THE BEGINNING.



People without experience or capital must begin at the foot of the ladder, if they would succeed in under-glass gardening.

The key to the whole situation is the single sash, for when its uses and functions are fully understood, and its possibilities realized, the novice has become an expert, and is ready for greater things.

The sash which at the start covers a cold frame is at length made to do duty on a hot bed. The hot bed sash, which originally began work in the spring, is put to work in the autumn, and made to produce results in winter time.

The next step is to use the same frame of glass on a sash-covered forcing house, and of course the next is the forcing house constructed of large-sized glass, on the most advanced modern ideas.

This little book will be divided into three parts. The first part will explain the several steps or stages by which the single sash, in a natural way, grows into the great glass structure which converts winter into summer. The second part will enumerate the more important winter crops, and give directions for their culture. The third part will be devoted to the winter crops of minor importance; crops

which in certain favored localities may become of major importance.

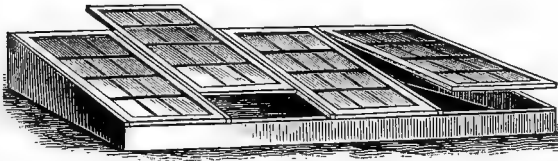
The sash will always have its place in the economy of the garden; a place which the forcing houses cannot fully supply. It is the duty of the sash to render small services to many people, while the forcing house renders large services to a few people. The sash is everybody's helper.



I look upon the pleasure which we take in a garden as one of the most innocent delights of human life.—*Addison*.

CHAPTER II.

COLD FRAMES, "BOXES" OR "STRINGS."



A cold frame is merely a glass-covered garden. The sides are of boards. The top is made of one or more movable sashes. The soil ought to be very rich. An ordinary sash covers eighteen square feet of ground space, being about 6 x 3 feet in dimensions. Sashes seven or eight feet long can be obtained, and are sometimes used, but the six-foot size is most convenient.

Many plants perish from the effects of frost. Others, including both vegetables and flowers, are not injured by severe freezing. Their growth is checked, but their vitality is not impaired.

The function of the cold frame sash is to ward off cold winds, to keep the ground clear of snow, and in the spring to increase the feeble heat of the slanting sunbeams, and thus to foster plant growth. The ground will freeze solid in the cold frames in winter, but to a less depth than in the open garden.

The construction of the cold frame or "box" is simple. For a single sash four boards are required, but for a range of sashes the necessary lumber is less in proportion. The sash can be bought from the seedsman; the frame must be made by a carpenter, so as to accommodate the requisite number of sashes.

In private gardens a more elaborate frame or "box" is usually made. In addition to the four boards absolutely demanded for the sides and ends a six-foot board is cut diagonally, and used upon the sides, with a six-inch strip across the top. This provides for a six-inch pitch to the glass. The same frame, made deeper, is used for amateur hot beds. The market gardener, operating on a large scale, constructs his "boxes" more cheaply, as will be explained.



THE "BOXES" AT REST.

The summer picture entitled, "The 'Boxes' at Rest," is from a photograph of the grounds of a Philadelphia market gardener. It shows how the boards are set and how supported. Ordinary inch boards, free from knots, are used. In the centre of the picture we look into a path or alley planted with radishes. The "boxes" on each side contain celery—a single row in each "box" or frame. The alley is about four feet wide; the "boxes" or frames six feet wide, to be covered by six-foot sashes. The small posts

with beveled tops supporting the upright boards are set in the walk or alley, in order to utilize every square inch of under-glass space in the bed.

The gardener "rests" his frames in summer by stripping them of their glass and changing their crops. No idle days are allowed them. No weeds are permitted to grow in them. They must get along without any summer holidays. Even the alleys are cropped.

The picture shows how easy it is to work the "boxes" and alleys by horse power. It is only necessary to remove the ends of the "boxes," and the horse may be driven through, as no cross bars are used, as was formerly the custom.

In the spring the horse aids in preparing the ground for the open-air crops, and in the autumn in getting ready for winter. Of course the horse cannot be used in cultural operations while crops are in the frames.

It will be understood that the words "frames" and "boxes" are synonymous. The Philadelphia market gardener employs the latter term. The Boston gardener calls them "strings."

It is not uncommon for gardeners to take care of two or three thousand sashes. The Budlong people, near Providence, Rhode Island, operate ten thousand sashes. Miles of them! And all are protected on the north side by high wooden fences.

A PHILADELPHIA WINTER GARDEN. In the northern part of Philadelphia, on Richmond street, John Davis operates about two thousand sashes. His "boxes" occupy a rectangular space which is wholly surrounded by a high board fence, which serves to break the force of the wind. His frames are built in the most simple manner; simply two lines of boards set on their edges, one line being twelve inches high and the other six inches high. There is a six-foot connecting board at each end of the "box," of course.

This picture shows how Mr. Davis' sashes are stored for the summer. They are neatly piled up against one of the fences or wind breaks by which his "boxes" are surrounded, and are covered with lids (shutters) or boards as a protection against wind and hail.



SUMMER STORAGE OF SASHES.

WORTHY OF MORE ATTENTION. The cold frame is worthy of much wider attention than it to-day enjoys. It is suited to the needs of the farmer, who seeks to add to his marketable products or to better his food supply. It is indispensable to the gardener, who must prolong his autumn cropping season and hasten the coming of spring. It is a way open and available to people who "want to make a little money." It is a necessity to the flower lover, since it will carry so many things safely through the winter, to say nothing of its early spring violets, pansies and daisies.

It will yield herbs and salads in variety in early spring, and hasten the starting of the summer crops. Few people,

indeed, have ever fully developed the possibilities of pleasure and profit possessed by an ordinary, glass-covered cold frame.

AVAILABLE CROPS. The cold frame is adapted to quite a long list of hardy or half-hardy things, as will be hereafter discussed in more or less detail. Of the twenty-four "crops" mentioned in this book all except seven are distinctly suited to cold-frame culture, and all of the exceptions (omitting mushrooms) may be started in the frames in the spring of the year, and hastened on their way toward maturity by the kindly influence of the glass.

REQUISITES AND HELPS. In addition to the sash and the frame upon which it rests there are several requisites for success in cold frame operations. The soil of the bed must be of the right character; rich, easily worked and well drained. Rotted sod is the best known basis for such a soil, and a big heap of sod ought, therefore, to be kept always on hand in a convenient place. Properly stacked up and made compact, such a heap will slowly decompose into soil of ideal fineness and quality. The heap ought to be once turned (a few months after it is made). It will need no further attention until wanted for use in the frames or for hot beds.

The culturist need never be afraid of too much manure, provided it is well prepared; that is, stacked, heated, turned and rotted down into a short, fine, sweet condition. In theory it is a loss to permit the ammonia of fermenting manure to escape into the air, but in practice it pays handsomely to have manure that is at once available for plant food. It is better to lose a little ammonia than a great deal of precious time; and it is well to remember that rotted manure is the best plant food known to the market gardeners, whose profits depend upon quickly grown crops.

WIND BREAKS. The gardener must not neglect to provide a wind break. The owner of a small lot of sashes can

usually find a suitably sheltered place for them on the southern side of buildings or shrubbery, but the extensive operator always builds a board fence to shield his glass from the north and west winds. See the remarks on this subject elsewhere, in connection with the cold frame culture of lettuce. To shut off the cold winds is an important matter. Do not neglect it.

CHANGE OF SOIL. It is a matter of common observation that new structures (frames and greenhouses) are usually free from disease. This means that disease germs are not likely to be present in new and clean places. Hence, it is strongly advised that the soil of the cold frame, for a depth of several inches, be changed every year. We believe the labor and expense are warranted, whether there is disease in the soil or not. There are expert operators, to be sure, who do not change the soil and who succeed. But mildew and other diseases are far more prevalent where the same soil is used year after year. Summer cultivation of the frames, in vogue among large operators, is the next best thing to changing the soil.

CARE OF FRAMES IN WINTER. Instead of laying down fixed rules for the management of cold frames in winter it is deemed best to refer the reader to the chapter on lettuce culture, which treats the subject in a definite manner. The principal thing to bear in mind is that ventilation must be given every day during winter when the sun shines, and even in cloudy weather when the ground under the glass is unfrozen or likely to thaw. Over ventilation seldom does harm to hardy plants, while under ventilation is almost certain to be followed by weakness and disease.

A shutter made of light boards, called a "lid" by Philadelphia market gardeners, may be used at night upon sashes in winter if desired, but the shutter is more commonly employed in connection with hot bed work. For a design

for a good and cheap shutter or "lid" see the cover of this book, the illustration being made from a photograph. Use half-inch boards, including the cleats.

It is not imperative to cover the sashes with shutters or mats at night during cold weather. Most large gardeners do not do so. Nevertheless, it will pay small operators to thus protect their frames, for the protection hastens spring growth.

If free and regular ventilation be given to the winter crops the sashes may be removed in March and used for other purposes; even for hot beds, if desired. Crops on which shutters have been used at night must not be exposed to the weather too early.

FALL AND SPRING MANAGEMENT. The hoe may be used both spring and fall among the plants in the cold frames. A small bladed hoe is necessary for the purpose. Watering will be needed just after the plants are set out, and sometimes in the spring, but not in mid-winter, though it is always good practice to strip the frames of their sashes during warm rains.

COLD FRAME "ROTATIONS." Here are four cold frame "rotations" practiced by Philadelphia market gardeners:

Spinach, sowed about September 15, cut at Christmas; radishes, sowed in February, pulled in April; bush beans, sowed in April.

Corn salad, sowed about September 15, cut at Christmas; radishes, sowed in February, followed by beans.

Lettuce, sowed about September 15, cut in April and May, followed by beans.

Spinach, sowed about September 15, cut at Christmas; lettuce (plants from the seed bed or seed) in February, followed by beans. Beets are frequently sowed in February, and other crop arrangements are possible.

SEED SOWING IN FEBRUARY. The working of soil under glass in February (without heat) is possible or impossible according to its quality. A stiff clay at that season of the year is certain to be wet, heavy and unfit for any kind of manipulation, while a well-drained, sandy soil (if not frozen) will be loose and friable.

Philadelphia gardeners enjoy a mellow, sandy loam, containing some gravel, the natural soil favoring early spring operations under glass without artificial heat.

In parts of the country where the soil is of a different nature, by reason of excess of clay, it is necessary to prepare beds and borders in advance, if early spring operations are contemplated. This can be done by drainage and by the use of sand, woods earth, rotted sod, well-rotted manure, &c., &c., worked up and incorporated so as to make a rich, light medium. Such a medium, when not actually frozen, is sure to be mellow. Litter may be employed as a mulch to prevent the deep freezing of ground not in use during January.

PRICES AND PROFITS. On a large scale the gross annual receipts from each sash may be set down (under present prices) at \$1 to \$2.

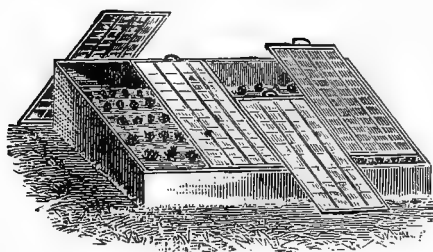
On a basis of a half-dozen sashes it is probable that something like the following, per sash, could be done: 50 heads of lettuce at 5 cents, retail, \$2.50; cucumbers, started under glass, \$1.00; beans or celery, 50 cents. Total \$4.

Or, if violets or pansies are sown, larger results can be obtained, if near a market. Pansies potted and in bloom sell well in the early spring. Violets in cold frames will bloom delightfully in winter, especially as the days lengthen.

The price of a so-called six-foot sash, glazed and painted, free on cars at Philadelphia, is now (1896) about \$2.10. Anybody can figure out the cost of the boards needed to make a cold frame or hot bed. A six-foot sash, sometimes called a "three-by-six" sash, is 38 x 72 inches in size.

CHAPTER III.

THE HOT BED.



The hot bed is merely a modified cold frame; an improved cold frame; a heated cold frame, if the contradiction be pardonable. The same pattern of sash is employed, but the board sides of

the frame are either higher above ground or deeper below ground. Hot beds are not often made in long ranges like cold frames, as the forcing house is more economical for large operations, as will be explained hereafter. The hot bed will, however, always have a place in private gardens.

It will be observed that the board sides of the hot bed are planned for depth; for holding a considerable quantity of manure underneath the soil. It is sometimes recommended that the manure be two or two and a half feet deep: we believe that one foot of properly prepared manure, well tramped, is quite sufficient. Thus, if we have one foot of manure, four inches of soil, and eight inches of air, the box must be made two feet deep. In filling the bed it is well to put in fifteen inches of manure, as it will speedily settle to twelve inches, and will leave just about enough air space under the glass.

The hot bed is usually made ready in February or March, in the latitude of Philadelphia. It is well to sink the box into the earth for half its depth, and heap the earth up against the boards on the outside, as a protection against cold winds. Hot beds may be made up in December and

operated all winter, if desired ; but they require close attention in the colder months.

PREPARATION OF MANURE. Do not adopt the rough-and-ready plan of taking the manure direct from the stable or shed in cold weather. On the contrary, it is far better to collect the requisite amount and make it into a compact heap. Use the watering pot, so that it may be made uniformly damp, or even wet. Do not, however, make the heap soggy with water. In a few days an active fermentation will be in progress, when the heap should be turned, shaking out all lumps, working long straw into the centre of the new pile, and again using water, if necessary.

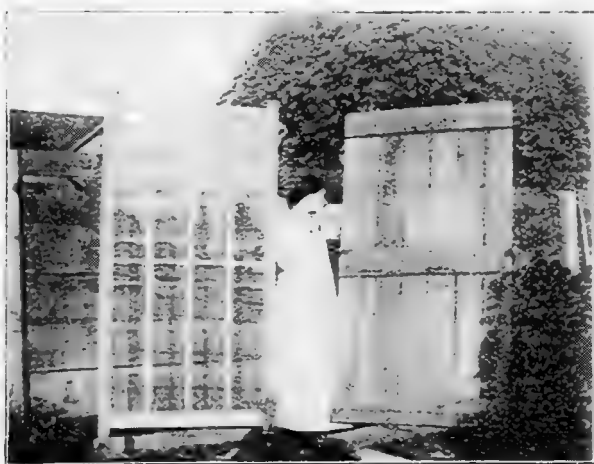
The aim is to induce an active and uniform fermentation of the whole mass, and to make this fermentation so active that it will continue after the soil is put upon the bed. A well-made hot bed will maintain a regular soil warmth for weeks, while a poorly made bed will be warm in spots and cold elsewhere.

