

FORCING LETTUCE.

GRADUATING THESIS

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In the last few years, forcing lettuce for winter use, has become a very profitable business in different parts of the country. To be successful, the forcing houses must be located close to a good and steady market. A city of 10,000 ought to demand sufficient lettuce to support a fair sized lettuce business. A town of half that size makes a combined forcing and greenhouse business very profitable.

The sale of lettuce is not necessarily confined to the home market as it can be shipped to very good advantage. For long shipments it is usually placed in barrels, the cabbage headed varieties stem up, while the open bunch is placed on its side. In warm weather the packed lettuce must be ventilated, while in cold weather the barrels or boxes should be lined with paper.

The season for forced lettuce north of the 35 parallel, extends from October to April or even to May. This extends over the greater part of the year, and gives plenty of time to raise three crops. The forcing house does not need to stand idle during the spring and summer, as other things may be grown, such as tomatoes, cucumbers, celery, onions, cabbage, etc. Various things can in this way be started and disposed of to small gardeners for early gardens.

Lettuce may be grown without much trouble if it is carried on in the proper manner. There are several points to be considered, some rather small but nevertheless quite important.

The position and kind of forcing house to be built should first be considered. The best location for a green house would be on a

south to a southeastern slope, as this gives better light and is warmer. A wind break on the north would be a great fuel saver in winter, but this is not essential and should not receive a great deal of attention unless it could be naturally or cheaply supplied.

The position of the forcing house depends chiefly on the kind of house used. A three-fourths or two-thirds span house should run east and west with the long side of the roof facing the south. By a three-fourths or two-thirds span house is meant three-fourths or two-thirds of the roof being on one side. This house is used mostly, and gives the most light that can be obtained. The even span house in the ridge and furrow system is also used a good deal. The even span house has the same amount of roof on each side. In the ridge and furrow system the houses are built side by side, one wall answering for one side of two houses. If there is plenty of room it is better to set them a few feet apart as the snow does not collect in the furrows and the benches are easier filled with soil by having side ventilators. The Canto is used in a small business and is all right if it is conveniently built, but the three-fourths span is more commonly used. There are other forms of green houses, but these are the only practical ones for forcing purposes. Since steam has been utilized for heating purposes, forcing houses are built from 100X20 to 100X30 ft. This makes it convenient, as the more surface that can be had under one roof, the better. For smaller forcing houses the hot water system can be used and it requires less watching and gives a steadier heat. The principle of the hot water system is, have the boilers lower than the heating pipes and with this arrangement one man can tend several houses 100X25 ft. so the expense of labor is very low.

Lettuce may be grown either on the ground or raised benches. The soil used is the same in both solid and raised benches, but the method

of preparation is somewhat different. In solid benches, the old soil should be removed to a depth of about ten or twelve inches and filled in with six inches of rich black soil. The top soil will be the same as for raised benches. Its preparation will be taken up in another place. Care should be exercised in watering, so as not to fill the subsoil with water, or proper drainage may be sacrificed. The entire amount of soil does not need to be removed more than once in four years.

The raised benches are usually the best in the long run as it brings the plants closer to the glass, which is quite essential for all plants. In a twenty foot house the benches would, for the best arrangement, be three and a half feet wide along the walls with an eight foot bench in the middle and with two two and a half foot walks on either side of the middle bench.

The soil in raised benches should be at least five inches deep and must be changed every year. Soil for lettuce should be prepared in the early summer. The best composition seems to be one part fresh horse manure to two parts sandy loam. This should be stacked in June in a low place and near the green house if possible. A stack made alternately of two inches of soil then one of manure is very easily mixed. This should be worked over twice, one in July and once in August. By September if there has been a moderate amount of moisture, the mixture will be in good condition for winter use. After each crop is taken off, the top soil should be removed as it may contain diseases and injurious germs. This should be replaced by a dressing of well rotted manure; to this may be added Sodium nitrate. A pound to fifty square feet is plenty. If too much nitrate is used it will burn the plants off and do more harm than good.

