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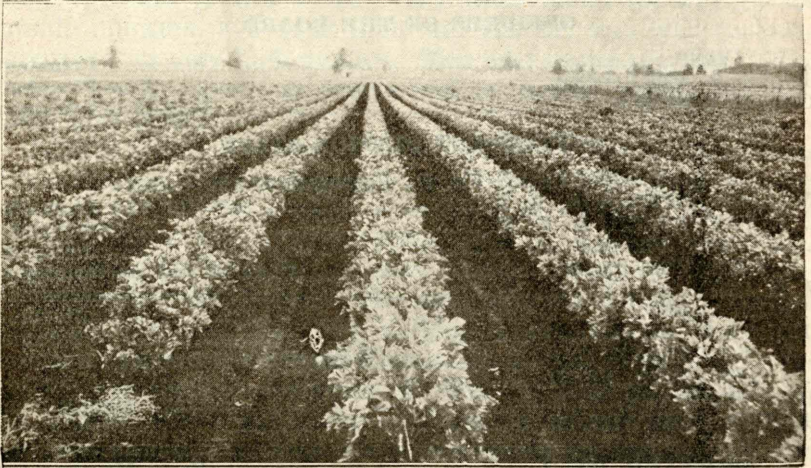
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CELERY CULTURE FOR UTAH

By
T. H. ABELL



CIRCULAR NO. 47

Utah Agricultural College
EXPERIMENT STATION

Logan, Utah

September, 1922

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CELERY CULTURE FOR UTAH

By

T. H. ABELL,

Assistant Professor of Horticulture, U. A. C.

INTRODUCTION

At one time practically all the celery consumed in Utah was shipped from California and eastern states. It was soon discovered, however, that celery could be raised in Utah, and as the population increased more and more acres were utilized in the production of this crop. Very little found its way to the outside markets, but what little did get out was well received because of its very high quality. Men who travel say that "Utah Celery" on the menu on trains and in hotels means the best there is in celery.

Within recent years several carloads have been shipped from this state, and there appears to be a rapidly increasing demand for more. With the growth in celery culture came the trial of many varieties, and at some unknown time, the introduction of a variety or varieties of superior quality variously known as "Chinese" or "Salt Lake." The source is not definitely known. However, they are popularly supposed to be "sports" of Giant Pascal. Recently the State Horticultural Society of Utah gave one of the "sports" the name of "Utah." This is undoubtedly the product which has given Utah-grown celery such a good reputation since it is crisp, white, not overlarge, not stringy, and has a sweet "nutty" flavor not usually found in other varieties.

Natural conditions in this state, particularly in the territory adjacent to the Great Salt Lake, are favorable to the culture of a crop of high quality. There are many acres of ideal celery soil, the average temperatures in the fall growing season are comparatively low, a condition which favors celery; and there is a good supply of irrigation water to keep the plants in a moist, continuously growing condition.

Summarizing, it may be said that Utah has the variety, the proper natural conditions, and the market. Added to these incentives there is now a fourth and very insistent reason for raising celery in this state. There are many acres of rich, high-priced land to which there is being applied comparatively high-priced water, a combination which requires a very profitable crop if the owner is to continue in the farming business. Celery is one of the crops which answers the requisite of being highly profitable.

These four causes have resulted this year in a great increase in the acreage of celery in Utah, and quite naturally a large part of this area is held by growers who have had little or no ex-

perience with the crop. The total acreage (1922) has been roughly estimated at 300.

If the reputation for high standard of quality of Utah celery is to be maintained in the future, it is imperative that every stalk which leaves the state this year be up to the required standard. Since the crop requires considerable skill and experience in handling, the new growers are asking for advice to aid them in bringing their crop to the harvest in proper condition.

It is with the idea of giving this help for this and future years that this information is being published.

HISTORY OF THE CELERY PLANT

The celery is a biennial plant, a native of the marshes near the coasts of Europe, Africa, and Asia. It grew wild in those regions in ancient times and was not considered edible until after the Middle Ages. It was first grown for table use in the lowlands of England and France. About 1880 two new self-blanching varieties were introduced which gave new impetus to the industry. After that many new varieties and the introduction of boards for blanching have given it a widespread culture and use. Today the culture of celery is carried on over such a large area that it is found on the market practically every day of the year.

FACTORS FOR QUALITY IN CELERY

Experience and experimentation have proven that the following conditions are necessary for the production of high quality in celery:

1. Good seed of high quality parentage.
2. A cool-growing season, especially during blanching.
3. A continuous, medium, rapid growth without check.
4. High nitrogen content of soil.
5. Fairly large quantity of water continuously available.
6. A medium amount of light (either too intense or too little light induces stringiness.)
7. Blanching with the exclusion of light but not air.

There are several ways of producing these conditions. Some methods are successful but expensive. It shall be the attempt in this circular to describe those methods which are generally accepted as successful and at the same time as economical as possible of materials and labor.

CELERY SOILS

Since celery is a native of the marshy lands it does best on soil which resembles marshy land. The soil should have a high organic content, be retentive of moisture, and there should be a sufficient supply of water at all times. These conditions may be secured over a wide range of soils. Much of the valley bottom lands in this state conform to the requirements. Any rich, black, or sandy loam with the addition of stable manure or green manure can be made to conform nearly enough to produce excellent crops. Unless there is an abundant water supply, difficulty will be encountered on lands which have a sandy or gravelly quick-draining subsoil. Clay, gravel, or sand are to be avoided.

Small quantities of alkali in the soil will not harm celery. This does not mean that any alkali soil will raise good celery, but if the other conditions are fulfilled a little alkali does no damage to the crop.