We are aware that some gardeners take manure direct from the stables, and make a hot bed on short notice, putting on the soil almost immediately, and planting seeds without delay. Everybody knows that a pile of fresh manure will set up an active fermentaton, without any care or preparation whatever, and the expert gardener simply takes advantage of this fact. Still, the plan of carefully stacking and turning the manure, adding water if necessary, is a better and safer one for the amateur gardener. A cold, lifeless bed in mid-winter is not desirable, and hence the above advice. Care in detail does not cost much, and insures results. It is some trouble to make a hot bed properly, but it is the cheapest way in the end.

SOIL, VENTILATION, &C. Use the same soil as for cold frames—clean, well-rotted sod. Pass it through a coarse screen, or trust to a fine rake, as you please. After tramping the prepared manure firmly in the hot bed, cover it with at

least four inches of soil, and put on the sashes. Place a thermometer in the bed, and await results. In the course of two or three days the beds may be trusted with seeds. The thermometer ought not to register much over 70° ; if the heat is greater it is better to delay matters for a few days.

There is a possibility of burning the seeds by putting them too soon in a new hot bed, especially if the sun shines upon the closed sashes. The beds must be aired even before



A SASH, A SHUTTER AND A GARDENER'S DAUGHTER.

the young plants appear above ground. The seeds may rot in the ground if over-heated. It is necessary to air the beds slightly from the start, even in cool weather; and to give more and more air as the plants increase in size and as the season advances.

There ought to be a thermometer kept in the hot bed, and the day heat not allowed to get above 70 degrees. The night heat ought not to fall below 50 degrees. Shutters, mats, carpets or litter will make it easy to keep young plants warm at night.

WHAT MAY BE GROWN. There is scarcely a limit to hot bed possibilities in the way of starting plants in the early spring. Seeds of all the tender vegetables and flowers may be entrusted to the gentle heat of the hot bed soil in March ; and even in February, under proper care. The length of the March day, however, is much more conducive to plant growth than the earlier season, and for most purposes the March hot bed will be found quite sufficient in this latitude. March 15 is early enough to sow the seeds of all the usual bedding plants and flowers, provided the glass is well managed. A quick growth is preferable, and this can be secured by sowing seed at this season, with its rapidly increasing daylight.

Remember that to have all things in readiness to sow seeds March 15 the hot bed must be made up before that date. Preparations must begin in February, for it will require not less than two weeks in the winter time to get the manure in prime order.

THE PLEASURE OF IT. Aside from the profit of the hot bed (which is considerable) there is a keen pleasure to all real gardeners in thus calling the earth into activity before winter is over. Even the steaming manure is highly suggestive of healthy vegetable growth ; and after the manure has been hidden by the heavy coat of dark brown soil we have at our command a veritable spring garden, in which our choicest seeds may be trusted.

The quick response of the seeds to the warmth and moisture, the bright green of the young plants, and their rapid growth from day to day, call for our admiration and make us rejoice, whether we are gardening for fun or for business.

IMPORTANT DETAILS. After the seeds are well started they must be transplanted or pricked out, an operation necessary in all hot bed work, if we want best results. The young plants have grown too closely and too rapidly to be

strong. They must be taken from the seed rows, separated from each other, and replanted in suitable quarters. The hardy ones can go to the cold frames, while the more tender sorts must still have the gentle bottom heat of the hot bed. Some gardeners transplant even radishes, though others do not, saying that the practice makes too many fibrous roots.

It is at transplanting time that the gardener wishes for expansion, for more sashes. He finds himself with a host of little plants, all demanding elbow room, and he sees that the coming of spring will create a market for just such healthy plants. The cropping season out-of-doors can be hastened by the use of well-started things like these, and the neighbors are certain to want plants for their gardens.

It is the same with the flower seeds. The young plants ought to be reset in more ample quarters, so that they can have root expansion, and make a more hardy and stocky growth than was possible in the crowded seed row.

The hot bed is the second step in the art of growing vegetables during twelve months of the year. Its economy, from a financial standpoint, is in working the frames to their fullest capacity, following one crop immediately with another.

In the autumn, as heretofore intimated, we may if we please set the hot beds again to work in forcing winter crops, and may produce lettuce, radishes, &c., even in January, at a time when high prices prevail.



Handsome profits reward success in winter gardening.

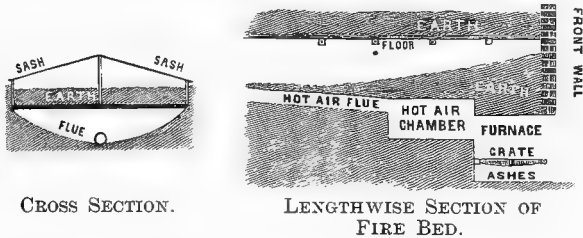
CHAPTER IV.

THE "FIRE BED."

There is a device or structure used in southern New Jersey to a limited extent (and perhaps elsewhere) known as the fire bed or hot air bed. Fire takes the place of fermenting manure, and yet it is different from a greenhouse.

It is not in wide or general favor, but is well adapted to certain purposes, as for instance for starting sweet potato plants in early spring.

The fire bed consists, essentially, of a broad bed of earth with fire beneath it, and with a covering of muslin or glass. A crosswise section of the bed is shown in the smaller cut and a lengthwise section in the large cut. The cuts, with a descriptive article, appeared in *Farm Journal* for March, 1886.



The larger cut shows the relative position of the furnace to the bed. The ash pit is several feet below the natural surface of the ground. The front wall must be of brick or stone, but the wall at the opposite end of the bed may be of wood, if desired. There is an arch over the fire, and another over the hot air chamber, with earth above, as shown. The hot air flue, which is also the smoke flue, is carried grad-

ually upward until it reaches the air space which is under the entire seed bed. Out of the open space beneath the bed, at the end opposite the fire, there is a square wooden chimney made of boards, which carries off the smoke and the other products of combustion.

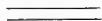
The arrangement of earth, as shown in the cut, prevents the heat in the seed bed from being excessive at the furnace end. The terra cotta or brick flue leading from the fire terminates several feet from the lower end of the wooden chimney, at a point perhaps fifty feet from the fire.

The chimney is twelve to sixteen feet high, and the bed itself is say twelve feet wide and sixty feet long. For such a bed the furnace must be about four feet deep, two feet high and eighteen inches wide. An eight inch terra cotta flue would answer for such a furnace.

The seed bed is supported by sleepers thrown across, four feet apart, on which boards are laid. The bed is a foot deep over the fire, and six or eight inches deep at the chimney end.

The small cut shows the manner in which either glass or cloth may be used to cover the bed.

Many such beds are to be seen on the New Jersey side of the Delaware river, not far south of Philadelphia ; but, as already stated, their use is confined to certain localities.



The love of the thing : that is the key to success in any line of work. It is nowhere more true than in horticulture.

CHAPTER V.

FROM FRAME TO FORCING HOUSE.

The next step upward in the art of winter gardening, when cold frames and hot beds no longer fully meet the requirements of the cultivator, is the construction of a steam-heated or water-heated forcing house, using the same or similar sashes as those employed on the frames and hot beds.

The advantage of the sash-covered house (as compared to frames) is that it enables the gardener to work under



INTERIOR VIEW OF LOUIS REICHNER'S SASH-COVERED FORCING HOUSE, PHILADELPHIA, SHOWING CAULIFLOWER AND RADISH CROPS.

cover; that he can reach his plants without exposing them to the weather; and that the temperature can be better controlled. The element of economy is also to be considered, for while the sashes will cover no more ground space on a forcing house than they formerly covered on the frames, yet a more rapid crop rotation can be secured by the greenhouse, as compared to the more primitive plan, and the gardener's

time is used to better advantage, since there is no period of enforced idleness in the winter season, nor is time sacrificed in lifting and shifting the sashes, the shutters, &c.

We present in this chapter several illustrations of the sash-covered forcing house—a most useful structure. Such a house is exactly adapted to the needs of the progressive gardener who has begun in a small way and who has accumulated a considerable number of sashes. It is the connecting link between the old way and the new way, and is now much used here and in New England. Methods everywhere are undergoing a rapid change.

On some of the largest market farms near Boston will now (1896) be seen extensive sash-covered houses for forcing vegetables. The owners have been impressed by the better economy of the large greenhouse as compared with "strings" (cold frames), and have taken this method of turning to account their otherwise out-of-date glass.

The several illustrations for this chapter are from photographs of Philadelphia establishments, and are suited to the requirements of this latitude.

By reference to the interior view of Mr. Reichner's house it will be seen how the sashes are laid on to form the roof. The construction of the house is also shown in part, and it is easy to realize that the glass roof can be wholly removed.

The peak or highest part of the roof is not much more than six feet above the surface of the middle bed, and the "square" of the house is about two feet above the ground. The permanent glass sides in Mr. Reichner's house are 24 inches high; in Mr. Esher's house 20 inches high.

The beds are made directly upon the ground, three in number, separated by sunken walks, a little over a foot in width at the top, and a foot in depth.

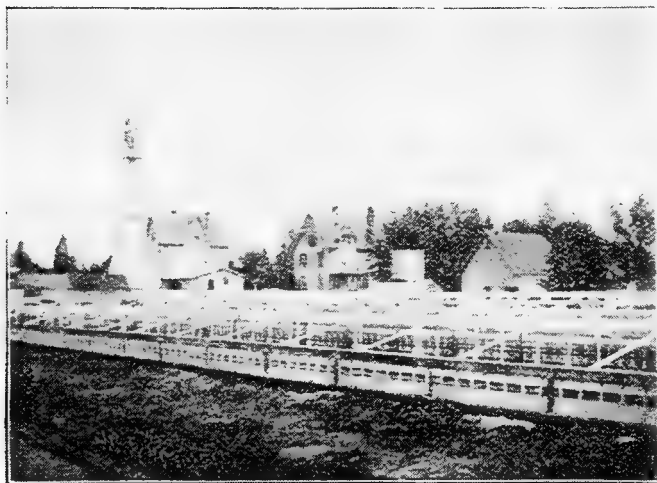


The soil of the beds is held in place by boards, and the boards along the walks are supported by iron braces, of the shape shown

in the cut. The brace is made of flat iron, stiff enough to support the strain upon it. Each of its three parts is one foot in length, but its upper ends are fourteen inches apart.

The economy of space secured by these sunken walks is obvious. In Mr. Esher's house the distance from the bottom of the sunken walk to the sash above is 5 feet 5 inches, which requires a man to stoop slightly in going from place to place.

The house being so low there is no loss of fuel in heating it, and as there are no raised beds there is no staging to be kept in repair.



SUMMER VIEW OF SASH-COVERED FORCING HOUSE OF JOHN C. ESHER,
AT COLLINGSWOOD, N. J.

THE CONSTRUCTION. Mr. Esher has a number of sash-covered houses for forcing vegetables, all built upon the same general plan. A partial description of one of them will serve to illustrate how all are constructed. The picture will aid in giving an idea of the framework.

As there are two rows of sashes on each side of the house there must be five lines of support, the peak or ridge piece serving for two lines of sashes. These five lines are permanent. The outer lines, forming the sides of the house, are of wood, resting upon wood, with glass below. The interior ones rest upon iron pipe posts, which are strong and yet light, occupying but little room.

Each of the two hundred (or more) sashes required to cover one of Mr. Esher's houses is 7 feet long by $3\frac{1}{2}$ feet wide, glazed with 10 x 12 panes.

Each sash when on the house is held in place by two screw bolts. These bolts pass through the sash, take hold of the wood beneath easily, have square heads and can be removed with little trouble.

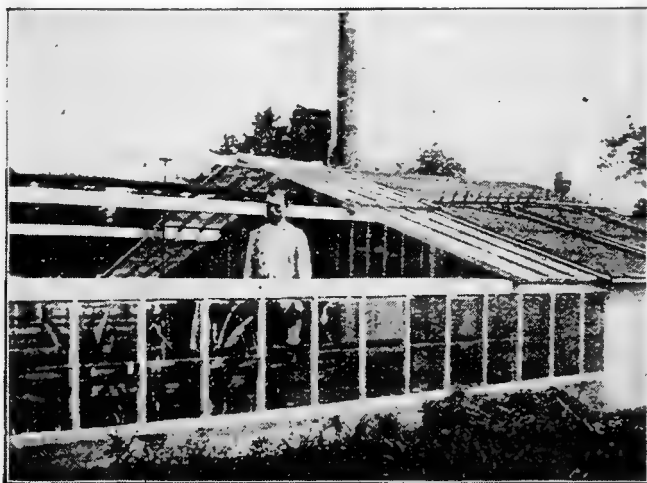
Provision is made for ventilation by making every third sash of the upper row, on each side of the house, movable at its lower end. This admits fresh air immediately over the walks on both sides of the house.

The joints of the sashes are covered with weather strips to keep out the cold, and along the peak of the entire roof where the sashes come together there is nailed a strip of felt or tarred paper, which effectually turns the rain and snow. The paper is tacked in place with circular tin roofing buttons.

THE VENTILATORS. Sometimes the sash to be used for a ventilator is simply hinged to the opposite sash, at the upper end. This permits the lower end of the sash to be raised at pleasure. Mr. Esher has what he thinks is a better plan. He takes two pieces of hoop iron, each a foot in length. In each piece five holes are drilled. Through the middle of each piece a six-inch wood bolt is passed, and driven part way into the top of the ridge piece of the greenhouse.