The soil must have good drainage and be well aired. If the top of the ground is kept too wet, lettuce will begin to rot. This is

especially true when the plants get large enough to shade the ground. For good drainage the bottom of the benches should be of slate, porous brick made for that purpose, or six inch boards set an inch apart and with holes drilled through them do very well. These have to be renewed about every five years.

#### Surface Irrigation.

Surface irrigation is probably used more on lettuce than under ground irrigation because it is slightly cheaper. Surface irrigation may be used to just as good advantage as any other, but it requires more care and adds a little extra work.

In the first place the soil should be in good condition before lettuce is planted into the bed. Too much water will cause the soil to sour and remain cold and close. On the other hand, it must not be too dry; anyone can tell about how much water the soil needs. The soil must also be open or loose enough to admit air. It should be loosened with a hoe or dibble and then packed firmly just before planting. This may be done by patting it with a board or some other weight. The amount of water needed by the soil before lettuce is planted is the same, whether surface or underground irrigation is used.

Surface irrigation if used on small plants, is liable to beat them into the ground. This is especially true if hydrant water or water under pressure is used, as the force of the water breaks and bends the plants at the surface of the soil. If small plants are bent to the ground and a little dirt washed over them, they are liable to break their stem by growing too fast, so the stem breaks before it becomes strong enough to pull its leaves free from earth, or it may check the growth or make a crooked plant. Surface irrigation also leaves the surface in such a condition that it will bake. This is detrimental to all plants whether growing in or out of doors, and

must be tended to at the proper time.

Sub-irrigation on the other hand, prevents most of these difficulties. The soil does not bake on top, the plants are not bent, broken or washed under, and the soil does not have to be worked so often. It is a great help to have the air damp in the green house. If surface irrigation is used this does not need to be looked after, as the walls and benches keep the plants nearly saturated with water. In su-irrigation the walks and walls should be well sprinkled at least twice a day or oftener if the weather is hot and dry. Sub-irrigation also tends to air the soil through the irrigation tubes. The best and practically the only device for sub-irrigation is to place long wooden boxes 3X3 inches or one and a half inch gas pipe, with a great many holes bored in them, in the bottom of the benches. These should be about twenty inches apart with one end closed, the other slightly raised and an elbow run to the top of the ground. The beds may be watered by inserting a hose above the elbow, thus giving the desired under ground irrigation.

Lettuce seed should be planted about the first of August for the first crop, and from six to eight weeks before the next crop is to be planted. To save time and space, seed may be planted in shallow boxes in rows from two to three inches apart. Seed should be covered to a depth of about twice its shortest diameter. The top of the seed bed should be level and the boxes set level so that water will not stand in one place. After wetting down, the boxes should be kept in a light, warm place. If the sun is too hot they should be shaded. When the plants get their first true leaves they should be transplanted into plats 2X3 or 3X3 inches apart. They will grow in these until the middle of September or the first of October, when they should be planted in the benches. If transplanted to the bench when too small

they are liable to get a set back of a week or two, which would be a serious loss.

#### Transplanting.

To transplant lettuce properly does not take as much experience as it does careful work. The soil should be quite moist both in the bed in which the plants are growing and in the one to which they are transplanted. The most essential point to note is to remove the plant without disturbing the roots. This may be accomplished by running some sharp, flat implement, slantingly under the plant and then prying it out. A place large enough to receive the plant with its soil attached should be previously made in the new bed. The soil should be pressed firmly about the roots of the plant when in its new position. The method of transplanting is the same whether it be from the seed bed to the secondary flats or from the secondary flats to the permanent bench.

This crop if properly cared for will be ready for market by Thanksgiving when the market is good. This gives plenty of time for two more crops. When the crop is nearly ready for market, the temperature should be kept down to fifty degrees at night and sixty in the day time.

The first and last crops of lettuce may be set a little farther apart and radishes planted between the rows. Radishes will mature in from twenty-one to thirty days, so they will be out of the way by the time the lettuce begins to shade them too much. During the dark and chilly days of winter, however, all the ground and attention should be given to the lettuce.