Best results are secured on level land.

FERTILIZERS

Most of the soils in which celery is raised need some added fertility. It is hard to find anything superior to stable manure for this purpose. One grower uses it at the rate of 25 tons per acre. The exact amount to use will depend upon the soil in question. At any rate, a little is better than none.

Few recommendations can be made as to the use of commercial fertilizers, their content, or amount. No doubt a fertilizer high in nitrogen will prove beneficial in many cases. Manure furnishes this, but more may be needed on some soils. One grower is using a commercial mixture of 4 per cent nitrogen, 6 per cent phosphoric acid, and 5 per cent potash at the rate of 1000 pounds per acre, but the results are not definite enough to recommend it for general use. The Department of Horticulture hopes to inaugurate some work along this line in the near future.

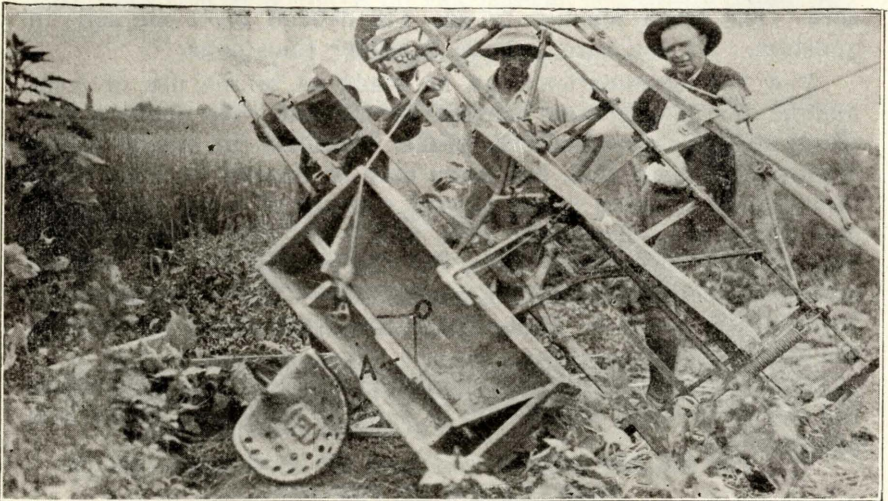
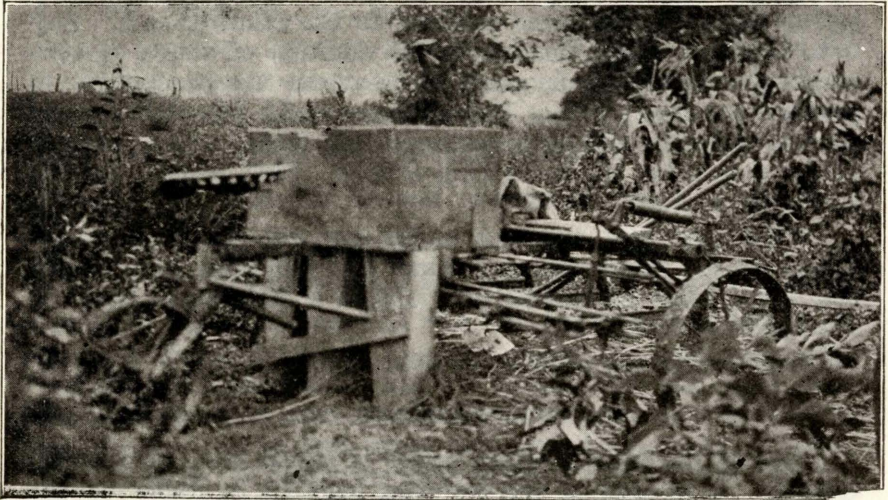
If commercial fertilizer is applied in a strip 2 feet wide where the row is to come, about half as much is needed as where it is broadcasted.

PREPARATION OF THE SOIL

Land for celery should be plowed at least 8 inches deep—10 inches is better. Fall plowing will put the land in better shape than spring plowing. If manure is to be applied, it is best plowed under in the early fall. In the spring the surface should

be loosened with a disk or spring-toothed harrow and the clods broken up.

Although it is possible to raise an early crop before planting late celery, it is considered best to rest the land during the spring, keeping the weeds killed and the surface cultivated.



Two views of a home-made fertilizer distributor. The outlet is a crack (O) about $\frac{3}{8}$ inch in diameter. The agitator is a board (A) from the edge of which extend several nails down to the outlet, and is moved by hand. The fertilizer is applied only where the row of celery is to be.

Just before preparation for planting the soil is loosened with a spring-toothed harrow. Plowing at this time makes it too loose.

Experience has shown that applying manure broadcast in the spring or summer before planting causes rusting of the leaves because the decaying manure in the soil comes in contact with the plant in blanching. If manure is not used until spring it should be applied in a dead furrow where the row of plants is to come and covered with about 6 inches of soil. In this way no manure can come in contact with the leaves of the plant.

One grower who plants in trenches plows 6 back furrows which leaves high ridges with deep hollows or dead furrows between about 6 feet apart. He cleans this trench out and applies manure in it, then covers the manure by plowing one furrow from each ridge. This soil in the trench is leveled, irrigated to settle both soil and manure, worked up again into fine condition, and then furrowed with two furrows about 18 inches apart. This leaves a ridge between the furrows. The plants are set in the water-line on each side of this ridge, making the double row 10 to 12 inches apart.