In summer time, when the houses are not in use, these bits of hoop iron still remain in pairs (a sash's width apart)

on the top of the ridge piece. In the autumn, when the sashes are put on, the opposing sashes come together at these points, and wood screws (screw bolts) fasten the hoop iron strips to the styles (wooden bars forming the sides of the sash). Hence, upon completion of the work, each ventilating sash is held in place at the upper end by two strips of hoop iron (instead of hinges). This thin iron is flexible, and is in all respects as good as a hinge, and does not rust out like a hinge. The lower end of the sash is lifted exactly as in the case where hinges are used. The ends of the styles, at the top, are beveled, so as to make the opposing sashes fit closely together.



LOUIS REICHNER'S FORCING HOUSE.

A further illustration of how the movable sashes are set on the framework of the house is shown in the summer-time picture of one of Louis Reichner's houses, at Belmont avenue and Ford road, Philadelphia.

A great advantage of such houses as these, in addition to points already noted, is the ease with which they can be thrown open to the weather in summer. Mr. Esher, for instance, grew a crop of celery (close planted so as to be self-bleaching) in the beds of his forcing house during the summer of 1896; and another user of such a house testifies that stripping the house of its glass in the summer makes it safe to employ the same soil for at least two years, whereas in a near-by house that is permanently covered with glass he finds it necessary to change the soil every year in order to escape disease.

The two gardeners referred to in this chapter (Messrs. Esher and Reichner) are both located within convenient reach of the great wholesale markets of Philadelphia. Their principal crops are radishes, lettuce, cauliflower, beets, water cress, mint, &c. They also grow rhubarb in the winter season, but in greenhouses of a different pattern, having platforms or staging under which the rhubarb roots are placed.

THE SUCCESSION OF CROPS. In the sash-covered forcing houses just described the winter's work begins in September, from the 15th to the 20th, before the glass is put on. The beds are made ready and sowed with Cardinal Globe and White Box radish. Lettuce seed is started in an outside bed, and brought into the houses later. Water Cress (Dreer's Erfurt) is sowed in October, and Snow Storm cauliflower about the first of November.

For cultural directions concerning these and other winter vegetables the reader is referred to the subsequent pages of this book, where each is briefly treated under its respective name.

Mr. Esher's main reliance is the radish, of which he expects three crops always, and sometimes gets four crops.

Houses of this description are particularly adapted to the radish, lettuce, beet and cauliflower, and are recommended to gardeners whose markets demand any of these crops.

CHAPTER VI.

THE GREAT MODERN FORCING HOUSES.

There are but few larger glass houses in the world than the one-acre structures at the Dreer grounds, at Riverton, New Jersey, and it is, therefore, not out of place for a book with the Dreer imprint to speak with some authority upon methods of turning winter into summer.

These glass houses at Riverton, however, are not used for the commercial production of winter vegetables, and so we



VEGETABLE FORCING HOUSES OF W. L. ALLEN, AT ARLINGTON,
MASSACHUSETTS.

have looked towards Boston for types of the best and largest American forcing houses, and for the best methods of growing vegetables for market in the winter season.

It is one thing to grow things under glass, regardless of cost, and another to show a clear and satisfactory balance of receipts above expenses. The Yankee grows vegetables on business-principles, rather than for sentiment or luxury, and as his houses are among the best to be found in this country we have turned our camera in his direction.

A Pennsylvania or New Jersey trucker, visiting New England, is surprised at the number and size of the vegetable forcing houses to be seen at Arlington, Belmont and other suburbs of Boston, near Providence, Rhode Island, and elsewhere. The largest of the Rawson greenhouses, at Arlington, attains to the great size of 50 by 400 feet, with panes of glass 20 by 30 inches in dimensions.

Many establishments in the same neighborhood have houses almost as extensive. John S. Crosby, William H. Allen, D. L. Tappan and others have very large under-glass



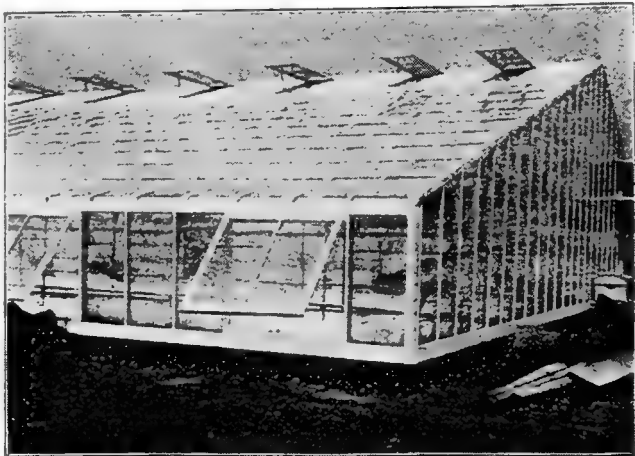
SMALL DOORS IN NORTH SIDE OF BOSTON FORCING HOUSE.

establishments at Arlington; and the Hittinger Brothers, at Belmont, have a place that is a model in all recent greenhouse appliances. These people and their neighbors grow acres of lettuce, cucumbers, radishes, &c., in the winter time and exchange their products for bank accounts.

The illustrations show the general plan of construction of the New England vegetable greenhouse. The beds are made upon the ground, and the soil (in most of the houses) is changed or "shifted" every year, wholly or in part. The method of using the forcing house to best advantage, in point

of economy of time, is explained in the chapters on lettuce and cucumbers.

A great help in the matter of changing the soil of these great houses is the small door on the north side of the house, as herewith shown. A line of these doors extends from end to end of the forcing house, being cut through the double wall of boards on the cold side of the building. The doors are, of course, permanently closed during the winter.



GLASS DOORS OR VENTILATORS, NEAR GROUND, ON WARM SIDE OF BOSTON FORCING HOUSE.

On the southern side of the house, below the "square" or pitch of glass, a number of glass doors or ventilators are placed. These doors or glass windows swing outward, being hinged on their upper edges, and are used during any time of the year, whenever required by the temperature of the house. These ventilators, in connection with others at the peak of the glass roof, aid in producing a perfect circulation of air above the plants growing in the beds. The ventilating

glass window, on the south side of the house, is frequently hinged on the lower edge, and made to swing inward.

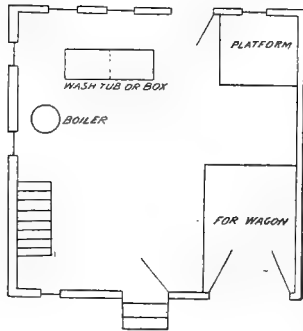
The first cost of the modern forcing house is not as great as formerly, though it is still considerable. Its use is fully warranted for commercial operations, and it is likely to become increasingly common in all parts of the country.



Winter gardening throughout the United States must increase under to-day's conditions. The under-glass crops are all "money crops."

CHAPTER VII.

A WINTER WORK ROOM.



Here is a suggestion for a winter work room ; a place for doing all the laborious details of "getting ready for market." It is from one of our 1896 note books, and is an almost exact copy of the "wash room" of John S. Crosby, of Arlington, Massachusetts. Mr. Crosby is entitled to the merit of its simple and convenient details.

Everybody in the market gardening business knows the vast amount of labor involved in washing, bunching and preparing stuff for market at all seasons of the year, and that this work in winter is often painfully cold and altogether disagreeable.

The above work room or "wash room" is a model of comfort and convenience, and its best feature is its simplicity. It is not expensively built, yet every detail seems perfect.

Numerous windows admit light by day, and electricity furnishes illumination by night. The boiler and its pipes keep the place comfortably warm.

The floor of the wash room, which is of cement, is raised say two feet above the level of the ground outside the building.

Large doors open for the reception of the market wagon, which stands below the level of the wash room floor. The doors close with the wagon on the inside.

The washing trough (about 4 by 10 feet in size) is divided in the middle, so that one portion can be emptied while the other is full of water. The water is drawn directly from spigots, and escapes immediately under the washing box. The floor slopes so that all drainage is toward this spot.

In one corner there is a wooden platform, raised a few inches, for the storage of crates, boxes and baskets. The tables for bunching can be placed in the centre of the room or in any other desired position. Stairs lead to an over-head apartment, as shown in the left of the cut.

This wash room, as intimated above, has the charm of cheerfulness. It is built on business lines for business purposes, and is calculated to rid the gardener's business of the unpleasant winter work of former days. It will be noticed that the market wagon can be loaded in the same apartment in which all the work of washing and tying is done; and, if necessary, the wagon can be safely locked up in this place at night.

Its well graded cement floor and the arrangement for bringing in the market wagon are especially worthy of notice. The stuff to be made ready for sale can be brought into the room from the front or the rear, as may be most convenient, as there is a door on each side of the building.



American horticulture has reached a stage where profits depend upon doing things well.

CHAPTER VIII.

BORDER WORK AND IRRIGATION.

It is rather difficult to define the meaning of the word "border," as used by American gardeners, since the term is somewhat elastic in its application.

In general it may be said to mean any small piece of ground exposed to the air and sun which is not a part of the open field. It is not glass-covered, and it is usually sheltered by a building, fence, wall or hedge, so that it cannot be swept by cold winds. The north and west are the directions from whence come the cold, drying winds of February and March; winds which cause so much destruction to the canes of raspberries, blackberries and the like, and which are really more hostile to vegetable life than severe cold itself.

A border, therefore, may be described as a piece of warm, sheltered, out-of-doors soil. The richer the soil the better for its purpose. It may be so small as to be worked with the spade, or so large as to require the plow.

The ordinary border is merely a small, warm, sunny bit of rich, dark mould, which dries off quickly in spring by reason of its location, its good drainage, and its exposure to the sun.

On the other hand, we see some quite extensive borders in the fence protected enclosures of the large market gardeners.

Border work is so intimately associated with under glass operations that the subject must be mentioned in this little book. Part of the work of the cold frame and most of the work of the ordinary hot bed is done with a view to spring operations in the open air; and as every day in early spring counts for so much it is necessary to join the glass work and the open air work as closely as possible. The border is the connecting link.

In addition to its spring-time usefulness the border ought to carry many things safely through the winter months, the plants being protected only by straw, salt hay or other litter. Lettuce plants will go through the winter without harm. Onions planted in October will yield early shoots or "scullions." Spinach will be ready for the earliest market; it can be cut, in fact, all winter, during mild days. And there are many other purposes for which the border is peculiarly adapted. Of course this part of the garden is to be as rich as well-rotted manure will make it. A two-inch coat of manure ought to be dug under previous to every crop, and a complete fertilizer also used as a stimulant of rapid growth.

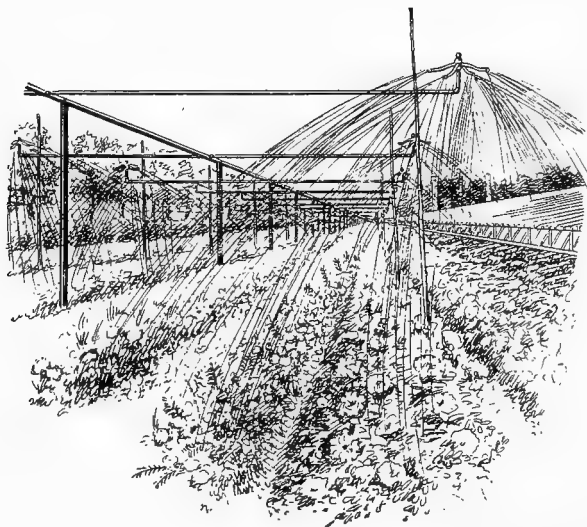
This excessive manuring is entirely safe where plenty of water can be used. And thus we come to consider the subject of irrigation.

The border must be frequently and thoroughly watered in the spring of the year. It must be planted to its utmost capacity, cultivated to perfection with hand hoe or wheel hoe, and worked in all respects as intensely as the hot bed itself. The border offers opportunity for the most concentrated forms of out-of-doors gardening.

IRRIGATION OF BORDERS. To take well-started plants of beets, lettuce, &c., out of the frames in the early spring, or to sow seeds of radish or other early market crops in the open border, and then to have all plans frustrated by drying winds or prolonged drought is neither satisfactory nor profitable. There are crops indeed (cauliflower, for instance) which resent any interruption in their growth, and which never fully recover from injury sustained in transplanting into dry soil.

It is hence necessary to be prepared to irrigate the border; and the more thoroughly the work is done the better. On a small scale the watering pot will answer, but on a large scale a rubber hose pipe is mostly employed by market gardeners.

We here present a picture of a cheap, practical and effective scheme for watering an extensive plat or border. The picture is drawn from a photograph made on the large, well-kept place of the Messrs. Hittinger Brothers, at Belmont, Massachusetts.



The essential feature of the scheme is an elevated two-inch central pipe, running the length of the plat. It is held up by iron posts made of pipe. A horse can pass under the main horizontal supply pipe. The water pressure is 25 lbs. to the square inch. At points say 18 feet apart cross pipes extending twelve feet in both directions are inserted, as shown in the picture. At the end of each lateral pipe is an umbrella (revolving) sprinkler. The weight of the sprinkler and small lateral pipe is supported by a wooden stake or pole.

At the Hittinger establishment this scheme of irrigation covers about an acre of ground. Sixty sprinklers are

employed, and are all run at the same time. The time required to give the ground a thorough soaking is about thirty minutes. The amount of water used in that time is about 15,000 gallons.

The cost of this system of irrigation is not great. The whole acre of ground thus supplied with moisture is made productive up to its fullest capacity, no matter how dry the weather may be in early spring.

Lying immediately on the warm side of a great vegetable forcing house (partly shown in the picture), with deep, rich, mellow soil, this border was the largest and most successful thing of the kind noted in our 1896 observations.

The economy of construction, the uniform way in which the water is applied to every portion of the ground, and the ease with which it is managed, are the principal points in its favor.

No matter how careful a man may be with hose or watering pot, he will give some parts of the ground more water than other parts ; but a mechanical sprinkler, operating uniformly at many points, will almost equal the clouds themselves in the even distribution of steadily falling drops of water.

The supply of water for such a system of irrigation may come from a tank, from a force-pump, or from a street main. The plan is feasible and economical, and tends to reduce out-of-doors gardening to an exact science.



The possibilities of pleasure in winter work under glass are as great as the possibilities of profit.

CHAPTER IX.

INSECTS AND DISEASES.

