GROWING PLANTS FOR WAR GARDENS

By C. E. DURST

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Many vegetables produce satisfactory results when the seeds are planted directly in the open, but a number of them must be started under glass in order that they may be grown successfully in the climate of the Middle West. The reasons for this are fully described in Circular 215 of this station. Directions are given there also for making hotbeds and cold frames. It is the object of this publication to describe methods of growing plants for transplanting purposes.

GENERAL DIRECTIONS

The Soil.—The soil used for growing plants should be loose and friable. Rotted manure and sand are often added to give it the proper texture and fertility. An excess of organic matter is likely to favor damping-off of the seedlings, and for this reason many gardeners plant the seeds in soil containing little, if any, organic matter, and shift the plants to richer soil before they begin to need much plant food. Even tho the plants escape disease, an excess of manure is likely to stimulate too rapid growth. The amount of sand and rotted manure to add will depend on the type and condition of the soil. There is little danger of using too much sand, but a large amount of manure is inadvisable. Diseased soil is sometimes sterilized with steam, formaldehyde, or hot water to destroy the organisms.

Plant Flats.—The seeds may be sown directly in the soil of the hotbed, but usually it is better to sow them in shallow boxes called flats, which are then placed in the beds. Handled in this manner, the work of seeding and shifting may be done on tables in a warm shed or basement, where conditions are more congenial than in the open air both for the gardener and for the plants; furthermore, the growing seedlings may be readily changed to another place in case disease threatens or there is danger of the hotbed being flooded.

Flats are easily made of packing-box material. A convenient size for home gardens is 17 inches long, 12 inches wide, and 21/2 inches deep on the inside. The ends should be of 7/8-inch lumber so that the sides and bottoms, which may be made of 3/8-inch pieces, can be nailed solidly to them. It is well to provide a suitable supply of such flats in advance. At least one quarter-inch crack should be left between the pieces of the bottom, or holes should be bored at intervals, to insure good drainage.

Seeding.—No matter whether seeding takes place in flats or directly in the hotbed, the soil should be worked to a fine condition before planting. A sieve may be necessary to remove lumps which cannot easily be pulverized. Do not handle the soil while it is wet.
When the seeds are sown in flats, the flats should first be filled heaping full of soil and the surplus struck off with a straight-edge (see Fig. 1). A short board with a ¾-inch block tacked beneath will be found very convenient for compacting the soil, as shown in Fig. 2.

![Fig. 1.—Striking off the surplus soil in a flat with a straight-edge](image)

![Fig. 2.—Compacting the soil in a flat](image)

It is better to sow most of the seeds in drills rather than broadcast. This insures uniform covering; the seedlings may be treated easily if disease threatens; and the plants may be removed readily for shifting.

Drills are very conveniently made with a thin strip resembling a ruler. By working this backward and forward where the drill is desired and pressing it from side to side occasionally, a drill of uniform depth can be made quickly.

If the seedlings are to be shifted while small, seeding may be quite thick, but if they are to reach considerable size in the flat or bed, the
seeds should be sown more thinly. Covering is best accomplished by pressing the soil over the seeds from both sides with the fingers. The surface should then be slightly compacted and given a light watering.

*Shifting the Plants.*—Shifting is the process of changing the young plants to other beds, to flats, or to pots, so as to give them more room for development. Fig. 3 shows tomato plants which were not shifted, shifted once, and shifted twice, all being of the same age. It is easy to understand which would give the best results. The ideal time for shifting is when the first pair of rudimentary leaves, or cotyledons, is well developed, and when the first pair of true leaves is showing well. The plants will begin to crowd each other and stretch for light about this time.

Pry the plants up in small bunches with a knife or a flat stick, and gently crumble the soil between the fingers so as to leave as many of the small roots intact as possible. *Do not pull the plants.* Fig. 4

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**Fig. 3.—Tomato Plants Not Shifted, Shifted Once, and Shifted Twice, All of the Same Age**

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**Fig. 4.—Tomato Seedlings Removed in the Manner Recommended, and by Pulling**
shows seedlings which were taken up in the manner suggested, and by pulling. The plants should always be handled by the cotyledons rather than by the stems, for the latter are eventually cast off anyway, and no great harm results if they are injured.