The kind of lettuce demanded in the market must determine the kind of lettuce grown. This varies with different localities; some demanding a cabbage variety, while others prefer the open, leafy head.

For the cabbage lettuces, the Big Boston, May King, Hot-House, and Belmont may be placed first. For the open head or bunch varieties of lettuce, Grand-Rapids, Hanson, Black Seeded, Simpson, Early Curled Selisia, and Denver Market are the most important for forcing purposes. The Cos lettuce has a rather small market demand, but by some it is considered very good.

#### Tip Burn.

The most common and practically the only pests lettuce has are tip burn and the green aphid. (*Aphis brassicae*) and (*Rhizobius lactuca*). Tip burn is caused by excessive heat. There is no cure, but to make the plant look well, the affected parts should be removed. The simple preventative is to keep the house at a moderate temperature; sixty degrees Fah. being sufficient for day temperature and fifty degrees Fah. at night.

The aphid is quite small and can be best combated by fumigating. Kerosene-emulsion is sometimes used. The formula for kerosene-emulsion is whale oil soap, one-half pound, kerosene two gallons, soft water, one gallon. Dissolve the soap by boiling in water. While hot pour in the kerosene and stir violently for five or six minutes. When ready to use, dilute one gallon of emulsion with nine to twelve gallons of water.

The aphid cannot be poisoned as it does not eat any of the solid portion of the plant but only sucks the juice. Fumigating with tobacco stems is very effective.

The house should be closed and a dense smoke left in the house over night. The apparatus used in burning tobacco stems is very simple and can be made in any tin shop. It is cylindrical in form and may be made any size. A convenient size and one that will do for ordinary green houses, is three and a half feet high and fifteen to



eighteen inches in diameter. The top is left open but a heavy bottom is needed. On the side and at the bottom an opening 6X6 inches should be cut, so as to admit air to the burning stems. A handle at the top makes it convenient to carry. If the smoker is made of heavy sheeting rather than tin, it will last longer, as tin soon burns through. If the green house has a wooden floor, it will be advisable to have short legs put on the smoker, as there is often enough heat on the bottom to burn wood.

A small amount of paper is first put in the smoker, then the tobacco stems. The stems are dampened and then set to burning slowly. Care should be taken to not let the stems blaze, as it will heat the smoke and burn the lettuce leaves. A specially prepared substance called nico-fume is also very effective. It is cleaner and much easier to use.

Electric light is used in forcing by some growers and they report it very successful. However, unless there is considerable gain in having a crop ready for market a week earlier, it will not pay. Again electric light will be of an advantage if spring vegetables are to be forced. It may give a start of two to three weeks during the winter. After the third crop, tomatoes or cucumbers may be forced or onions, cabbage, celery, etc. may be started for early gardeners.

In short, the principal things to consider are as follows: first, the character of the soil. This should be of a sandy nature with less than five percent of clay. If clay is present in much larger quantities the surface of the soil, on becoming dry, will bake and form clods. It also remains wet and cold, which is likely to induce rot. A good lettuce soil, properly supplied with drainage, will allow the surplus water to pass through it and the root will penetrate to

a much greater depth than in a cold, heavier soil.

Secondly, not only having suitable varieties but selecting the plants from the best seed. If a desirable variety has been found it is a good plan to grow your own seed, using only the best. When transplanting, the weak plants should be rejected. In doing this, an even stand will be secured that will be ready for cutting at the same time, thus both securing a better crop and a saving in time.

Thirdly, careful attention should be given to regulating the temperature at night and to ventilation in the day time. The burning of the edges of the leaves is sometimes due to neglect of ventilation. Sixty degrees is high enough for a day temperature and even at this, the houses should be ventilated.

Fourthly, secure a steady growth and guard against a check. Adding some fertilizer as ground bone, sodium nitrate or wood ashes after each crop, increases the size of the plants and hastens maturity.

Fifthly, care for the houses so that insects and fungus diseases cannot gain a foot hold.

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The following are descriptions of some of the best varieties:-

#### GRAND-RAPIDS.

One of the best and most popular sorts for early forcing. Makes large, compact bunch of leaves. Fine quality and handsome appearance.