This little book is so entirely elementary that we can give only one brief piece of advice about plant diseases, and that is to have none of them.

Disease seldom or never troubles plants set in fresh soil in new frames or new houses, and this is one reason why beginners so often have "good luck" at the outset, to be followed by "bad luck" in later years. Of course there is in reality no "luck" about it. The beginner works with wholesome surroundings.

The disease called "damping off," which affects many under-glass crops, is supposed to be of fungous character. It mostly results from bad air. Free ventilation and cleanliness will usually prevent it; though it sometimes troubles plants in the open air. It is especially common in old frames or hot beds, near decaying boards, and in soil that has been previously used. Its prevention is possible, in the way indicated, but the death of the plant is sometimes our first notice of its presence in the bed.

"Burning" of lettuce is also supposed to be a fungous disease, the result of improper management. The lettuce decays at the heart, and is rendered worthless. Fresh soil is the best remedy, if other conditions (including ventilation) are not at fault.

Aphides, or plant lice, can be destroyed with tobacco smoke or tobacco water, though it is sometimes difficult to kill these insects on the under side of lettuce leaves. It is well to see that the seedling plants (when transplanted) are free from the insects. Tobacco stems may be used among the lettuce plants.

In discussing this question an English authority of the present year (Carter's Practical Gardener, London, 1896) says it is surprising what a great insect-enemy pure water is; but if this fails resource must be had to something stronger. Three or four ounces of soft soap dissolved in a gallon of water, and half a pint of tobacco liquor added, will kill all ordinary insects, especially if the plants are syringed with it at a temperature of about 120°, or dipped in it. It will not injure the plants.

Maggots trouble some cold frame vegetables, especially radishes, onions, etc. Powdered copperas sprinkled over the beds, before planting, is mentioned by Professor L. H. Bailey as a preventive. Carter's Practical Gardener (London, 1896) recommends gardeners "to strew sufficient fresh soot over the ground to discolor it, before drawing the drills for reception of the seed."

There are many fungous diseases which the gardener must combat, but let it be remembered that all the parasitic fungi prey upon vegetation which is not quite up to its greatest vigor. Under proper cultivation, watering and ventilation, the chances are always on the side of the plant or vegetable. It is in the gardener's neglect of the requisites for the growth of his plants that the fungus enemy finds its opportunity and gets in its evil work.

Of all the avenues of failure bad ventilation is probably the one that causes most trouble; and unwholesome soil the next in evil effects.

It is advised that thorough cleanliness be observed; that the sashes be washed or painted every year; that the unpainted wood work of the frames be renewed before decay sets in; and that the same soil be not long used in any structure (frame or greenhouse) from which the fresh air is permanently excluded.

To follow this advice literally may not in all cases be possible, but we may remind our readers that perfect cleanli-

ness and perfect plant health are very closely associated. Nature has assigned to the fungi the duty of watching perpetually for cases of disobedience of health rules, and every plant which suffers any loss of constitutional vigor is at once attacked and destroyed. The careless gardener is thus taught what practices to avoid in future operations.

We believe that old wood and old soil are almost certain to produce "damping off" of plants, even under what may be termed good management; and a mushroom house where the boards are decayed is quite sure to produce unsound mushrooms. In the latter case we have an instance of a fungus preying upon a fungus. Perpetual motion seems to be nature's law. When a plant ceases to grow it is destroyed.



Work the lazy garden. You pay rent for it all winter, do you not? Make it earn dividends every month of the year.

CHAPTER X.

THE PLANTING OF THE SEED.

Seed planting in winter is quite the same operation as in summer, and the same rule holds good, to wit: the smaller the seed the nearer the surface. Many seeds are perfectly hardy, while others lose their vitality when sown in cold or wet soil. In the modern greenhouse seeds may be planted in mid-winter, or at any other season of the year.

Lettuce, radish, cauliflower, beet, water cress, &c., may be sown (with heat) whenever it suits the convenience of the gardener, at intervals through the winter; and there are no rigidly fixed dates for planting the seeds of beans or melons.

Tomatoes and cucumbers, being crops of prominence and of long duration, are started, we may say, in mid-summer, and again near mid-winter.

Parsley, spinach, carrot, cabbage, corn salad, endive and pansy have fixed planting dates, to meet special markets.

Mushrooms are grown from spawn (to be had of the seedsmen). Onions are mostly raised from bulbs, except where the seed is sown in spring under glass for transplanting to the outside beds. Potatoes are multiplied exclusively from tubers.

Asparagus, rhubarb, daisy, mint, and violets are grown from roots for the most part.

Another classification of the winter crops enumerated in this book may be made as follows:

Grown without heat: Spinach, cabbage plants for spring, corn salad, endive, onion, daisy, pansy, violet. Grown with heat: Tomato, cucumber, cauliflower, beans, melon, mushrooms, potato. Grown both ways: Lettuce, radish, parsley, beets, water cress, carrots, rhubarb, asparagus, mint.

The starting point, in all cases, is in reliable seeds, roots, &c. The planting of the seeds and their subsequent care is a matter requiring intelligent and continued effort.

PART II.

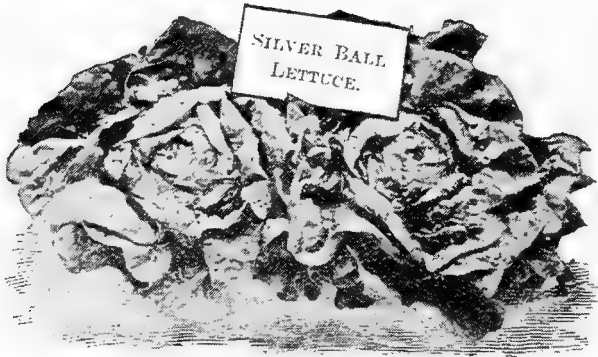
THE UNDER-GLASS STAPLES.

LETTUCE,
RADISH,

CUCUMBER,
TOMATO.

For the second part of our little book on the culture of winter vegetables we have selected four crops which are so largely grown, and grown in so many places, that they may be termed the leading under-glass staples. These four crops will be treated more in detail than those mentioned in Part III; albeit in some localities the things which in this book are treated as minor crops will loom up into primary importance, and will take their places as the principal money makers. The four crops here brought forward must, however, be recognized as the leaders in the eastern part of the United States at the present time.

CHAPTER XI.



LETTUCE.

Lettuce must be regarded as the most important of all the under-glass crops, and it is now in demand during every

one of the twelve months of the year. It is necessary to grow different kinds of lettuce at different seasons, but otherwise the succession of seed time and harvest is unbroken. The tribe is a hardy one throughout, and yet there are kinds which bear more freezing than others, while, on the contrary, there are varieties which are quite able to withstand the scorching effects of summer heat. The request for crisp, well-grown lettuce is now answered in the markets from January to January.

There are at least five distinct methods of lettuce culture practiced by market gardeners, which will be briefly described. These five methods may be called ridge culture, cold frame culture, hot bed culture, forcing house culture and open air culture.

RIDGE CULTURE. Ridge culture begins with the sowing of the seed in the open ground in September. The broadcast method is commonly employed, and no great care is exercised, since the object is merely to obtain strong plants in October or early November. The precaution must be taken to "firm" the seed in the soil at planting time, as the weather in September is often dry, and if the soil is not pressed closely about the seeds there may be delay in germination. Lettuce seed as a rule starts quickly into growth.

Late in October the young plants are ready for the ridges, which are made by running a plow in both directions in furrows twenty inches or two feet apart. The top of the intervening furrow is smoothed with a hand rake, and a row of lettuce plants, eight inches apart, is set on the south side of the ridge. Sometimes another row is set on the north side of the ridge also. It is as the gardener may determine by experience. The single southern row, as a rule, seems to be more satisfactory.

The hardy nature of the lettuce plant enables it to strike root before the coming of severe freezing weather, and after

the roots have started to grow the plants are comparatively safe from injury. They need to be protected with salt hay or straw during the mid-winter months, beginning in December, and allowing the protection to remain on the plants until March. In spring the covering is removed, the soil stirred with a hoe, and the lettuce plants made ready for heading, an end which they accomplish in April or early May.


The ridge system has been and still is extensively followed by Philadelphia market gardeners, though the tendency is toward the quicker results secured by under-glass methods. The object of the ridge is to get good drainage and a kindly exposure to the sun's rays, and these ends may be secured in almost any garden without much trouble or expense.

The open-air seed bed of the autumn, in which the seed was dropped September 15, will usually carry its plants unharmed through the winter, if protected with straw or litter. The young plants from such a bed can be used for mid-winter forcing or for spring planting if desired. The advantage of the ridges, with their autumn-set plants, is merely in the fact that they save time. The earliest warm days start the plants to growing.

COLD FRAME CULTURE. The next simplest way to grow lettuce is in cold frames or "boxes." There is no artificial heat of any kind; no bottom heat furnished by manure. The glass protects the plants against wind and snow, and also fosters growth to some extent even in winter time. But during the months of December, January and February the lettuce plants do little more than hold their own. Yet all the time (except during excessive cold) they are adding strength to their roots; and this is not strange when we observe the persistence with which chickweed and other hardy plants grow in the cold frames during the winter months, and the apparent ease with which violets come into

bloom in the same situation while winter still holds the outside world. Plants appear to be dormant during winter, but for all that many of them are actively at work, especially in their underground portions.

Cold frame lettuce plants are commonly taken in October from the out-of-doors seed bed sown September 15. They are set in the sash at various distances apart, or from seven to ten inches. The old way, still followed by some gardeners, is to put fifty plants under each sash. A system now in vogue at Philadelphia is to plant eight by nine inches apart. This allows for thirty-eight plants to the sash. This is for large lettuce, the price of which warrants the extra space allotted to it.

This handy marker for frames and borders can be made by anybody in a few minutes.  Cut it from a piece of one-inch board, 35 inches long and 4 inches wide. Bore a hole for a rake handle, allowing for slant. Make the distance between the points exactly eight inches.

Lettuce seed may be sowed in frames in February for early spring plants. The beds are put in order, made smooth, struck out in both directions with a marker, and a few lettuce seeds dropped at every "hill" or crossing point of the lines. After the lettuce has made a little growth all the plants except one are removed. This method is employed at a season (in early spring) when the ground is so cold that transplanting is difficult. As a rule, however, we would recommend transplanting wherever possible, as it always favors root development and better subsequent growth.

The winter treatment of cold frame lettuce is simple. Air is given during the day and the sashes are closed at night. This is the practice of the market gardeners. The sashes must not be kept closed during the day when the ground under them is thawed or likely to thaw. Moisture under a sash will produce foul air and disease. Only when

the mercury is very low is it safe to allow the sashes to remain closed during the day time, and even then it is a dangerous thing to do if the sun shines on the glass. Free ventilation is the safe rule. Snow must be removed and the walks or alleys between the ranges of glass kept open, so that the beds can be properly examined every day.

Watering the cold frames is not necessary in winter time, and but seldom in the early spring.

The Philadelphia truckers and market gardeners do not, as a rule, cover their cold frames at night with "lids" (shutters) or mats. Private gardeners and amateurs, on the other hand, will find it to their advantage to do so. It hastens the maturity of the lettuce and several days can be gained in the crop.

The Philadelphia cultivators are, however, careful to build high board fences on the north and northwest sides of their glass to keep off the cold winds; and this plan is worthy of imitation. Indeed, it is essential to success. The height of four or five boards is sufficient here. New Yorkers use six boards, and the Boston "market farmers" employ seven boards (laid sidewise) in the construction of their screens or wind breaks. The Boston men, indeed, build a wind fence for each row or "string" of frames. For instance, they put up a seven-foot fence (seven boards), leaning toward the north. At its base, on the sunny side, they set the cold frames, or "boxes," or "strings." Then they allow a considerable space (perhaps forty feet) before building another fence so that the shadow may not fall upon the glass in the rear. Many of these wind fences or breaks are yet to be seen in New England, and still have their uses, although the Yankee lettuce growers for the most part seem to have equipped themselves with forcing houses.

HOT BED CULTURE OF LETTUCE. The hot bed culture of lettuce is not very widely practiced on a commercial scale

in the vicinity of Philadelphia, but is well suited to the needs of small gardeners and amateurs in this latitude. The large grower of to-day must have a forcing house, but the small grower can do well with a few sashes, getting the necessary heat from an underground bed of fermenting manure. For the preparation of hot beds the reader is referred to the chapter on that subject.

The hot bed for lettuce culture can be made ready in the fall, or at any time during the winter. If lettuce is to be forced during the severe weather of January and February there must be a greater depth of manure employed in the construction of the bed than where it is made up in March simply for starting the seeds of bedding plants.

A depth of two feet of manure is none too much for a mid-winter bed for forcing lettuce. A temperature of from 50° to 65° is desirable; and fresh air must be given in the day time, even in cold weather.

Plants can be had from the out-of-doors seed bed, or from seedling plants in the cold frames. Such plants respond quickly to the genial bottom-heat of the hot bed, and are stimulated rather than stunted by the cool air which reaches them from above when the sashes are raised.

The only reason market gardeners do not use hot beds is that they find a better economy in forcing houses; but the hot bed is well suited to amateurs or small gardeners, as already stated, and the bed can be employed for a second crop of lettuce if worked to good advantage. That is, it is possible to take well-grown plants from the seed beds (or, preferably, once transplanted), and quickly force them into head in a winter hot bed. Then, by having other well-grown plants available, a second crop can be brought forward in the same bed before it has lost all of its bottom heat.

FORCING HOUSE CULTURE. The forcing house plan is simply the hot bed system developed on broad lines, but it has

gone so far and become so famous that it must be separately classified. It is the hot bed system with the manure replaced by hot water or steam, and with the movable sashes replaced by great glass structures of which nobody dreamed a generation ago.

Lettuce is pre-eminently the most profitable of the forcing house crops, though other popular vegetables and fruits are now rapidly coming into favor. It is lettuce, however, to which the greatest winter acreage is given. Two crops of lettuce are always grown and sometimes three crops, and the glass then goes to cucumbers, tomatoes, &c. But lettuce has first place, as will be described in the paragraphs about Boston methods.