If very many plants are to be shifted to flats, it will be worth while to make a planting board, like that shown in Fig. 5. For shifting plants to pots, the soil should contain sufficient moisture to adhere when pressed in the hand, but not enough to be sticky. In making the first shift to small pots, first fill the pot heaping full of soil and strike off the surplus. Insert the forefinger of the right hand at the side of the pot, holding it perfectly rigid, press it over until the center of the pot is reached, and withdraw. Next insert a seedling to the proper depth and fill the hole with fine soil. The operation is finished
by pressing the soil down around the outer edge of the pot with the thumbs.

Shifting the second time, in cases where this is advisable, should take place when the plants begin to crowd each other in the flats, or before their roots have become "pot-bound" in pots. Plants in flats are conveniently taken up and placed in their new positions with a garden trowel.

In shifting the second time to pots, a small handful of cinders or a piece of broken pot, concave side downward, is placed over the hole at the bottom to insure good drainage. A small quantity of soil is usually placed over this. The plant is removed from the smaller pot by turning it upside down and tapping the edge of the pot on a table or box. The rim of loose soil at the upper edge is often stripped off, so that it may be replaced with fresh earth. The plant is then set in the center of the larger pot, soil is filled around it, and compacting is accomplished with the fingers or by a blunt piece of wood.

All plants should be watered after each shifting. This work should be done out of the sun and cold, so that the plants will not suffer. All pots, no matter what the size, should be plunged in soil or sand in the bed to prevent evaporation thru the porous material.

Sterilizing the Flats and Pots.—Flats and pots are likely to become carriers of plant diseases in time, and for this reason it is advisable to sterilize them each spring before they are used. Immersion for 15 minutes in a solution of one pint of commercial formaldehyde (40 percent) to 25 gallons of water will destroy any organisms there. It is important also that disease-free soil be used for growing the plants; if infection is suspected, the soil should be sterilized.

Starting Plants for Small Gardens.—For a small home garden, a sufficient number of head lettuce, cabbage, cauliflower, kohlrabi, celery, eggplant, tomato, and pepper plants can usually be started in a flat placed in a sunny south window. Here they may be handled for the first two or three weeks, or until the first shift will need to be made. The use of this method makes it unnecessary to construct the hotbed so early, and it is possible to employ a surface hotbed for receiving the plants. A living-room temperature, of course, will be somewhat warm for the cool-season crops, but with fairly thin seeding, they will endure it without serious effect for a short time.

DIRECTIONS FOR HANDLING EACH CROP

Of the vegetables ordinarily started under glass, lettuce, cabbage, cauliflower, celery, kohlrabi, radish, beet, and onion are cool-season crops. The tomato, pepper, eggplant, and sweet potato are warm-season vegetables. Muskmelons, cucumbers, lima beans, and sweet corn, which are sometimes started under glass, also belong to the warm-season group. If only one hotbed is at hand, therefore, it should be
Started under glass March 1, shifted to 2½-inch pots, transplanted to open April 10

Started under glass March 1, shifted to flats 2x2 inches, transplanted to open April 10

Seed sown in open April 1, plants thinned in rows to one foot apart

Fig. 7.—Three Methods of Growing Head Lettuce
FIG. 8.—BEET AND ONION PLANTS SHEARED BEFORE TRANSPLANTING

FIG. 9.—CAULIFLOWER PLANTS IN FLAT READY FOR TRANSPLANTING
partitioned so that two sets of conditions can be maintained (see Temperature, page 15). Pe-tsai and endive, altho commonly transplanted, are usually started in the open.

In the following table the dates for sowing the seeds and for transplanting to the open are given, as well as the number of shifts and the most satisfactory methods of handling the plants. The dates are especially adapted for central Illinois. In southern Illinois, transplanting should take place about ten days earlier, depending on the season, and in northern Illinois about ten days later. In all sections the dates for transplanting will need to be varied somewhat to meet seasonal differences. Directions for each crop follow the table.