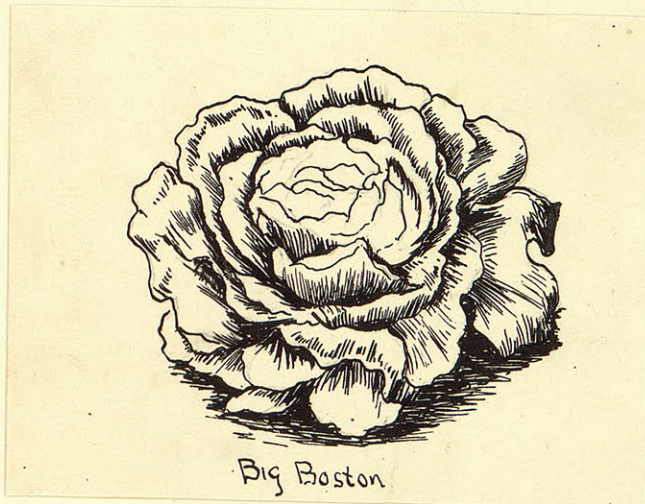
#### PARIS WHITE COS.

The Cos lettuce differs entirely in shape from the other varieties, the head being elongated and of conical form, eight or nine inches in height, and five or six inches in diameter. The outer coloring of this variety is yellowish-green. To be had in perfection it requires to be tied up to insure blanching.



BLACK SEEDED SIMPSON.

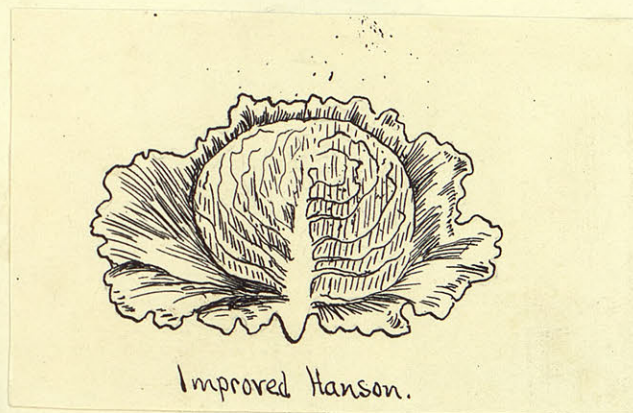
A well known and popular variety. This large-leaved lettuce is by far the most popular of all sorts among market gardeners. Many large planters in the west where a leaf lettuce is in demand, plant this sort exclusively. It forms large, loose leaves of ideal light green color; the leaves are quite thin, very tender and crisp, of fine quality. It is the best "all around" lettuce; one of the finest for use under glass; equally good for frames and early planting; a most excellent sort for summer, as it withstands heat.



Big Boston

## BIG BOSTON OR IMMENSITY.

A very popular variety with gardeners who want a large heading, forcing sort, and also for outdoor winter culture. The plants are large, hardy and vigorous, with broad, smooth, thin leaves which are light green in color, and when well grown are quite tender. This is grown in the south as a winter lettuce.



Improved Hanson.

## IMPROVED HANSON.

This standard variety is one of the best for outdoor summer planting, owing to its wonderful heat resisting qualities. It forms very large, firm heads, which are deliciously sweet, crisp and tender. The outside leaves are green and inside ones almost white. This is a fine market sort for all sections and the very best for the central and western states where there is a great deal of sun.



Denver Market.

## DENVER MARKET.

An early head lettuce, good either for forcing or open ground. The leaves are beautifully curled and crimped like the Savoy cabbage, very crisp and tender and of excellent flavor.



May King.

## MAY KING.

This is a new early lettuce. Plant this lettuce for the first early head lettuce. It is equally good for outdoor planting or forcing. In our trials, this lettuce made a remarkable showing. The outer leaves have a slightly brownish tinge, while the heart is a beautiful yellow, very crisp and tender. For substance and quality melts in the mouth like butter. Its growth is extremely rapid and its fine large heads are ready in advance of any other heading variety.