Another and perhaps easier method used by a grower who plants on the level is to plow a double furrow, leaving 10 inches between the two. Manure is put in the furrows and covered by the plow. The soil over the manure is then leveled and commercial fertilizer applied. A planting furrow is then made in the 10-inch strip between the furrows so as not to tear up the manure.

The planting furrow may be made with an ordinary one-horse potato hiller supplied with 2-foot wings to shove away the soil which the hiller throws up.

TRENCH vs. LEVEL PLANTING

These are the two systems in use and both are used successfully; both methods have good points.

If the blanching is to be done largely by hand the trench planting is best because it is easier to pull dirt down than to lift it up.

If the blanching is to be done with a hiller, level planting is more successful since the hiller is designed to work either on the level or in a ditch.

If there is any possibility that the irrigating water is not easily kept in a furrow, the trench planting is inadvisable since the plants are often washed out or covered with mud. This is not so liable to happen with the level planting. Mud in the heart of a celery plant when it is young invariably checks its growth or kills it outright.

Where there is enough subirrigation so that no furrow irrigation is required, such trouble will not be encountered in the trench method.

It may be well to remark here that level planting is the more popular method in other celery-producing states.

SEEDING

The seed should be the best obtainable. Growers get from 2500 to 25,000 plants from an ounce of seed, so the amount of seed necessary will depend upon its quality.

For the early crop of celery, seed may be sown the latter part of February or early in March in hotbeds which have lost most of their heat. Too much heat on celery seeds rots them and they fail to germinate.

For the late crop seeds may be sown in an open seed-bed from April 15 to May 1, giving them about 8 to 10 weeks from seeding to setting out. The soil should be fertile and strengthened with some well-rotted manure. The soil should be worked into fine tilth and leveled until perfectly smooth, or water will settle in the low spots and ruin the plants.

The seeds may be planted in rows or broadcast. If damping-off is encountered the row method is best. Experience is necessary to learn just how thickly to plant. The seed is covered about $\frac{1}{8}$ inch deep with fine soil.

It is a common method to sift the covering soil thru a sieve made of common window screen wire. Water should not be applied directly to the surface of the soil after the seed is sown since it is planted so shallow as to be quite easily washed out. The soil should have some protective covering until the plants have begun to show thru. Either burlap or finely pulverized old stable manure is suitable. One grower in the east uses hog bristles successfully; he rakes them off and stores them after the plants are up and uses them year after year. Anything porous and without weed seeds is suitable for this purpose.

The soil must be kept moist all the time or these shallow planted seeds, if sprouted, will die. The plants will begin to come up in 2 to 3 weeks, when the protective covering must be removed.

RAISING THE SEEDLINGS

The seed-bed should always be moist enough to keep the seedlings growing continuously without any check. Too much water, especially at night, may cause the damping-off fungus to start. This disease attacks the young plant at the surface of the ground causing the plant to wilt permanently. When this

occurs the affected plants and soil and those adjacent should be dug up and carefully removed so as not to infect the rest of the bed. To avoid this trouble it is safest to water early in the morning, thus giving the sun a chance to dry up the surplus moisture before night.

When the second leaves appear the plants may be transplanted to stand 2 inches apart each way. This gives more sturdy plants than merely thinning but is not considered economical. Nearly as good results may be obtained by thinning so the plants stand 1 to 2 inches apart, to prevent them from crowding and becoming spindling, and root pruning with a long sharp knife to break off the tap root and cause a more bushy root system to develop. Such a root system is not so easily damaged as a long tap root would be in moving to the field.

Plants for the early crop should be gradually accustomed to wind, rain, sun, and cold before setting in the field. This "hardening-off" tends to prevent any loss from checking the growth when set in the field. Plants grown in the open seed-bed will, of course, be accustomed to outdoor conditions.

Although a light frost will do celery plants no harm, a heavy frost may give them a severe check. It has been thought to cause them to go to seed. Any kind of check to the growth is liable to cause "seeders", so should be carefully guarded against.

Just before the plants are dug for removal to the field they are well watered. If the plants are large it is well to clip off a few of the upper leaves to balance the root pruning which always occurs. Sheep shears are useful for this purpose. The longer roots should also be pruned off. Excessive pruning is undesirable.

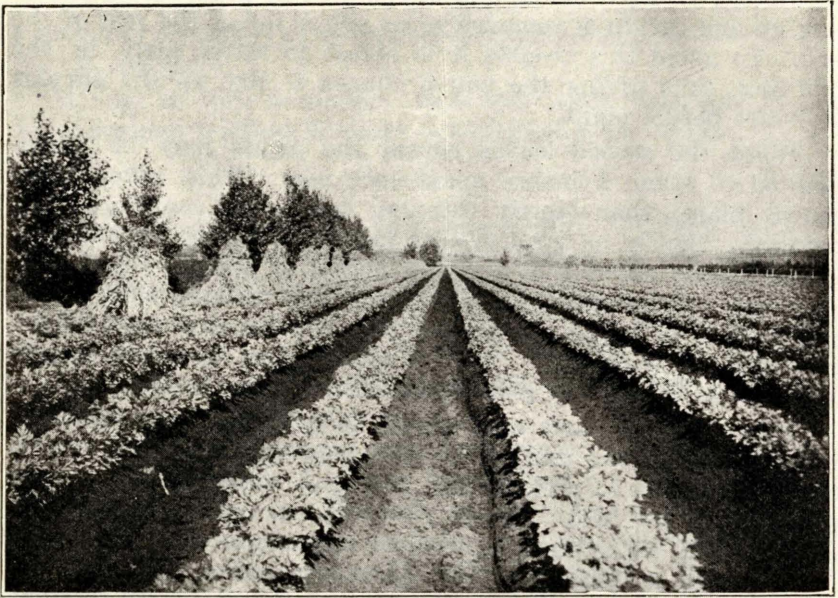
SINGLE vs. DOUBLE ROWS

Celery is raised successfully by planting in both single and double rows. Both methods have advantages.