**DIRECTIONS FOR GROWING TRANSPLANTED PLANTS**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Dates of sowing</th>
<th>No. of shifts</th>
<th>Distances in flats or beds, or size of pots</th>
<th>Dates for transplanting to the open</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onions</td>
<td>Feb. 1</td>
<td>0</td>
<td>Not shifted</td>
<td>April 10</td>
</tr>
<tr>
<td>Beets</td>
<td>Feb. 20–Mar. 1</td>
<td>0</td>
<td>Not shifted</td>
<td>Apr. 10</td>
</tr>
<tr>
<td>Head lettuce</td>
<td>&quot; 20–&quot; 1</td>
<td>1</td>
<td>1/2&quot; in flats or beds</td>
<td>Apr. 10</td>
</tr>
<tr>
<td>Early cabbage</td>
<td>&quot; 20–&quot; 1</td>
<td>1</td>
<td>1&quot; in flats or beds</td>
<td>Apr. 10</td>
</tr>
<tr>
<td>Early cauliflower</td>
<td>&quot; 20–&quot; 1</td>
<td>1</td>
<td>1&quot; in flats or beds</td>
<td>Apr. 10</td>
</tr>
<tr>
<td>Kohl-rabi</td>
<td>&quot; 20–&quot; 1</td>
<td>1</td>
<td>1&quot; in flats or beds</td>
<td>Apr. 10</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>March 1</td>
<td>2</td>
<td>2&quot; &amp; 4&quot; in flats or pots</td>
<td>May 15</td>
</tr>
<tr>
<td>Peppers</td>
<td>&quot; 1</td>
<td>2</td>
<td>2&quot; &amp; 4&quot; in flats or pots</td>
<td>May 15</td>
</tr>
<tr>
<td>Eggplants</td>
<td>&quot; 15</td>
<td>2</td>
<td>2&quot; &amp; 4&quot; in pots</td>
<td>June 1</td>
</tr>
<tr>
<td>Celery</td>
<td>&quot; 15</td>
<td>2</td>
<td>2&quot; in flats</td>
<td>May 15</td>
</tr>
<tr>
<td>Summer cabbage</td>
<td>&quot; 15</td>
<td>1</td>
<td>2&quot; in flats or beds</td>
<td>May 15</td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>April 20</td>
<td>0</td>
<td>Not shifted</td>
<td>June 1</td>
</tr>
<tr>
<td>Muskmelons</td>
<td>&quot; 20</td>
<td>0</td>
<td>Not shifted</td>
<td>May 15</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>&quot; 20</td>
<td>0</td>
<td>Not shifted</td>
<td>May 15</td>
</tr>
<tr>
<td>Lima beans</td>
<td>&quot; 20</td>
<td>0</td>
<td>Not shifted</td>
<td>May 15</td>
</tr>
<tr>
<td>Sweet corn</td>
<td>&quot; 20</td>
<td>0</td>
<td>Not shifted</td>
<td>May 15</td>
</tr>
<tr>
<td>Late cabbage</td>
<td>&quot; 20</td>
<td>0</td>
<td>Not shifted</td>
<td>June 15</td>
</tr>
<tr>
<td>Pe-tsai</td>
<td>July 1–15</td>
<td>0</td>
<td>Not shifted</td>
<td>Aug. 15</td>
</tr>
<tr>
<td>Endive</td>
<td>&quot; 15</td>
<td>0</td>
<td>Not shifted</td>
<td>May 15</td>
</tr>
</tbody>
</table>

**NOTE.**—A list of desirable varieties for home vegetable gardens is presented in Circular 198 of this station.

**Onions and Beets.**—Larger onion bulbs and earlier beets are secured if the plants are started in hotbeds. The seeds should be sown directly in the bed in drills about 1/2 inch deep and 3 to 4 inches apart. It will not pay to shift these plants. The Prize Taker onion and the Crosby Egyptian beet are good varieties for this purpose.

**Lettuce.**—Head lettuce can rarely be grown successfully in the Middle West by planting the seeds in the open. By starting the plants in hotbeds from four to six weeks in advance, little trouble is experienced in producing an excellent crop. The seeds should be sown in drills about 1/4 inch deep in flats or directly in the bed. This crop does not transplant to the open readily and the best stand and finest product are obtained when the seedlings are shifted to 2 1/2- or 3-inch pots (see Fig. 7). It is especially important that the plants be
FIG. 10.—A SPECIMEN OF GRAND RAPIDS LETTUCE

FIG. 11.—A SPECIMEN OF KOHL-RABI
set with the crowns just above the surface. More than one shift is inadvisable. Big Boston is an excellent variety.

Leaf lettuce may be grown successfully by planting the seeds on the outside, but the large, leafy heads are obtained earlier if the plants are started under glass. The plants should be shifted once to pots or flats, or directly in the bed. Grand Rapids is the best forcing variety.