OPEN AIR CULTURE. The fifth of the great methods of lettuce culture, the out-of-doors way, is not within the range of this little book. In passing, it may be well to say that lettuce may go into the open ground as soon as the soil can be worked. Young plants ought to be ready in the earliest spring, from seed sown in frames or from wintered-over plants.

If the plants are set out or sowed in the open ground in rows ten inches apart, and allowed to stand eight inches apart in the rows, there will be room for all the necessary cultural operations and for the subsequent development of the heads. The richest and mellowest soil is demanded for successful lettuce culture, whether under glass or in the open air.

VARIETIES. The varieties of lettuce in favor among gardeners at this time are very numerous, and we can merely give a few suggestions. Much depends upon soil and situation.

For ridge culture in the neighborhood of Philadelphia the sort that is most widely popular is the Early White Cabbage or White Butter. It is almost entirely hardy. Early

Dutch Butter Spotted is most used in cold frames. Big Boston is also used for frames. Hittingers' Belmont Forcing is to be highly recommended for hot beds, forcing houses, &c.; and Silver Ball has a record almost equally good. The latter is also a good lettuce for open-air culture.

THE MARKET. There is an ever-increasing demand for good lettuce. Every city, town and hamlet in the land is a lettuce market. The demand will never cease; in fact, it is likely to grow larger every year for many years to come. We may therefore conclude that there will always be "money" in the crop for those acquainted with the best cultural methods.

Lettuce can be transported from place to place. It is a good shipper, especially in the cooler months of the year. But it is, after all, a perishable crop, which cannot be held long or stored in any great quantities. It is, moreover, best for table purposes when perfectly fresh. For these reasons the small grower of lettuce will never be driven to the wall by his greater competitor. He will always find a market open to him.

LETTUCE CULTURE AT BOSTON. The lettuce growers near Boston have achieved such wide renown on account of their skill, and because their product stands so high in the market, that it is well to look into their methods. Many an envious Pennsylvanian or Jerseyman has wished for the secret of "the Boston way" of growing lettuce, and more than one attempt has been made to learn the trade secrets of the Yankee gardeners.

Our own belief is that the New England people have no "trade secrets," but rather that they succeed through the excellent execution of methods already widely known. They are aided, it is true, by a cool, moist climate, and a soil that can be made perfect by the use of manure. They are also blessed in being near to good home markets.

But, after all, the real success of the New England gardener depends on his management of details. Nothing is too much trouble for him, and he cannot get appliances that are too good for him. We will presently explain the careful details of some of his processes; and as to his glass houses, they are as large and as well equipped, probably, as any in the world.

Let it not be imagined, however, that the business is without its drawbacks, even on the coast of Massachusetts Bay, for the Dreer note books have records (made in 1896) of mildew and "burn"; and one Down-East gardener was inclined to believe that Jersey had excelled Massachusetts in her lettuce products in the New York markets during the previous winter. There may be a bit of comfort to Jersey truckers in this comment, for it goes to show a recognition of the good quality of Jersey lettuce.

The Boston lettuce grower begins operations in his forcing house in autumn on the following general plan. He first prepares the beds by digging into them about three inches of well-rotted horse manure. The beds are all upon the ground (not on staging), and this amount of manure can be incorporated with the soil without much trouble. No artificial fertilizer is used in the houses. (The date of beginning operations seems to be changing, with a tendency to get started a little earlier each year.)

Six weeks before the young plants are needed for the forcing house the lettuce seed is sown in an out-of-doors bed—in a bed containing no manure whatever. This is to get plants wholly free from the germs of mildew. This is a point of great importance.

The young plants, once transplanted (3 inches each way), are thus strong, stocky and perfectly healthy when they reach the bed in the forcing house. They have spent six weeks in getting ready to grow. They are now prepared to make rapid progress in the six or seven weeks of time allotted to them for heading.

They are set eight inches apart each way, and there is nothing especially noteworthy about their life in the forcing house. They are well ventilated, freely watered on bright days, and kept at a steady temperature.

After the lettuce begins to head the temperature is kept down to 40° at night. In day time the temperature runs up to 60°, but plenty of air is given.

Some New England growers now sow lettuce seed as early as August 1. This puts plants in the forcing house about the middle of September, and yields a crop ready for market about November 1.

The next crop of lettuce is treated in the same way, except that a two-inch coat of manure (instead of three) is dug into the bed. The young plants are taken from an in-doors seed bed. The plants are, however, started in the same manner and are as carefully transplanted and as well rooted, so that no delay will follow their transfer to the forcing-house. They are so well developed that they can be headed in about six or seven weeks in the large house.

The usual routine of work is to follow two crops of lettuce with a crop of cucumbers (see chapter on cucumbers); but there is a tendency now (1896) shown toward securing three crops of lettuce, to be followed by cucumbers a little later in the spring than under the ordinary way.

The details of the work done by the New England "market farmers" are instructive. Take, for instance, their method of preparing manure for their forcing houses. This manure is hauled fresh from the city stables. The long straw is first shaken out. The manure is then brought to a uniform condition of wetness, and is rotted by repeated turnings. A fresh fermentation is started each time it is turned, until finally it is short, sweet and exactly suited for quick conversion into plant food.

There is not a detail in the whole operation of lettuce growing in Boston that cannot be precisely duplicated in other

parts of the United States, save only the items of climate and soil; and we believe that any one who will study the construction of the New England forcing houses, the free admission of light and air, the position and treatment of the beds, the starting and subsequent management of the plants, &c., can produce lettuce as successfully as they grow it at Boston.



D. L. TAPPAN'S VEGETABLE FORCING HOUSE, AT
ARLINGTON, MASSACHUSETTS.

LETTUCE PRICES. We can give only approximate winter prices for lettuce in the Philadelphia market, and when we quote \$10 down to \$4 per 100 heads it will be understood that the season and the demand are the controlling influences, and that fixed prices do not exist. In the same way cold frame lettuce may be quoted at from \$6 to \$3 per 100 heads, but these prices refer to really fine stuff. Poor lettuce goes a-begging.

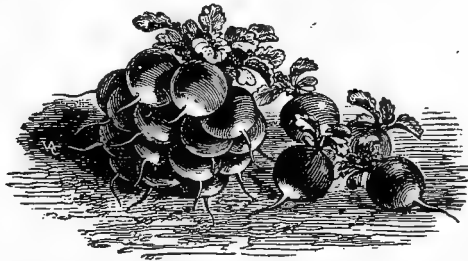
At these figures there is a margin of profit on carefully conducted operations, but there is no room in the business for any except wide-awake, progressive workers.

Amateurs and beginners are perfectly safe with lettuce, because the demand is unfailing and the crop reasonably certain. But when it comes to large operations, involving heavy investments of capital, growers must of necessity do like the Boston people in pushing for the best appliances and most advanced methods known in modern gardening.

CHAPTER XII.

THE RADISH.

Admitting that the lettuce stands first in prominence and profit among the under-glass vegetables, in forcing houses as well as in frames, we feel warranted in giving second place to the radish. This humble vegetable cannot command the fancy prices so willingly paid in the winter season for fresh green cucumbers and plump red tomatoes, but it far out-scores these dainties in numerical consequence, and by sheer abundance out-weighs them in money value.



WHITE-TIPPED SCARLET GEM RADISH.

From the Esher forcing houses (heretofore mentioned) 72,000 bunches of radishes were sent to the Philadelphia market during one winter recently, the instance being cited to show that there is a brisk demand in cold weather for the green things which formerly marked the advent of spring. Mr. Esher deserves the name of a radish specialist.

The radish is everybody's vegetable. It is a half-hardy thing, requiring a comparatively cool temperature for its perfect development. It adapts itself to hot beds and forcing houses quite well, but it objects to an over-heated forcing house as much as to an excessively exposed cold frame. It

grows too many leaves and becomes pithy in one situation, and in the other case its growth is stunted or wholly checked, and under severe freezing it dies. Its proper temperature is from 40° to 65°, with plenty of fresh air.

In rich soil, with sufficient water, it is a quick cropper, sometimes being ready for market in twenty-one days from the seed.

Its period of sale covers the whole year, in its several varieties, though its best season is in the winter and spring months, when its merits as a crisp, toothsome relish cause it to be most fully appreciated.

The seed is usually sown in the bed where it is to grow. Such is the common practice near Philadelphia. Some of the Yankee gardeners, however, have a different plan, for they transplant the radish from its seed bed, just as they do most of their crops, in order to increase the development of the root.

The effect of transplanting anything is to check top growth, and to encourage root growth.

Whether the practice of transplanting the radish does or does not encourage the growth of small feeding roots to an objectionable degree, and whether or not the expense for the labor is warranted in the results secured, are open questions on which we find a difference of opinion. They are points which individual gardeners must decide for themselves.

To transplant or "prick out" radishes is not a slow operation, and an expert can pass a thousand plants per hour through his hands. It is, of course, a labor which is to be avoided unless it pays in cash results.

It is good economy to work a winter forcing house to its fullest capacity, saving the time of the house (whenever possible) by doing all the seed sowing in smaller and less expensive quarters, and even transplanting young plants temporarily into beds less extensive and valuable than those of the final forcing house.

Red and white varieties of radish (preferably the turnip-rooted sorts) are used for under-glass culture. Of the reds we know of nothing at this time superior to Cardinal Globe and White-Tipped Scarlet Gem, although a new radish of merit, almost leafless, has just (1896) been sent to America from beyond the sea. It must be tested here before it can be endorsed. White Box, of many shades of variety, is a favorite everywhere, both under glass and in the open garden.

In heated structures radish seed may be planted at any season. The Philadelphia market gardeners begin to sow radish seed in cold frames in February; though March is a more favorable month, on account of increased sunshine.

The long radishes require more time to mature than the globular sorts, and are not so profitable under glass on that account.

When not grown as a regular crop the radish is often used as a minor or catch crop; that is, a crop to occupy the ground during the growth of something of more importance. They are thus grown in forcing houses, among cucumbers, and in cold frames, between rows of carrots or beets.

Or the radish may be grown as part of a succession of crops, as our 1896 note books indicate. There we have an account of a market gardener who starts in early fall, gets two crops of radishes, one of lettuce, one of tomatoes, and one of cucumbers, making five crops in all, covering the whole year in the operation. This work is done in a sash-covered forcing house, where the glass is removable in mid-summer.

The wholesale market price of radishes at Philadelphia in winter may be quoted at \$2 to \$4 per 100 bunches. Of the red sorts it requires ten or twelve to make a bunch, and of the white sorts six or eight to a bunch.

In giving the place of second importance among winter crops to this vegetable it must be understood that the market

as a whole is considered. There are comparatively few gardeners who make a leading specialty of the radish, but a very large number who use it in a small way or as a catch crop. It is an important one as a whole because more people are interested in it than in any other crop, possibly excepting lettuce.

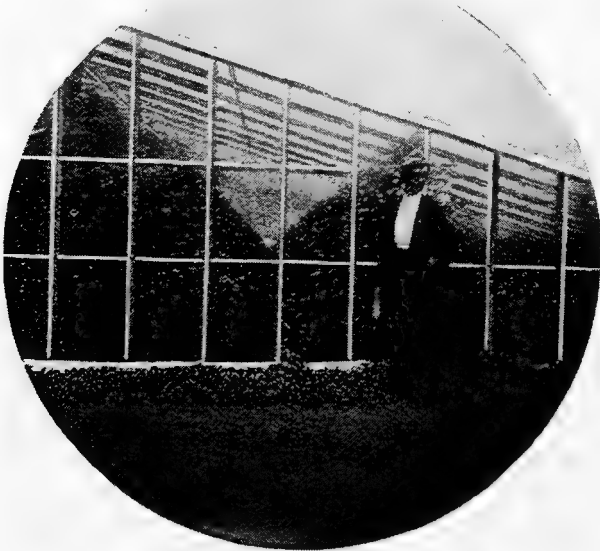


From 1000 to 1200 sashes can be worked on an acre of ground. At the low rate of \$1 per sash this means sales amounting to \$1000 or \$1200 per acre.

CHAPTER XIII.

THE CUCUMBER.

The cucumber is a leading crop in the greatest American forcing houses. The Boston gardeners have been getting as high as \$30 per hundred for White Spine cucumbers in January; and from that price down to \$12 per hundred in the later months. The New England cucumber growers have had the Eastern markets almost wholly under their control, for some years past, during the winter season.



END VIEW OF A GREAT FORCING HOUSE, SHOWING CUCUMBERS.

There is a disposition now shown in this country to grow for the winter market the long, so-called English forcing cucumbers, of which something will hereafter be said.

The Boston method of growing lettuce is described in Chapter XI, where it is mentioned that the first lettuce crop is cut in November. The second crop of lettuce is headed about the first of January, and the beds are then made ready for cucumbers.

About December first cucumber seed is sown in a warm bed; on heat, as they say. Such a bed is given bottom heat from fermenting manure or from steam or hot water pipes, usually the latter plan.

The young cucumber plants are pricked off twice (sometimes three times), in order to give them good root development; for, as we have elsewhere reminded our readers, to transplant a seedling is to discourage its top growth and to encourage its root growth.

The seedling cucumber plants are finally potted in five-inch or six inch pots, and by the first of January, under proper management, they are well started and vigorous, and the pot is full of roots.

The White Spine cucumber, or one of its improved forms, is the variety commonly used at Boston at this time. Arlington White Spine is a favorite. The seed is grown in the open air.

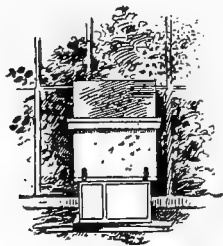
It will be remembered that the beds of the great New England forcing houses are made upon the ground, and that the soil is deep and mellow. For each of the two crops of lettuce grown a heavy coat of well-rotted manure is used, so that when the time comes for cucumbers the soil is well supplied with plant food of just the kind needed by the rank feeding roots.

But this is not enough, for previous to setting the plants in the beds (early in January) trenches are dug from end to end of the house, about a foot wide and a foot and a-half deep. Not more than two or three trenches can be dug in an ordinary house, as the vines require a great deal of space for their proper development. From a single cucumber row

the vines may be trained ten feet upward on two opposite, sloping trellises, thus covering fully a ten-foot-wide strip of ground space from one end of the greenhouse to the other. A greenhouse twenty-five feet wide would therefore warrant the digging of only two or three trenches.