If the blanching is to be done largely by hand, the double row is the more economical of labor as less dirt will need to be moved per plant. If the plants are to be set in trenches it means mostly hand labor; consequently, the double-row method would be desirable.

If the hilling is to be done with a hiller, the single-row method is best since it is practically impossible to get the soil between the rows unless done by hand. If it is the aim to avoid hand work, the single-row method is more desirable.

If it is an early crop to be blanched by boards, the single-row method would, of course, be used.



Giant Pascal planted in 5 ft. rows.

In the double-row system 10 to 12 inches is necessary between the two adjacent rows in order to get the dirt between the plants. If the rows are so close as to allow for no soil between them, the pressure of the soil on the outside is liable to produce crooked plants which are worthless on a good market.

DISTANCES FOR ROWS AND PLANTS

If soil is to be used for blanching, the distance between rows is of great importance, since if the rows are too far apart land is wasted and if too close it becomes difficult to keep the soil from rolling down the bank and away from the plant.

For the single-row method where the blanching is to be done with a hiller less than 5 feet seems inadvisable. If narrower, the banks are so steep that the shovel work required to keep the banks in place counteracts the time saved by using the hiller. Where the hilling is all done by hand, 4 feet may be sufficient.

For the double-row trench system, 5 or 6 feet is the usual distance. This is because an extra amount of soil is needed for placing between the double rows.

It is doubtful if 3 feet between rows is ever desirable except

for an early crop blanched by boards, when 3 feet would be the maximum distance.

Experienced growers agree that from 6 to 10 inches is the proper distance for plants for the late crop. The early varieties may possibly be set closer. For the late crop experience has shown that if closer than 6 inches one plant crowds out its neighbor, and the final result is the same as an 8- or 10-inch planting. Eight inches between plants is the best average to make every plant a market plant. "Runty" plants waste not only soil, water, and fertility, but the labor used in producing them.

The following table gives the number of plants per acre for different distances and systems:

Distance		No. of Plants per Acre	
Between Rows	Between Plants	Double Row	Single Row
Feet	Inches		
3	6		29,040
4	8		16,335
5	8	26,136	13,068
6	8	21,780	10,890
7	8	18,666	9,333

Marketable plants should weigh 25 pounds to the dozen; consequently, celery must not be crowded. The percentage of plants which will be marketable depends upon season, soil, distance, variety, quality of seed, and more important than all upon the skill of the grower.

SETTING THE PLANTS

The early crop is set in the field as soon as the soil is in condition and weather settled, usually early in May. The late crop is set out from June 20 to July 1. This gives the crop about two months of growth before blanching is started.

After the plants are dug from the seed-bed they should be kept moist by wrapping in a wet sack or other material. Only a short time should elapse between digging and setting, for, as has been mentioned before, any serious check in the growth of the plant is likely to cause it to go to seed.

The essentials for a celery-planting crew are a boy for dropper and a man for setter. The setter will go much faster if he does not have to carry his plants but finds them lying on the ground where they are to be set. The boy drops them the proper distance apart keeping just ahead of the setter. In fact, when the setter becomes skilled it will make the dropper work fast to keep ahead.

It is best to have a small stream of water running down the furrow and set the plant in the mud at the water line on the south side, if the rows run east and west, or on the west side, if the rows run north and south. The latter precaution will avoid the reflection of the sun's afternoon rays from the water to the newly set plants which has been known to burn the tender leaves and kill the plants.

Planting may be done with a dibble, trowel, or fingers. The essential thing is to develop an easy swinging motion with as few movements per plant as possible. The plants must be set so that all of the roots are in the soil and so that the soil is packed tightly against the roots. If the plant may be easily pulled up after setting it is a good indication that the roots are surrounded with loose soil and are quite likely to become dried out when the free water in the soil drains away.

The plant should be set so that the crown or point where the leaves originate is just at the surface of the soil.

Simplified descriptions of three commonly used rapid methods of planting are as follows:

1. **With a Dibble.**—The dibble, which may be made by sharpening a 6-inch piece of a broom or shovel handle, is thrust into the soil and removed with a twisting motion to prevent the soil from sticking to it. The plant is then set with the root in the hole and the dibble is thrust into the soil beside the first hole, thus pushing the soil firmly against the roots. This is successful only in soil which is wet enough not to crumble into the hole.

2. **With a Trowel**—The trowel is thrust at an angle into the soil in the side of the furrow, and bent over to one side, opening a short V-shaped trench. The roots of the plant are laid in this trench and the soil is pushed back into place with one stroke of the trowel.

3. **With the Fingers.**—The plant is grasped in the left hand with the roots protruding from between the thumb and first two fingers. The roots are laid on the mud at the water line and pressed down into the mud by the tips of the fingers of the right hand. The hole which is left is then filled by a push of the right hand.

INSURING A GOOD STAND

It is important that every plant in the field lives and comes to marketable size. There are several precautions to be taken to insure this result.

In the first place only the strongest plants should be set out. It does not pay to use weak plants. Then they should be set properly so they may have a good opportunity to start

growth immediately without being dried up, washed out, or covered with mud.