*Cabbage, Cauliflower,* and *Kohlrabi.*—These three crops require the same conditions for growth. The seeds for the early crop should be sown in a flat or in the bed in drills ¼ inch deep. One shift is sufficient, and the plants give excellent results when shifted to flats or directly to the bed. They should be set 2x2 inches apart and a little deeper than they stood in the bed or seed flat.

Cabbage for the summer crop is started and handled in the same way. Late cabbage and cauliflower are commonly sown thinly in drills on the outside in moist soil; if the seed is sown thinly, shifting will be unnecessary. These crops are not always a success late in the season, especially in central and southern Illinois.

*Tomato.*—The tomato does very well when the seeds are sown in drills in a flat or in the bed. Good results are obtained when the plants are shifted twice to flats or to the bed, allowing 2x2 inches and 4x4 inches, respectively. Still better results are secured if the plants are handled in 2- and 4-inch pots. The very best results are obtained, however, when three to four seeds are sown directly in a 2- or 2½-inch pot. The seedlings should be thinned to one plant per pot when well started, leaving the best one. The plants are shifted to 4-inch pots when all the soil is occupied, or when they begin to crowd each other in the smaller ones. For an extremely early crop, the plants are sometimes shifted a third time to 6-inch pots. In shifting tomatoes they should each time be set a little deeper than they stood before.

*Pepper.*—Peppers are conveniently started in drills in a flat or in the bed. The plants transplant readily, and as good results are secured when they are handled twice in flats, allowing 2x2 inches and
4x4 inches, as when shifted to pots. Setting should be slightly deeper each time the plants are shifted.

**Eggplant.**—The directions given for the tomato will apply also to the eggplant. This vegetable does not transplant readily and the handling of the plants in pots is especially advisable.

**Celery.**—Celery seed is very small and delicate, and requires special treatment. Fill a flat in the regular way, and compact as usual. Instead of sowing in drills, broadcast the seed thickly. Then scatter enough fine soil over the surface merely to imbed the seeds, but *not enough to cover them*. Water lightly with a fine-rose sprinkler, cover the flat with a piece of cloth or newspaper cut to fit snugly inside the flat, and then moisten the covering. The cover keeps the surface
moist, which is essential for the germination of the delicate, shallow-planted seeds. Sometimes later waterings are applied over the cover, but it is better to remove the cover each time and replace it after watering. When a majority of the seeds are fairly well germinated, the cover should be removed. It is possible to start several thousand celery plants in a small flat by this method.

It does not pay as a rule to shift celery plants more than once, but one shift is absolutely necessary, for the plants would become tall and thin and almost worthless in the seed flat. It is not feasible to make the shift when the first pair of true leaves appears. The change is usually made when the plants have become larger, but before they have begun to crowd and stretch. They are best shifted to flats, allowing 2x2 inches. It is very important that celery plants be set at the same depth they were in the seed flat.

**Sweet Potato.**—Sweet-potato plants are started from medium-sized potatoes of the previous year's crop. These are planted directly in the bed. To prevent rot from spreading to all the potatoes, should it start in any portion of the bed, the potatoes are placed about ½ inch apart. They should be covered with about 1½ inches of soil or sand. Bottom heat is necessary, tho it should be mild. A manure hotbed which has already grown a crop of earlier plants provides excellent conditions. Water should be used sparingly, if at all, until the plants appear, after which there is no danger of rotting the potatoes. When the first crop

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**Fig. 15.—Bedding Sweet Potatoes**
of plants is pulled, the bed should receive a sprinkling of soil or sand and a copious watering; a second crop of "slips" will then soon appear. Shifting is unnecessary. Sweet potatoes are not successful in northern Illinois or in the flat prairie soils of central Illinois.

_Muskmelons, Cucumbers, Lima Beans, and Sweet Corn._—These crops do not transplant readily like tomatoes and cabbage, but by planting the seeds in a container so that the plants may be transferred to the field without breaking the earth from the roots, a better stand results, earlier crops are secured, and the vine crops have a better chance against the striped beetles. In commercial gardening, specially made dirt bands are used, but for the home garden as good results can be obtained from tin cans with the bottoms melted off, strawberry boxes, pots, or inverted squares of sod. From three to five seeds should be planted in each container. In central Illinois, planting should occur April 20 to 25. The plants can be handled in these containers for about three weeks; thus they will be ready for the open garden May 10 to 15, which is the proper outdoor planting time for these crops.