Fermenting manure is placed in the trench to the depth of ten inches, and firmly packed after the manner of making a hot bed. Soil to the depth of eight inches is put on the manure, and the general level of the bed restored. The cucumber plants are dumped out of the pots and set directly over the manure in the trenches, and a tropical temperature is maintained in the house.

The plants are set $3\frac{1}{2}$ feet apart, two plants at each point, for training in opposite directions upon the trellises. The bottom heat furnished by the manure in the trenches, aided by the temperature of the house itself, stimulates the already vigorous plants into a rapid growth, and enables them to produce blossoms and fruit in the course of a few weeks.



A FRIENDLY ALLY
OF THE UNDER-GLASS
CULTURIST.

The cucumber grower has no more useful ally than the honey bee; and the same industrious, unpaid laborer will do good service among tomato blossoms. Every New England gardener has one or more swarms of bees, and a hive is carried into the forcing house soon after the cucumbers are planted, so that the bees may be ready to visit the first blossoms.

The cucumber (like other plants of its tribe) bears two kinds of blossoms on the same vine. One sort has stamens and the other a pistil. It is necessary for the pollen of the former to be carried to the latter. The work was formerly done by hand, with a camel's hair brush, until it was found that the same result could be obtained

more easily and cheaply through the agency of bees. The little insects are also more certain to find and fertilize all the cucumber blossoms than even an expert human operator.

Cucumbers demand a high temperature, as already intimated. The house may run up to 100° in sunlight, but ought not to fall below 60° at night, lest the plants be stunted.

The trellises are made by using A-shaped trusses of iron or wood (V-shaped at the row, but A-shaped as to the way the trusses or supports are constructed), reaching from the bed nearly to the glass, with wires eight inches apart



A VETERAN CUCUMBER GROWER (JOHN S. CROSBY, ARLINGTON, MASS.)

running lengthwise of the house. The vines, which grow with great rapidity, are tied to the wires with string or raffia; and it is no small trouble to keep the vines properly tied up. When the work is well done the fruit can be gathered from the under side of the trellis without difficulty.

In four or five weeks from the time the plants leave the pots the cucumbers begin to go to market. The market box of the Boston grower holds about ninety cucumbers.

· ENGLISH FORCING CUCUMBERS. A class or group of cucumbers known and catalogued under this general name is now coming into demand at Philadelphia and other cities. Thus far the English forcing cucumbers are sold only to what is called the fancy trade ; that is, to people who know the excellence of the article and have means to pay for it.

There are several growers at Philadelphia raising English forcing cucumbers. The seed is scarce and high in price, but this does not matter when it is realized that so few seeds are required to supply even a large establishment.

The cucumbers of this group are very large in size, being so long as to equal three of the common type. They are practically seedless, and as to quality they are held in the highest esteem by people acquainted with them.

They can be forced all winter, under the treatment heretofore described, but each plant must be given much room.



ROLLISON'S TELEGRAPH FORCING CUCUMBER.

John G. Gardner, an experienced grower, elsewhere quoted, recommends that they be planted four feet apart in the rows ; two plants at a place, for training in opposite directions. Mr. Gardner recommends the variety called Telegraph.

Under proper treatment the fruit can be had in sixty days from the seed (according to Mr. Gardner), and the bearing season may be prolonged for months, and even from one season to another.

As to prices, the cucumbers of this type will easily bring 25 cents each in winter, and will be in demand among a class of buyers who are both numerous and desirable. To

this class, by the way, growers of winter luxuries are catering with increasing profit year by year.

The kind known as Telegraph still holds its place among growers of experience, but the Dreer house imported three varieties from London during the summer of 1896 that are so far ahead of all others in popular favor in England as to be worthy of recognition in America. These three new varieties are Lockie's Perfection, Rochford's Market and Covent Garden Favorite. The latter two are in highest esteem with the London market gardeners.

The growing of English forcing cucumbers is no more difficult than the culture of other sorts, and as the demand (at good prices) is likely to increase the subject is worthy of attention from progressive gardeners.



TARRAGON.

Tarragon roots for forcing are now on the market. The plant is largely used for flavoring vinegar.

CHAPTER XIV.

TOMATOES.

Pursuing the idea advanced in the preface, that the best way to tell how to do things is to tell how things are being done by successful people, we quote Warren R. Shelmire, of Avondale, Chester county, Pa., on under-glass tomato culture, whose cultural methods are given to us for the purpose.



THE LORILLARD TOMATO.

Mr. Shelmire sows seed in July for the winter crop, and in November for the spring crop. He considers Lorillard best for winter and Mayflower best for spring.

After the young plants are well started in the seed bed they are pricked out or transplanted; and then, after some further growth, potted in three-inch pots. This insures strong root development. They reach the bed of the forcing house say two months after the time of sowing the seed, at

which time the plants are about eight inches high. The roots fill the three-inch pots.

Well-rotted manure of any kind may be used for the under-glass tomato bed. Sheep manure is excellent. Finely ground bone and bone black are suitable stimulants. "Be careful," says Mr. Shelmire, "of commercial fertilizers."

The tomato plants are set two feet apart in the beds. Each is trained to a single stem by pinching off all lateral shoots. A heavy string is tied to the plant near the ground, and carried to the rafter above. To this string the plant is trained, and an upright position thus secured.

The day temperature of the tomato house ought to be from 70° to 80°; the night temperature 60°.

The fruiting season begins in three or four months after the sowing of the seed; that is, in from one to two months after the plants are set in the bed of the forcing house.

The blossoms must be pollenized regularly, at least every other day. This is an important matter, bearing directly upon fruit production, and hence upon the cash results of the business.

The fruiting season lasts about three months. In winter it is best to prepare the tomatoes for market by wrapping them separately in paper, and packing in small baskets, using plenty of paper as a lining for the basket. In spring larger baskets are used, with excelsior as packing material.

The profits are quoted by Mr. Shelmire as being "very uncertain." If the cultivator succeeds in getting a crop well set on the vines, and if mildew does not get into the greenhouse, the tomato crop may be regarded as a fairly profitable one.

OTHER POINTS ABOUT TOMATO CULTURE. The Ohio experiment station has been growing tomatoes in greenhouse beds similar to those made for lettuce, about eight inches deep, and sub-irrigated by means of draining tile. It is

considered advantageous to water the plants in this way, rather than on the surface in the usual manner. The estimated yield of under-glass tomatoes is two pounds per plant. In this estimate each plant occupies only one and one-half square feet of space.

It will be observed that Mr. Shelmire's plan allows four square feet of bed space to each plant.

Some tomato growers have found that a hive of bees in the forcing house adds to the certainty of pollenizing the blossoms. The New England growers nearly all employ bees for the purpose of fertilizing under-glass crops.

Fifty cents per pound has been a common New York quotation for winter tomatoes, for some years past.

John G. Gardner, a well-known horticulturist (see article on beans), sows tomato seed July 27 for the first under-glass crop. He expects fruit in ninety days from the planting of the seed. This planting date enables him to have tomatoes ready for market about the first of November, immediately following the end of the out-of-doors crop. He continues to plant seed, at intervals through the winter, planning to end the under-glass fruiting season in July, when home-grown, open-air tomatoes are on the market.

PART III.

CHAPTER XV.

THE MINOR CROPS.

ASPARAGUS,	DAISY,	PARSLEY,
BEANS,	ENDIVE,	POTATO,
BEETS,	MELON,	RHUBARB,
CABBAGE PLANTS,	MINT,	SPINACH,
CARROT,	MUSHROOMS,	VIOLET,
CAULIFLOWER,	ONIONS,	WATER CRESS.
CORN SALAD,	PANSY,	

The list of winter crops treated in the third and concluding part of this little book does not exhaust the under-glass possibilities, for almost all the garden vegetables are capable of production during the whole year, with the facilities and markets now within the reach of American gardeners.

Those mentioned above are the crops now commonly grown in addition to the so-called staples treated in Part II.

We do not mean to belittle the value of any of these things in thus treating them as of minor importance, for every part of the country—every latitude, every altitude, every geological belt—is especially adapted to a certain crop or crops, and success is often a question of learning what is best suited to the location and surroundings of the individual gardener.

This is, indeed, a very fortunate circumstance, since it gives to every culturist in the whole country some special advantage, and by so much adds to the possibility of good profits. Except for this variation the gardener would be ruined by the universal competition.

In other words, we believe that every part of the country can produce something better than any other part of the country.

The common bedding crops are not mentioned in detail in this book because they belong more properly to the open air group, yet the beginner in glass gardening must not make the financial mistake of omitting to provide for such things. There is a brisk spring demand everywhere for tomato, cabbage, egg, celery, pepper, beet, lettuce and other plants needed for early gardening operations. The retail prices of these things amount to many dollars during April and May.

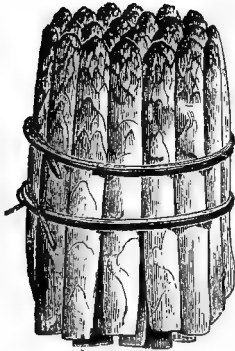
There is a distinct and widely-marked tendency in America toward better gardening; toward the production of crops which lately were regarded as unremunerative on account of their limited sale. The increased demand for what were once called luxuries has resulted in a change that must be recognized as a new era in American gardening. Operations in under-glass work are in progress all over the United States of a size and character undreamed of a generation ago; and while there have been failures among these new enterprises there have been so many conspicuous successes that there is a temptation for ambitious young men to engage in under-glass horticulture.

It requires good brains to manage a large American vegetable forcing house, and the results before us show that brains have won profits in such enterprises.

From among the group of "minor" crops will doubtless come some important business successes.

CHAPTER XVI.

ASPARAGUS.



When it is known that the first home-grown asparagus in the Philadelphia market sometimes brings \$1 per bunch, and that the demand for this succulent vegetable is in no danger of falling off, it is easy to understand why the near-by truckers indulge in a friendly rivalry in their efforts to be first in the market.

The earliest bunches command the highest prices, though for the matter of that the quotations for asparagus in the Philadelphia market are generally satisfactory to the producers all through the spring season, as was the case in 1896.

Asparagus can be forced in several ways. The large roots can be taken from the outside beds in the fall, stored in sand, and carried into the forcing house at any time during the winter. This plan is a wasteful one, as usually managed, and is advisable only under the special circumstances of an extra good market or as a way of getting rid of an old bed.

The roots thus treated are sacrificed, as they do not live long after the violent handling which the plan necessitates; or, if they live, they have but little vigor.

A better way is one which is practiced by the Philadelphia gardeners, and which may be termed a money-producing method. It is to place sashes over undisturbed roots, in the open ground.

To prepare for this work a proper location, with warm exposure, is selected. Three rows of asparagus are planted, the rows two feet apart. They are given the usual treatment, being well cultivated in summer and heavily manured in the late autumn. The greatest strength and development are sought for by the gardener so that the roots will respond to the demands made upon them.

About the third year after planting the asparagus may be forced with glass. Lines of boards are set on their edges on both sides of the bed, about eight feet apart, and eight-foot sashes are laid crosswise, making an ordinary cold frame.

The glass materially hastens the genial soil warmth which must precede the "shooting" of the asparagus, and an early crop is thus secured.

In summer the sashes are removed, and the bed permitted to renew its strength under open-air culture and conditions. The roots are never disturbed.

The labor and expense of this plan of forcing asparagus are so light, comparatively, that the practice is regarded as a profitable one.

No plan which involves disturbing the roots is advisable, except under peculiar circumstances. The feeding roots are long and slender, and are injured or broken if the plant is moved. The cold frame plan, or a modification of it, is the best of the cheap ways of forcing asparagus.



Imperial Long-Standing kale is sowed broadcast in the open ground in August and September, for spring cutting. It must be protected with straw or litter during the winter months.

CHAPTER XVII.

RHUBARB.

Rhubarb seems to be gaining in popular favor, for we hear of rhubarb specialists and their large crops, and we see the construction of great stretches of framework over rhubarb beds that by the addition of sashes become forcing houses in the spring of the year.

Allusion has been made in an earlier chapter to the production of rhubarb under greenhouse benches. Some of the Philadelphia growers follow this plan.

Louis Reichner, Belmont avenue and Ford road, takes roots of the Paragon variety from the open field in the late autumn, packs them a foot apart on the ground under one of his greenhouse benches, and pulls the stalks twice in the early spring. His bed of 1896 was $4\frac{1}{2}$ feet wide by 150 feet long. The roots are permitted to die after use.

The bunches are made of from three to five stalks, and the wholesale price in winter is \$8 to \$10 per hundred bunches.

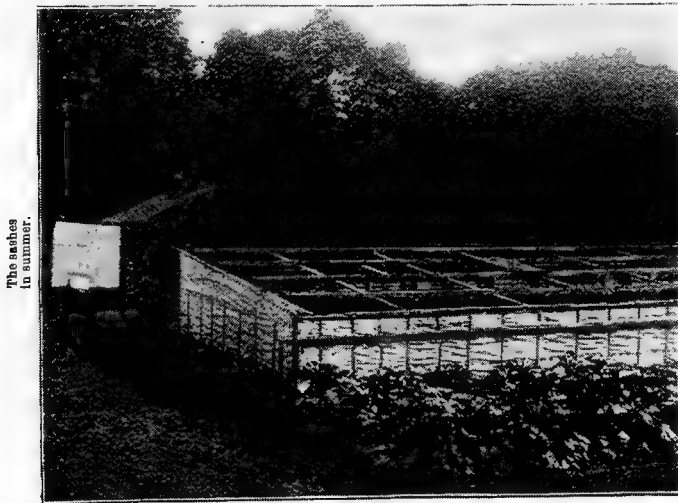
There is a space of about two feet from the top of the rhubarb bed to the bottom of the bench or stage above it; no loss of valuable room. New roots are brought in each year from the open garden.