Soon after the plants are set it is a good idea to fill in the first irrigation furrow with dry soil, taking pains to cover the moist soil around the newly set plants. This prevents the soil from drying, and, if heavy, from becoming baked around the plants, which condition is very likely to give them a check. This method also does away with one hoeing. A new irrigation furrow is then made with a hand cultivator about 6 or 8 inches from the row on one or both sides. Care must be taken not to throw soil onto the plants.

Finally, the weeds must be kept down. Celery plants do not compete successfully with weeds.

IRRIGATION AND CULTIVATION

The frequency of irrigating and cultivating are two points which the individual grower must work out for himself. If the soil is of the quick-draining type the irrigations must be more frequent than on a slow-draining, retentive soil. The more the cultivation the less the irrigation needed.

The level of the irrigation water should never come above the crown of the plant as it is liable to deposit mud in the heart of the plant. This is usually disastrous if the mud is not immediately removed.

Early in the season celery grows quite slowly and needs only enough moisture to keep it growing nicely. An excess of water at this time will either force a rapid growth which is detrimental to quality or wash some of the plant-food out of the soil.

Later in the season, during blanching, the plants grow rapidly and need a lot of water. It is during the blanching season that the importance of level land is realized, because after the plants are hilled the furrow is deep in the ground and a long way from the plants. The only way to get water to the plants is to throw up one or more dams in the furrow and allow the water to raise about half way up the bank, thus soaking thru to the roots. This is hard to do on land with much slope.

On very old and worn-out soils it may be beneficial, at the end of several irrigations during the beginning of the blanching period, to apply nitrate of soda crystals in the water. This is done by sprinkling the crystals in the water as it stands in the furrow. The dammed-up water will stand long enough to dissolve the crystals and will then carry the soluble nitrate into the soil where it will be immediately available to the roots. This can easily be tested out in several parts of the field to determine its effectiveness for a particular piece of land.

It is well to keep in mind that the celery is a native of marshy places; consequently, it will not tolerate dry soil.

The soil should be cultivated after each irrigation.

METHODS OF BLANCHING

The leaf stalks of celery must be bleached or blanched before they are marketable. Any method which keeps the light from the stems will cause the green coloring matter to disappear, the stalks to become crisp, and the bitter flavor to be replaced by a sweet "nutty" flavor. This may be done with tile, paper, boards, and soil. For the home garden, setting a drain tile over the plant or wrapping the plant with paper are quite satisfactory, but at the present price of both tile and paper they could hardly be recommended for use on a large scale.

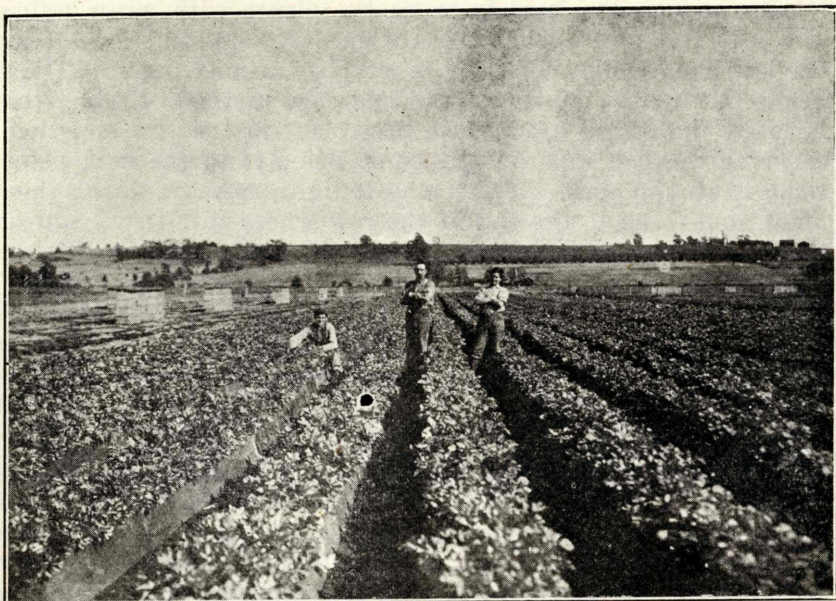
In some places where a special market demands a perfectly clean, white celery, it is sometimes the practice to first wrap the plant with paper and then bank with soil, thus preventing any danger of discoloration by the soil.

There is another method in which the plants are set 6 inches apart each way in long beds 3 or 4 feet wide. The principle involved here is that the spread of the leaves will keep the light from the leaf stalks. Only the outside row is banked or boarded. Experience has shown that the stalks are not thoroughly blanched (if of a green variety), and they are inclined to be spindling. However, this method is quite satisfactory for early or self-blanching varieties in the home garden.

The blanching of celery with boards is practical only for the early and self-blanching crop, because the weather during the summer in this state is too warm for hilling with soil, rusting and rotting often resulting. The plants are set in rows 3 feet apart and little or no hilling is necessary. Twelve- or 14-inch boards of convenient length are used for this purpose. A row of boards is laid along each side of the row, then two men raise the boards, inner edge first, thus lifting all the leaves, into position close against the plants. The boards are held upright by pieces of wire bent into "U" shape which fit down over the boards. A little soil thrown against the bottom of the board excludes all light from the bottom. This method of blanching requires 2 or 3 weeks. The boards may be transferred to another row as soon as one is blanched and may be used many years if properly stored to prevent warping and rotting.

BLANCHING WITH SOIL

The only practical method for blanching the late celery crop in Utah is with soil. Furthermore, this is the method which



Blanching Early Variety with Boards.

gives the celery its excellent flavor. Boards sometimes impart a resinous flavor to the product.