![Image of a man working in a garden]

**FIG. 16.—MUSKMELONS STARTED IN DIRT BANDS**

_Pe-tsai and Endive._—Pe-tsai and endive are grown mainly in the fall. Pe-tsai goes to seed in the spring without forming a head, and there are so many other excellent salad crops available at that time that endive is not popular. These two vegetables, especially the former, are excellent ones for fall use, and deserve a wider planting in home gardens. Rich soil, plenty of moisture, and planting at the right time are the secrets of successful culture.

The seeds should be sown about July 1 to 15 in moist, cool soil, either in a carefully selected seed bed or in drills directly in the open.
garden. In the former place, the plants are often shaded from the hot sun by covering them with brush or a lattice frame, and may be watered if necessary. The seeds should be sown thinly. No shifting is necessary, the plants being transplanted directly from the seed bed to the open garden.

When sown in drills in the garden the plants are merely thinned to 10 or 12 inches apart in the row when they begin to crowd, the thinnings being transplanted to other rows. The plants should be transplanted to about the same depth they stood previously.

Growing Lettuce and Radishes to Maturity.—Leaf lettuce and the small globe-shaped radishes may be grown to maturity in the hotbed by sowing the seeds thinly in drills 4 to 5 inches apart. A finer lettuce crop is obtained if plants four to five weeks old are used; these should be set about 8x8 inches. Grand Rapids is the best variety of leaf lettuce for forcing, and Rapid Red is a good variety of radishes.

Head lettuce may also be grown successfully in a hotbed. The plants should be set about 10x10 inches directly in the soil of the bed.

CARE OF THE GROWING PLANTS

The plants should be handled during growth so that a slow, steady development will be encouraged. It is easy to force plants into rapid growth, but size without stockiness is undesirable.

Temperature.—If both cool-season and warm-season crops are to be grown in one hotbed, the bed should be partitioned so that two sets of conditions may be provided. The cool-season crops should be kept at from 45° to 65° F., while for the warm-season plants a temperature of 60° to 80° should be maintained.

Watering.—Water should be applied in the morning on bright days so that the leaves and stems of the plants will become dry before night. Apply sufficient water to wet the soil thoroughly and then wait until it is needed again, rather than apply light sprinklings frequently.

Ventilation.—Ventilation should be provided on warm days by propping up the sash on the side away from the wind. If it is too cold outside for the sash to remain propped up for any length of time, raise the sash for a minute or two at a time several times during the day. In any case, ventilation should not be continued after the air begins to become chilly in the evening.

Protection in Cold Weather.—Early in the season the beds will require extra cover at night besides the sash, and sometimes throughout the day during cold weather. Various kinds of covers are described in Circular 215. Until the weather becomes fairly warm at night, manure should be banked over the edges of the bed each evening, and in extreme cold, it should be spread over the entire bed. The extra covering and the manure should be removed in the morning as soon as the outside temperature rises above freezing, and they should be
replaced in the evening before the temperature lowers to that point. During late spring no extra cover or manure is required as a rule.

*Damping-off.*—Some of the seedlings are very likely to be destroyed by "damping-off." This is due to soil diseases which attack the stems at the surface of the ground. Damping-off is most destructive under moist, warm conditions. Such conditions should therefore be avoided as much as possible. Soil with an excess of rotting organic matter or manure is undesirable. Sulfur or sand distributed between the drills discourages the diseases. In severe attacks the healthy plants should be shifted to fresh soil at once. The vegetables most likely to be attacked are eggplants, celery, and lettuce, although cabbage and tomatoes are sometimes affected. (See Fig. 17.)

![Fig. 17.—Eggplant Seedlings Affected by Damping-off](image)

**HARDENING OFF**

No plant should be taken directly from a hotbed and exposed at once to open weather conditions. The change should be made gradually. This may be accomplished by first removing the sash on warm days, then on cooler days, then on warm nights, and finally on cool nights. With plants shifted to flats, however, it is better to move them to cold frames covered with glass and gradually harden them off there. The cool-season plants may finally even be subjected to a light frost, but the warm-season crops should never be exposed to so low a temperature. The plants should be given only enough water to keep them healthy, so that they will become accustomed also to the drier conditions of the open field. Do not be surprised if the cabbage plants turn purple and the head lettuce to a bronze-red color. These are indications of well-hardened plants.¹

¹Directions for transplanting plants to the open are given in Circular 198.