Daniel R. Comly, of Bustleton (Philadelphia), employs a sash-covered pit, or sunken cold frame, for forcing rhubarb in the early spring months.

John Davis, on Richmond street, Philadelphia, forces rhubarb on the natural level of the ground, where it grows all the year, by raising the sides of ordinary cold frames so as to afford sufficient space for the development of the leaves.

FORCING RHUBARB IN NEW ENGLAND. Our observations in Massachusetts in 1896 brought our camera within

short range of several very extensive rhubarb forcing houses, one of which is partially represented in the engraving. The sides of this house are covered with heavy paper, and provision is made for steam heating. When the sashes are in place the building can be heated quite easily, as the heat is not turned into the house until the winter is nearly over. The general details of construction can be learned from the picture.



RHUBARB FORCING HOUSE OF E. J. FAUNCE, ARLINGTON, MASSACHUSETTS.
[Building 31 x 264 feet.]

This is perhaps a fair type of the great rhubarb forcing houses in New England. They vary in construction. Some are heated and some unheated. In the latter case the glass is merely for protection and for holding the warmth of the sunshine. Some have sloping roofs and some flat roofs. In the latter the rain finds its way from each sash to the ground below.

From an 1896 note book we take the following figures and estimates concerning a rhubarb house near Boston: Sashes needed to cover the framework, 320; rhubarb pulled only once; average yield estimated at 20 pounds to the sash; average price $7\frac{1}{2}$ cents per pound; estimated gross receipts, \$480. This means \$1.50 per sash.

The rhubarb in this case is planted two feet apart each way. It is well cultivated, and fertilized generously with cow manure and hog manure. The glass is put on the house about the middle of February, and removed after a total service of four to six weeks, and then used over radishes in frames. The house is provided with steam pipes. No watering is done. The whole cost, above cultivation and manuring, is the labor each year of handling the sashes; in putting them on and removing them from the framework of the house. Except during the early spring the house is wholly open to the weather. The roots are not moved.

The varieties of rhubarb most commonly grown are Linnæus, Victoria and Paragon. Some growers have a decided preference about variety; others do not know the name of their own strain, depending wholly on cultural methods for success.



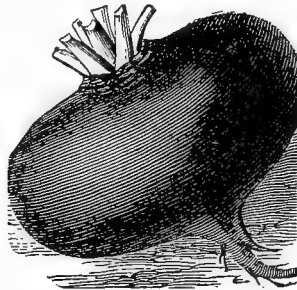
Kohl-rabi or turnip-rooted cabbage is sown in January and February in cold frames by the Philadelphia market gardeners. The Early White Vienna is a favorite sort for sowing at this time of the year. The young plants are set in the open ground for their subsequent development.

CHAPTER XVIII.

BEETS.

Market gardeners sometimes complain that beets are "too slow" for growing under glass with profit. Nevertheless great quantities are thus grown in hothouses, hot beds and frames, and there is reason to call the beet crop a good one for the worker with glass.

When cold frame beets can be sold at the rate of eight bunches for a dollar, wholesale, and hot bed beets at the rate of five bunches for a dollar, wholesale, there is something in the business for the producer. A bunch will contain from five to eight beets.



CROSBY'S EGYPTIAN BEET.

These figures are realized for what may be termed the first and best in the Philadelphia markets, but prices quickly fall. The demand is continual, but Southern competition has injured Philadelphia prices to some extent. Still, this market will always be a good one, capable of absorbing enormous quantities of fruit and vegetables, and willing to pay good prices for prime articles.

Another objection to beet culture under glass, aside from the time required, is the room demanded by the leaves or tops.

To cure this defect several beets have been put on the market which require but little space for their development. Crosby's Egyptian is a recognized stand-by for under-glass work, and Carter's Excelsior is another favorite.

The Philadelphia gardeners sow beet seed in cold frames, in February, in rows eleven inches apart, with lettuce between. The lettuce is off in time to give the beet tops room for development. Thomas Brooks, Jr., one of the most extensive truckers in the Richmond street district, favors Carter's Excelsior for such use in frames.

If beets are wanted in mid-winter they can be had in forcing houses or hot beds. The Boston gardeners sometimes grow beets as a catch crop under their cucumber trellises, in the great forcing houses; but the beet prefers a lower temperature than the cucumber, and does better where it can get plenty of fresh air. Wherever the temperature is too high (say above 65°) the beet shows a tendency to run too much to top. The same is true of the radish.

There cannot be doubt about profit in raising beets in cold frames near a good market. The cost is small and the risk light. Whether beets can be made to pay in hot beds and forcing houses must be determined by the judgment of individuals. It will depend on circumstances.

With the lettuce removed, as suggested in the plan of Mr. Brooks, there would remain say three rows of beets under each cold frame sash. At four inches apart this would be about fifty beets to the sash, which might sell for \$1 or more in early spring. To this, of course, would be added the lettuce sales, and also the value of the spinach cut at Christmas, so that the gross annual sales of the sash might easily amount to \$2 or more under this rotation.

CHAPTER XIX.

CAULIFLOWER.

For a picture of cauliflower the reader is referred to the frontispiece. The same vegetable, in growth, is shown in the interior view of the Reichner forcing house, in Chapter 5. It is a crop of no small importance, both under glass and in the open air.

Cauliflower is worth from 25 to 50 cents per head, wholesale, in the Philadelphia markets in winter. It is a member of the cabbage family, requiring a comparatively low temperature. Its cultural requirements are quite the same as in the case of the radish, the beet, etc. Well started plants set in the forcing house will produce heads in twelve or thirteen weeks.

Cauliflower is a good under-glass crop, but one which requires much room, on account of the size of the plants, which must be set two feet apart each way, in order to secure proper development. Seed sowing may be done at any time in heated structures by amateurs; but market gardeners plan to have their crops mature at certain dates, when good prices are reasonably certain.

The Reichner plan is to sow the seed about the 10th of October, and pot off into 3-inch pots. This makes the plants ready for the forcing beds between Christmas and New Year's, and brings the cauliflower into market in February or March. The Snow Storm variety is used. The plants are set 18 inches by 2 feet in the beds. Other growers favor Snowball, Erfurt, &c., and prefer to set 2 x 2 feet, as above stated. Some of the Boston growers choose to transplant twice, rather than use pots.

Mr. Reichner, who is a successful grower, says: "Lots

of manure, lots of water and plenty of air, and you will have no trouble in growing cauliflower." The temperature must be kept down, or the head will "draw" into an open and undesirable form.

A temperature ranging from 40° to 65° will answer for such crops as cauliflower, radish, &c.; and free ventilation is a requisite.

Beginners and amateurs are surprised to learn that cauliflower seed is worth from 40 cents to \$5 per ounce, depending on the strain; but when the fact becomes known that the seed is extremely minute, and that a packet of the best sort can be had for 25 cents, the price seems more reasonable. The cauliflower seed is so small that a little of it goes a long way, if sown with care.

The cheapest cauliflower is in reality that which experience shows to be the best and surest-heading kind, regardless of the first cost of the seed. We know of nothing at this time superior for forcing purposes to Snow Storm, a variety of ivory whiteness and a good header.

Cauliflower can be started in the fall (September 10 to 20) and "wintered over," the same as cabbage, but it is better to select some other sort than Snow Storm for the purpose, as this one objects to any check or interruption in its growth. Snowball may be safely carried through the winter in frames, but there seems to be a disposition on the part of gardeners toward early spring sowing in frames and hot beds, and away from the practice of "wintering over" which was once so generally in vogue.

Nothing can be more satisfactory than Snow Storm cauliflower if given correct treatment from the date of seed sowing to the time for heading. It will generously repay good management.

CHAPTER XX.

MUSHROOMS.



Mushroom culture can be treated but briefly in the limited space afforded by a single chapter. But the mushroom is a winter crop of so much importance that it cannot be altogether omitted from this book.

And yet it is not, properly speaking, an under-glass crop, because the greenhouse is not the best place in which to grow it; though it is grown to some extent under greenhouse benches. The changes of temperature of the greenhouse are hostile to success with mushrooms. Wherever there is light there is heat, and wherever the light penetrates there are contrasts between day and night temperatures. This is the only reason that "dark places" are better for mushrooms.

The mushroom in nature grows in the open field, in full daylight; but it grows best at a season of the year when the day temperature is on the decrease and the soil temperature makes the night comparatively warm. The ideal temperature for mushrooms is 57 degrees.

Many experimenters have ceased to grow mushrooms on account of the uncertainty of the crop, but this is in reality an argument in its favor, since it tends to insure a good market and good prices for those growers who push on to success. The price for the past ten years, taking an average, has not been below fifty cents a pound; and there is a fair margin of profit to the grower at this figure. Some expert growers have secured an average price of sixty cents,

as the trade is a fancy one, and prices depend largely on success in pleasing a class of rather particular buyers.

The five requisites of success in mushroom culture are : A proper bed, right moisture, good spawn, uniform temperature (near 57 degrees), and good management.

We may at once dismiss two of these requisites by saying that good spawn can be had of any reliable seedsman who knows what he is selling, and by emphasizing the fact that a steady temperature of 55 to 60 degrees is the best that is known. We have three points remaining for consideration : the bed, the moisture, and the management.

The common commercial mushroom is grown in a bed made of horse manure and loam. A wet, soggy bed is to be avoided, as it will rot the spawn. A perfectly dry bed is also to be shunned, as the spawn will no more grow in such a place than seeds will start in a box of dry dust.

The ideal mushroom bed is one in which there is a slow, steady, gradually decreasing fermentation ; a fermentation which by its warmth and vapor quickens the spawn, encourages it to "run" or send out web-like filaments, and which finally puts the bed in the condition of an autumn meadow—a medium filled with a mass or network of spawn.

The whole bed ought to become just what the mushroom "brick" was when it came from the seedsman, except with more moisture. A handful of the material applied to the nose will give an unmistakable odor of mushrooms.

If a heavy shower falls upon a meadow when the mushroom spawn is in a feeble state, only partly "run," the spawn will perish and there will be no crop there in the fall ; and if the impatient gardener applies water to his mushroom bed when the spawn is in its early, weak condition the crop will be wholly ruined.

If nature (in a good mushroom year) be studied and imitated the secret of growing mushrooms will be learned. When the spawn has filled the bed, and the little buttons

begin to appear on the surface, we may safely (though sparingly at first) use the watering pot. Later on the application of water will do no harm. The effect will be the same as that of a warm rain in August or September; there will be a great show of mushrooms.

DETAILS OF MANAGEMENT. Having outlined the end to be attained the method of procedure may be briefly stated as follows :

Select a place (preferably a dark place) where a temperature of 50° to 60° can be maintained. A cellar will answer, though a shed, stable or arch can be made to serve the purpose. An underground situation, like a vault or cave, is an excellent place; perhaps the best of all.

Obtain fresh horse manure to the desired amount, estimating that a ton of manure, after preparation, will make about sixty-five square feet of bed (10 inches deep).

Prepare the manure by stacking, turning, shaking and re-stacking, adding loam at the rate of one bushel of loam to four or five bushels of manure.

Avoid the too free use of the watering pot; the manure must be moist, but not wet. It will require two or three weeks to get the manure in good order.

Make the bed about ten inches thick, tramping or pounding it so as to render it firm and compact. Insert a thermometer and await results.

If the manure is in good order the mercury will rise. Sometimes it will go up to 100° , or even to 120° or 130° . After a time it will begin to fall, dropping slowly or rapidly according to conditions.

On the downward course of the mercury, when 90° has been reached, insert pieces of spawn. It matters little whether they are broken large or small. A brick of spawn ought to be sufficient for six square feet of bed. Insert the pieces say two inches below the surface, and firm the manure about the spawn.

Do not cover the bed until the spawn has been planted for a week or ten days ; then spread a coat of loam an inch thick over the whole bed, and make the surface smooth and firm. If covered too soon the soil will act like a blanket, raise the temperature, and kill the spawn.

Do not apply water until the mushrooms begin to appear, which ought to be in six or eight weeks from the time of spawning. Litter may be used to prevent the surface



END OF MUSHROOM HOUSE OF WYMAN BROTHERS,
ARLINGTON, MASSACHUSETTS.

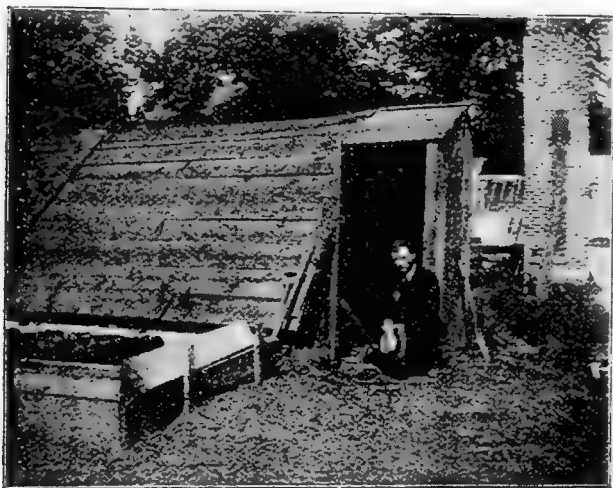
of the bed from drying out too fast, or a fine spray may be thrown on the surface of the bed at intervals, provided the water is not sufficient to sink below the surface.

A crop of mushrooms under the best management seldom exceeds a pound and a half to the square foot. The average crop is nearer half a pound ; and there are many total failures.

John G. Gardner, whose present address is West Conshohocken, Pa., is an expert mushroom grower. He takes the manure almost as it comes from the stables, incorporates a

very large percentage of loam with it, makes deep beds, and controls the heat and moisture so well that he gets unusually large and long crops. The secret of his success is the care and accuracy of his details. He imitates nature.

The Kift mushroom house at West Chester, Pennsylvania, is a building seventy-five feet long by about ten feet wide. It was formerly a greenhouse, with equal double



MUSHROOM HOUSE MADE FROM OLD GREENHOUSE, BELONGING TO JOSEPH KIFT & SON, WEST CHESTER, PA.

pitch north and south. The building for some reason was hard to heat, so without removing the sashes it was converted into a house for growing mushrooms. The glass was simply covered with roofing paper, on top of which hemlock boards were laid, as shown in the picture. The peak of the roof where the boards come together is covered with paper. There is a door in each end of the building, but there are no ventilators. The house is heated with steam. A mushroom bed covers the entire floor, the walk being laid on raised

wooden supports. There is also a raised bed three feet wide along the north side of the building. This makes the total area of the house 975 square feet. The house has produced satisfactory crops of mushrooms for several years.