Blanching with soil usually begins about August 20 to September 1, or when the plant is 6 to 8 inches high, and is continued for about six weeks, when the stalks are white. The crop is then harvested or stored.

Although manufacturers of certain types of celery hillers claim that, with their machine, celery may be hilled without ever touching the plants with the hand, many growers find there is too much risk attached to such a method. Whatever the method of hilling, no dirt must be allowed in the heart of the plant as it invariably causes rotting, especially if it gets wet—and it usually does.

There are several methods of insuring upright compact plants and preventing the entrance of dirt into the center. One which is widely practiced is to grasp all the leaves of the plant with the left hand, holding them tightly together while hoeing, shoveling, or scooping the dirt up against the leaf stalks. One grower finds a scoop made by cutting a section from an old preserving kettle to be very satisfactory. This method is used where the double-row trench system is practiced.

Another method used by a successful grower who plants in

single rows on the level is to tie the plants with paper twine. The leaf stalks of each plant are gathered up and held with the left hand while the string is wrapped around the stalks just below the leaves. A very rapid and easy method of doing this is to tie the string around the first plant in the row and then, carrying the ball in the right hand, bring it to the next plant, wrap it around once, and, keeping it tight, carry it to the third plant, and so on to the end of the row where it is tied again on the last plant. It is essential that all the larger leaves be held up.

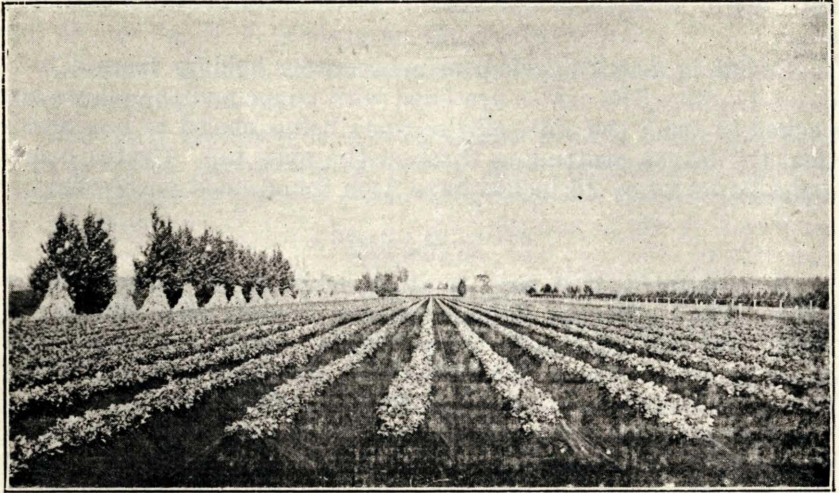
Paper twine is the only satisfactory material for this purpose, because, while cotton twine would constrict the stalks as they grow and must be cut at each plant, paper twine becomes wet and falls apart as the plant expands. It may be secured from or through any seed company.

After the plants have been "handled" or tied, the soil is banked up with a hoe, shovel, or hiller. The use of a plow for hilling is not usually successful because when the dirt is thrown up, especially on the second or third hilling, it has a tendency to pile up at too steep an angle, so it comes rolling down again. With a hoe or shovel the dirt may be piled at any desired angle. The principle of the hiller is to roll the dirt from the bottom of the furrow up to the top of the bank, always keeping it at the same gentle angle. Hillers are made adjustable to any convenient angle.

Celery hillers are made by several firms and range in price all the way from \$25 to \$150. It may be interesting to note that one of Utah's experienced growers is buying a new hiller of the \$25 type. He considers it as practical as a more expensive one. This same gentleman also suggests that the beginner can very easily make a hiller from planks. The construction would be much the same as for a snow plow. It could be further improved by some sort of metal point. Some extra weight would probably need to be placed near the point. Hillers are pulled by either one horse or two in tandem.

The soil is cultivated several days before hilling so it will be dry. The hiller is allowed to go shallow so as to move up only the clods and large pieces of soil. One grower claims that the first 3 hillings should be done only with clods as they are less liable to cause rusting than where fine soil is packed against the stems. For the first 3 hillings most of the leaves are left exposed.

The fourth hilling, a week or two before harvest, is done with a shovel, care being taken to use fine soil, and only a few of the top leaves are left exposed. One experienced grower says



Blanching Late Crop with Earth.

it is impossible to produce a good, white crop without this last careful covering.

Blanching with soil usually requires about 6 weeks, so the crop will be ready to harvest about October 1 or after.

HARVESTING CELERY

Since the heat will quickly wilt it, celery should be harvested only in cool weather or in the cooler parts of the day in warm weather.

The dirt is plowed away from the stalks and the plants dug with a spade or a celery digger, which is a U-shaped, sharp-edged tool mounted on wheels. It is pulled by horses and passes under the plants cutting off the roots. With the use of this contrivance the plants are easily lifted by hand. The plants are then piled in a wagon and removed to the cleaning and packing shed, or placed in the storage pit.

PREPARING FOR THE MARKET

The inferior outside leaves are removed, the root trimmed to a flattened conical shape, and the stalks thoroly washed in running water if possible and drained. Any plants which are too small to average 25 pounds to the dozen are discarded as this is the minimum size desired by the market.

When celery is shipped "in the rough" only the very worst leaves are removed. The plants are graded into uniform sizes

and tied in bunches of one dozen. Each crate contains only one size.

Celery is usually packed in open crates holding from 4 to 8 dozen plants. The crates are lined with paper and the plants are packed in from the side, all the roots being placed in one direction, the leaves protruding through the open top. Crates measuring 24 by 20 by 16 inches have been found most successful.

STORING CELERY

It is doubtful if it pays to store much of the celery crop in Utah. The California shipping season extends from October to April, and the movement from Florida begins in January and closes in June. These two states ship such enormous quantities that any stock held till late is liable to take the low prices.

Other reasons for not storing large quantities is the difficulty of keeping it from rotting and the added expense of storing. However, there may be circumstances which will make storing necessary. There are two methods by which it may be cheaply stored.

When the crop is to be stored for only a few days, as when immediate shipping facilities are lacking or when a hard early freeze threatens, the celery may be covered with dirt in the field where it stands. Or it may be dug and packed in trenches about a foot wide and covered with soil. These are the cheapest methods, but they are suitable only for short-time storage for the reason that the stored plants are alive, and living things produce heat which unless allowed to escape causes decay organisms to grow. Great loss results.

If the celery is to be stored for any length of time, the method of storage must provide first, for a continuous moisture supply for the roots; second, for ample ventilation to prevent heating and consequent rotting; and third, protection from cold. One Utah grower has a simple and very successful way of accomplishing these ends.

A trench about one foot wide, and deep enough so the leaves of the stored plants come to the surface of the ground, is dug the length of the field. Enough water is run into the trench to make the soil in the bottom quite muddy. The plants from about 12 rows are then dug with most of the roots on and planted in the trench. Care is taken to get the roots into the mud and the plants are not crowded. A board roof is then built over this trench. The roof is made A-shaped of two 10-inch boards and is held up from the ground by two 8-inch boards on edge. This gives a large air space above the plants. Wooden ventilators to insure a good pure air supply are placed at regular

intervals of about 20 feet. The roof may then be covered with soil to any depth, depending on the temperature.

This method has the added advantage of keeping the leaves from becoming muddy.

The ideal method for storing celery is in a cellar provided with a water supply and affording good ventilation. Until a larger acreage is planted, such structures are hardly necessary in this state.

VARIETIES

For the early crop the White Plume and the Golden Self-blanching varieties are usually employed. They are quite easily blanched with boards in warm weather.

White Plume is the favorite in Utah.

For the late crop the Giant Pascal and the aforementioned "Utah" are most desirable, the latter being considered the better of the two. Giant Pascal is later, being ready for the market about November 1.

IMPORTANCE OF GOOD SEED

Two chief difficulties in celery culture are the production of "pithy" leaf stalks and of "seeders."

"Pithy" leaf stalks are the hollow ones which split open when the leaves are pulled from the root. By "seeders" is meant the plants which produce seed the first year. Celery is normally a biennial, but occasionally and sometimes frequently plants go to seed the same season the seed is planted. This, of course, ruins the plant for market use.

Pithiness may be avoided by using seed from only those plants which show no pithiness. At one time French seed was the more desirable since French seed growers selected with this point in mind while other seed growers did not. It is quite probable that American seed growers are now fully as efficient as the French.

"Seeders" are thought to be caused by either the inheritance of this defect or by some severe check which the plant receives during the early stages of growth, this check acting as a resting period comparable to the ordinary winter rest of the plant. It is easy to see that to avoid "seeders" one must provide seed from plants which show no sign of a seed stalk the first year and further, guard against any check in the growth of the plant.

The securing of good seed is also important from the standpoint of the inheritance of those characteristics which make ideal celery.

RAISING CELERY FOR SEED

Although it is possible to get good seed on the market some growers prefer to raise their own seed and thereby assure themselves the best. At harvest time several of the best plants in the field are selected and marked. They should possess all the desirable characteristics, including freedom from disease, and none of the undesirable. There are two methods of preserving these plants. One is to leave them standing in the field and cover them with soil through the winter.

One grower found that during a hard winter many of the plants stored in this way were killed. He finds the best method of storing is to dig these ideal plants with all the roots and some soil and store them in boxes in a cellar, where the temperature runs from 33° to 34° F., keeping them just moist enough to keep them alive. If a cold cellar is not available, storing the plants in trenches like those described for the late crop will do quite well.

In the spring the plants are set out early in ordinary good soil and kept growing without banking. The seed is borne in clusters which do not all ripen at once. When the clusters are ripe they are cut and hung in a dry, shady, well-ventilated place. As soon as all the seed is dry it is threshed out, cleaned, and stored in a cool, dry place.

INSECTS AND OTHER ANIMAL PESTS ATTACKING CELERY¹

Celery as a rule is not seriously injured by insects, but during late summer the common red spider (*Tetranychus telarius* L.) may cause some damage to the plants. This small pest is not an insect but a mite, just large enough to be seen by the naked eye. It may be green, red, or brown in color. These small mites feed on the tender leaves and shoots of the plant and weaken them by breaking the tender covering and removing the sap. Wherever one of these small animals goes it leaves a silken thread, and when they are abundant, the undersides of the leaves may be covered by webs made up of many of these silken strands. Beneath these webs the mites live and breed. Because of this protection it is almost impossible to hit all of the mites with a spray. For this reason control measures of this kind are advised only when severe damage to the plants is feared.

A spray of lime-sulfur at the rate of 1 gallon to 50 gallons of water with the addition of flour paste as a "sticker" will destroy many of the pests. Flour paste is made by boiling cheap flour in water at the rate of 1 pound of flour to 1 gallon of water.

¹By Dr. I. M. Hawley, Professor of Entomology, U. A. C.