We give here (page 84) a picture of a large mushroom house visited during 1896. It belongs to the Wyman Brothers, extensive market farmers at Arlington, Massachusetts. Its great length is not shown in the picture.

The construction of the house is very simple. It is made of hemlock boards. It is partly below the ground level. It is heated by steam. The roof is covered with paper and then with salt hay. The beds are made directly upon the ground. They are three in number, with narrow alleys between them for the convenience of those who care for the crop. The width of the house is about 17 feet, and of the beds about 4, 6 and 5 feet, with walks a foot in width.

The way to begin mushroom culture is to appropriate for the trial any underground place that may be available, and that can be heated if necessary in the winter season.

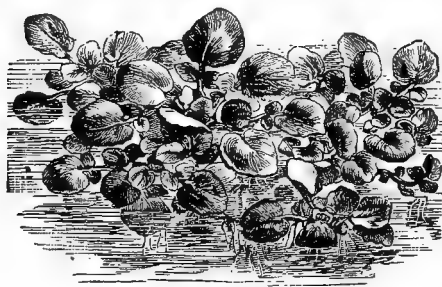
We know of one grower who used an abandoned vault or cave near his dwelling; an underground apartment walled with stone and with an arched ceiling. The temperature stood at 57° or 58° all the year without artificial heat. We have in mind other cases where mushrooms have been successfully grown in house cellars; but there is always an objection to carrying manure into a place under a dwelling house, lest it breed disease.

CHAPTER XXI.

WATER CRESS, BEANS, MELONS, MINT, POTATOES.

The grouping of these five winter crops is artificial, and is a mere matter of convenience. Beans and melons demand a tropical temperature for their quick development; 65° and upward. Mint, potatoes and water cress require less forcing, but can be grown with profit under greenhouse conditions, if near good markets. Water cress is the most important one of the group, commercially speaking, at this time in the winter market at Philadelphia.

WATER CRESS. The illustration shows the vegetable growing in water: it can be grown as well in the soil of a greenhouse bed. It is used in enormous quantities all the year in the large cities, being served with meats in the restaurants.



WATER CRESS.

The culture of water cress in brooks or near spring heads is well understood. It will grow anywhere in

shallow, running water. Glass sashes placed over beds made at or near natural springs will make it possible to obtain fresh water cress all winter.

It can be grown in forcing houses, as stated. The Philadelphia gardeners sow seed (True Erfurt) in October. It is put on the market in pint boxes, packed with the leaves uppermost. The boxes sell at \$5 to \$7 per 100, wholesale. Successional plantings are made, so as to have a fresh supply all winter.

The culture of water cress in beds is slightly different from the culture in running streams. In the former case it must not be made too wet or it will become slimy. In the latter case the constantly changing water removes any such tendency.

BEANS. John G. Gardner, of West Conshohocken, Pa., (formerly of Jobstown, N. J.), mentions Sion House as his best forcing bean. He has also used Long Yellow Six Weeks (a green-podded bean) and Mohawk, but prefers the one first mentioned. A tropical temperature (65° and upward) is needed for beans in the greenhouse. Beans are sold in half-pound and pound bunches in winter, and bring good prices among a certain class of buyers. The demand is a fancy one, and beans cannot everywhere be grown with profit.

A dwarf variety of bean, with long, green pods, known as Best-of-All, is used for forcing purposes by some Philadelphia gardeners. It resembles Sion House in many respects.

MELONS. The Early Hackensack melon is mentioned in the Dreer note books of 1896 as seen in cultivation in the large forcing houses of the Hittinger Brothers, at Belmont, Massachusetts. The crop was in fine condition, with numbers of well-developed melons on the vines. The feasibility of growing the melons to perfection was fully demonstrated. The profit of the operation was not within our reach to determine. The melon belongs to the class of fancy crops, and profits depend almost wholly upon the market in which such things are sold. In some places melons could be forced with profit; in other places the cost would exceed the receipts.

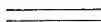
MINT. The cultivation of mint (spearmint) as a greenhouse crop seems to be increasing rapidly, and our note books show that it is now commonly grown in winter for all the large city markets.

It is grown from roots to be had of the seedsmen, or by

the division of the roots of the wild mint of the meadows. It grows in the soil of the forcing house without trouble.

Mint retails at 10 cents a bunch in the early spring. It is used for flavoring meats, especially lamb.

POTATO. It is no new thing for English gardeners to force potatoes in beds and in pots. They use a long, slender kidney potato, which comes to quick maturity. Our note books record a case where a Pennsylvania market gardener in 1896 succeeded in growing ordinary potatoes under glass in time to compete with the new potatoes from the South. He sold the under-glass potatoes at about the same price per half-peck as he afterward obtained per bushel for the out-of-doors product.



Water cress, mint and parsley must be ranked among the profitable minor crops.

CHAPTER XXII.

SPINACH, CORN SALAD, ENDIVE.

These three vegetables have a certain natural affinity, in that all are quite hardy, and all are well suited to cold frame culture.



SAVOY SPINACH.

is ready for the Christmas market, when it is worth from \$2 to \$3 per barrel wholesale at Philadelphia. The round-leaf sorts are preferable. Dreer's Round-Seeded Savoy is excellent



CORN SALAD.

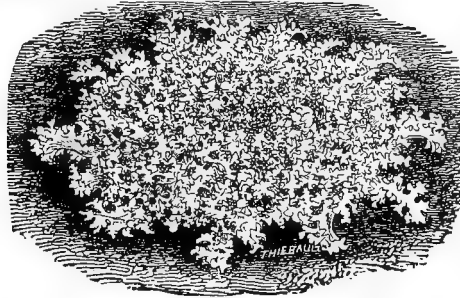
regularly like lettuce, while spinach is broadcasted or sowed in rows. It is sold in the Philadelphia market in consider-

SPINACH. This is the most important member of the group. It is grown in enormous quantities near all the large markets. The seed is sowed in frames (and in the open ground) in September, and the spinach

for fall sowing. The Boston gardeners sell their surplus spinach to the canners, getting 20 cents per bushel for it. Spinach seed germinates quickly, and the plants grow rapidly.

CORN SALAD. This is treated the same as spinach, except that it is often planted

able quantities; perhaps one-fourth or one-third as much corn salad as spinach. It brings 50 cents to \$1 per bushel in Philadelphia at Christmas. The Large-Seeded corn salad is commonly grown.



ENDIVE.

ENDIVE. A variety of endive commonly grown at Philadelphia in fall and winter is the Giant Fringed. The seed is planted late in August for the Christmas market, and the young plants transferred to frames. The wholesale price is six heads for about 25 cents, or 25 heads for \$1. Heads of endive, nicely bleached, are to be seen in all the Philadelphia restaurants in fall and winter. Endive is used as a salad. It is ornamental as well as edible. It is bleached by tying the leaves together or by covering with a piece of slate or wood.

The Giant Fringed may be called the finest of the green endives, and the Green Curled the best of the truly "curled" types. It is also green.

CHAPTER XXIII.

CARROTS, ONIONS, PARSLEY, CABBAGE PLANTS.

This chapter treats of another group of hardy or almost hardy plants. All are adapted to the cold frame, and all are within reach of the amateur gardener. They all figure in commercial operations, and are of considerable importance as money makers.

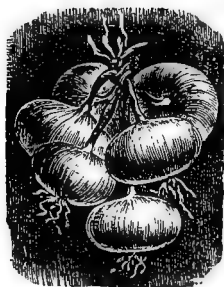


HALF-LONG NANTES CARROTS.

Other gardeners sow the carrots in spring, believing that fall-sown plants are stunted. Half-long Nantes is one of the varieties that is used. Five or six carrots make a bunch, and the wholesale price is twenty-five bunches for \$1. Early Scarlet Horn and Earliest Short Horn are used in hot beds and greenhouses.

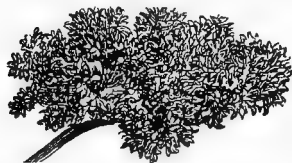
ONIONS. Onion culture under glass near Philadelphia is confined for the most part to starting seed in spring, for

CARROTS. The so-called stump-rooted or half-long sorts are generally used for under-glass work. They are in wide demand for flavoring soups. The Philadelphia gardeners sow carrot seed in frames from October 1 to October 15. The rows are eleven inches apart, with lettuce between; or radishes may be planted between the rows of car-



transplanting to the open ground, and to the production of scullions or shoots. The latter is an important and profitable industry. Half-grown onions are set in frames in the fall and allowed to make roots and even sprouts. In the early spring these shoots make a quick growth, when they are pulled apart, cleaned, bunched and sent to the market as scullions. They bring \$1.50 to \$2 per 100 bunches. Yellow Globe Danvers and other sorts are used.

PARSLEY. This crop ranks with water cress in its importance in the city restaurants in winter. So important is it



that when the home supply fails it is imported from the Bermudas for the Philadelphia market. It grows easily, in cold frames or hot beds. It requires but little heat. It is worth \$3 to \$4 per hundred bunches, wholesale. The curled varieties are preferred. Its culture is simple, as it merely demands a little shelter; good soil and fresh air.

CABBAGE PLANTS. The wintering of Jersey Wakefield and other first early cabbage plants is advisable in some parts of the country, for early spring plants. The seed is sowed in September or October, and the plants set deeply in the soil of the cold frame. If freely aired they will be strong in spring, and ready for quick growth. There is a disposition, as elsewhere noted, to depend more and more on early-sown spring plants.

CHAPTER XXIV.

PANSY, VIOLET, DAISY.

There are two good reasons for introducing the names of three flowers in this brief treatise on under-glass vegetables : they are raised by the market gardeners in the same cold frames with vegetables and sent to the same market, and they represent a good deal of money in the early spring months.



THE PANSY. Pansy seed ought to be sowed in September, and the plants wintered over. It is immaterial whether the seed be sown in the frames or in the open ground. They will live out of doors, if protected with litter, but they will accomplish more growth and store up more strength, and bloom more quickly, if wintered under glass.

Pansies bring 25 cents per basket of six to eight plants in the Philadelphia markets.

We especially recommend not the largest but the richest types, with clear and deep colors and velvety texture. Dreer's Royal Exhibition has been developed with these points especially in view.



THE VIOLET. There is no sweeter fragrance than that of early spring violets, and the blooms come almost for the asking. The roots are not expensive, and the culture is simple. It is only necessary to set the violet roots in frames under glass, and give them abundance of air

during mid-winter. The first warm days of spring bring forth the dormant buds. The heat of the sun is quite sufficient to produce flowers in abundance in February and March. The single, deep-blue variety known as Schoenbrun is in most common commercial use here for cold frame culture.

Luxonne is a larger type of single blue violet.



THE DAISY. The daisy demands the same cultural conditions as the pansy and the violet. It is the least common of the group, yet has many admirers. There is a comparatively new daisy called Snow Crest, bearing large flowers on long stems, which is worthy of trial along with the older kinds.

INDEX.

	PAGE.
Allen's forcing houses	32
Aphides	42
Asparagus	72
Beans	88
Bedding plants	71
Bees	63
Beets	77
Border	38
Boston methods, lettuce	53
Boston methods, cucumber	62
"Boxes"	11
Brooks, Thomas, Jr.	78
Budlong & Co.	13
"Burn" of lettuce	54
Cabbage	93
Carrot	92
Cauliflower	79
Change of soil	16
Cold frame	11
Comly, Daniel E.	75
Corn salad	90
Crop rotation	17
Crops, list of	46, 70
Crosby's "wash room"	36
Crosby, John S.	64
Cucumber	61
Cucumber, Boston methods	62
Daisy	95
Damping off	42
Davis, John	13, 74
Diseases	42
Dreer's one-acre greenhouses	32
Endive	91
English forcing cucumber	65
Esher, John C.	28
Faunce, E. J.	75
February work	18
Fire bed	24
Forcing houses	32
Gardner, John G.	65, 69, 84, 88
Hittinger's irrigation	40
Hot air bed	24
Hot bed	19
Insects	42
Insecticides	43
Irrigation	38
Kale	73
Kift's mushroom house	84
Kohl-rabi	76

	PAGE.
Lettuce	46
Lettuce, Boston methods	53
Lettuce marker	49
"Lid"	16
Maggots	43
Manure, preparation of	15, 20
Melon	88
Minor crops	70
Mint	88
Mushrooms	81
Onions	92
Pansy	94
Parsley	93
Plant diseases	42
Plant lice	42
Potato	89
Prices and profits	18
Principal crops	46
Radish	57
Rawson's forcing houses	33
Reichner's forcing houses	26, 30
Rhubarb	74
Rhubarb forcing house	75
Ridge culture	47
Riverton greenhouses	32
Rotations of crops	17
Sash	9
Sash-covered forcing houses	26
Seed planting	45
Shelmire, Warren R.	67
Shutter	16
Soil and preparation of	15
Spinach	90
"Strings"	11
Succession of crops	31
Summer storage of sashes	14
Summer use of frames	12
Sweet potatoes	24
Tappan's forcing house	56
Tarragon	66
Tomato	67
Under-glass staples	46
Ventilators	29
Violet	94
Wash room	36
Water cress	87
Wind break	15
Winter work room	36
Wyman's mushroom house	85

ADVERTISEMENT.

In the pages of this little book the primary aim has been to present facts; not to put forward the Dreer brand of this or that as being the only thing of its kind on the market.

Nevertheless it is proper to remind the public that we have for sale all the under-glass requisites, including sashes, tools, implements and fertilizers, and all the seeds and roots needed by amateurs and professional gardeners.

We can materially aid beginners in under-glass work in the choice of varieties of vegetables most likely to be profitable for market or satisfactory for domestic use.

Communications will receive prompt attention. Our catalogues can be had on request.

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Seedsman and Florists;

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