Four gallons of this paste will furnish "sticker" for 100 gallons of lime-sulfur. This spray does not kill the eggs of the mite, and it should therefore be repeated a week or ten days after the first application to destroy those that have hatched in the meantime. Spraying with Blackleaf 40 and soap or dusting with fine sulfur or "Nicodust" will also destroy many of the pests.

There are several leaf-feeding caterpillars, the immature stages of butterflies or moths, that may occasionally be found on celery. One of the more common of these is a large green worm marked with cross bands of black. In each of these black areas are six yellow spots. This is the caterpillar of a black swallow-tail butterfly. These caterpillars and other leaf-eating worms are not usually abundant enough to cause much damage and may be picked off by hand and destroyed. Obviously, it is not advisable to apply poison to celery.

CELERY DISEASES AND THEIR CONTROL

Late Blight.—“Late blight is caused by *Septoria petroselina* and is perhaps one of the worst diseases of celery.

“The disease first attacks the lower leaves of the stalk, producing irregular spots without a definite boundary line. When the spots become numerous the foliage withers and dries up. The disease attacks the leaves as well as the stalks, rendering the affected plants useless so far as market is concerned. In storage, plants affected with late blight will keep very poorly or rot altogether.

“Late blight may be controlled by spraying with 5-6-50 Bordeaux. The first two applications should be given the seedlings in the seed-bed. In the field the first spraying should be given about six weeks after transplanting and continued once a month until the rainy season is over. With the advent of heavy rains spraying should be done once every two weeks. Besides spraying, shading also seems to keep the disease in check. In spraying celery great care should be exercised to use a sprayer operated by a pressure of not less than 150 pounds. Where this is overlooked, large drops of the Bordeaux mixture may be deposited on the leaves and stalks, which upon drying may deposit copper salt sufficient to harm the consumer. Sprayed celery must be carefully washed and dried before shipping.

Early Blight.—Early blight is as common a disease as the late blight. In some seasons of heavy rains it is very destruc-

¹Taken from “Diseases of Truck Crops and Their Control”, by J. J. Taubenhaus.

tive. It appears early and affected plants have little market value.

"The trouble first appears on the outer leaves as pale blotches, visible on both sides of the affected parts. The spots are irregular, angular in outline, limited apparently by the leaf veins, and with slightly raised borders. The spots later turn brown to ashy white.

"As with late blight, early blight may be controlled by spraying with Bordeaux mixture. The Boston Market and Gold Heart varieties should be avoided because of their susceptibility to the disease. The White Plume seems to be resistant."

Damping-off of Seedlings¹.—Damping-off is caused by two fungi: *Pythium debaryanum* and *Rhizoctonia*. These organisms exist in the soil, living upon both dead organic matter and living tender plants, hence are extremely persistent when once present in soil.

The disease attacks the tender seedlings at the surface of the soil, consuming the tissues of the stem at that point. The plant quickly wilts and dies. It attacks many other seedlings besides celery, including tomatoes, lettuce, cabbage, cauliflower, and egg plant. It does not usually attack older and tougher plants.

There are several control measures for this disease. The first precaution is to avoid poorly drained soils for seed-beds, thick sowing of seed, and soil known to have the disease.

The most satisfactory method of preventing this malady where it has become really destructive is to sterilize the soil to be used for the seed-bed by means of live steam. This is done shortly before seeding by forcing live steam from a boiler into a large galvanized iron pan inverted over the seed-bed. The steam is run 30-60 minutes at a pressure of 80-150 pounds. The live steam penetrates the soil and kills not only fungus but weed seeds and insect eggs.

Damping-off fungus is favored by excessive moisture and high temperature. When damping-off appears the best remedy is to lower the temperature by shading and ventilating and allow the surface of the soil to become dried out. For the same reason it is considered best to water the seedlings only in the early morning so that the surface soil and leaves shall have a chance to dry off before night. This is especially important where hot-beds have to be closed up at night.

¹Abstract from "The Control of Damping-off in Plant Beds" by James Johnson. Wisconsin Exp. Sta. Rsch. Bul. 31.

SOURCES OF INFORMATION

Much credit for information given in this circular is due to the following: Mr. George Cornick of Salt Lake City, Mr. James Hewitt of Ogden, and Mr. Floyd W. Knudson of Brigham. Other sources are the author's personal experiences and observation and the following publications:

1. Macoun, W. T. Selection and Wintering of Biennial Vegetables for Seed. Canada Dom. Expt. Farms Cir. 15.
2. 1909—Reid, L. J. Celery Growing in Colorado. Colorado Exp. Sta. Bul. 144.
3. 1904—Austin, C. F. and White, T. H. Pithiness of Celery. Maryland Exp. Sta. Bul. 93.
4. 1918—Norton, J. B. S. and Leathers, C. E. Conditions Detrimental to Seed Production. Maryland Exp. Sta. Bul. 216.
5. 1913—Whipple, O. B. Celery Culture in Montana. Montana Exp. Sta. Cir. 26.
6. 1917—Norton, J. B. III. Concerning Quality in Celery. Vermont Exp. Sta. Bul. 203.
7. Goodspeed, W. E. Celery Investigation. An unpublished report in the files of the Utah Agr. Exp. Sta.
8. 1907—Beattie, W. R. Celery. U. S. D. A. Farmers' Bul. 282.
9. 1917—Tracy, W. W., Sr. Saving Vegetable Seeds for the Home and Market Garden. U. S. D. A. Farmers' Bul. 884.
10. 1922 (July 22) WEATHER, CROPS AND MARKETS, issued weekly by U. S. D. A.
11. Various articles in MARKET GROWERS' JOURNAL, Louisville, Kentucky.

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