

# Growing Potatoes

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The annual value of the potato crop in Missouri is approximately two million dollars. The crop is grown in every county in the state and practically every farm and home garden produces at least a small quantity for home use.

The principal commercial potato growing sections in Missouri are: The east central district consisting of St. Louis, Jefferson, and St. Charles counties; and the west central districts consisting of Ray, Clay, Lafayette, and Jackson counties. Buchanan and Andrew counties in the northwest, known as the St. Joseph district, are also important in potato production. The largest commercial area is the west central section, known as the Orrick district, where approximately 5,000 acres are devoted annually to the production of a second-early crop.

The average yield of the potato crop in Missouri is low enough to emphasize the fact that more modern methods of potato production should be generally adopted. Larger yields on fewer acres will reduce the cost of production per unit and in most cases improve the quality of the crop.

While the potato may be grown on a wide range of soils, maximum yields and most profitable returns are generally obtained from soils that are loose and friable, well drained, and which contain a liberal amount of plant food. Soil in poor physical condition and lacking in plant food can be improved through the application of barnyard manure, green manures and commercial fertilizers.

## CROP ROTATIONS

No definite system of crop rotation for potatoes can be recommended which will suit all sections of the state. On the general farm where crops are grown in greater variety, a three-, four- or five-year rotation may be used.

Although some growers produce fair yields by cropping the same land continuously, it is a well known fact that by following a good system of crop rotation the fertility of the soil is maintained in a more satisfactory way and losses from diseases which live over in the soil will be greatly reduced. A rotation used by some of the potato growers in the commercial districts is as follows:

First Year—Potatoes. Followed by soybeans or cowpeas turned under for a green manure crop in the fall.

Second Year—Potatoes. Followed by fall seeding of wheat.

Third Year—Wheat. With either red or sweet clover drilled or broadcast on the wheat in the spring and turned under as a green manure crop in the fall of the same year.

Another system of cropping which is used to some extent in the Orrick district is as follows:

First Year—Potatoes. Followed by wheat in the fall.

Second Year—Wheat. With red or sweet clover drilled or broadcast on the wheat in the spring. The stubble clover may be turned under in the fall as a green manure crop or the clover may be left for the next year.

Third Year—Clover. Cut the first crop of clover for hay and turn under the second crop.

A longer rotation adapted to general farming is as follows:

First Year—Potatoes. Followed by soybeans or cowpeas turned under in the fall.

Second Year—Corn. As a grain crop or with soybeans or cowpeas to hog down.

Third Year—Oats. Clover sown with oats.

Fourth Year—Clover.

For some of the vegetable and truck crop sections a very good combination is the growing of potatoes one year and such crops as tomatoes, cabbage, onions, or other vegetables the next year. In this way the fertility of the soil may be maintained by following the potatoes with a green manure crop and by heavy applications of barnyard manure following the truck crop.

## VARIETIES

Irish potatoes are very responsive to seasonal growing conditions. They are best adapted to regions having a comparatively cool growing season with an ample supply of moisture. Because of these characteristics, under Missouri conditions potatoes make their best growth during the spring. Early varieties which may

be grown in Missouri are: Irish Cobbler, Early Ohio, Bliss Triumph, Warba and Chippewa.

**Irish Cobbler.**—The Irish Cobbler is the best of the early varieties for Missouri. It is of good quality, matures early and gives a satisfactory yield. The vines are medium in size, with dark green stocky stems. The flowers are light purple in color, often fading to white. The tubers are roundish to roundish-flattened or slightly oblong-flattened; the stem-end is usually rather deeply notched, giving a rather shouldered appearance to the base of the tuber. Eyes are medium in number, varying from shallow to rather deep. The skin is smooth, creamy in color and sometimes netted.

**Early Ohio.**—The Early Ohio matures at about the same time, if not a few days earlier, than the Irish Cobbler. The flowers are white. The tubers are round to oblong with rounded seed and stem ends. The eyes are shallow. The skin varies from a light pink to a reddish hue in color. The principal objection to the Early Ohio variety is its tendency to produce “knobby” potatoes or second growth during seasons having unfavorable weather conditions.

**Bliss Triumph.**—Bliss Triumph is an early variety which is usually a few days to a week earlier than either the Irish Cobbler or Early Ohio. The vines are dark green in color, upright, with little branching. The color of the flowers is a very light rose to purple. The tuber is small to medium in size, of a blocky shape, and slightly shouldered on the stem end. The eyes are few in number and slightly depressed. The deep eyes at the seed end are characteristic of the variety. The skin is light red in color.

**Warba and Chippewa.**—Warba is a new introduction closely resembling Triumph but is white skinned and somewhat deeper dyed. It matures at approximately the same time as Triumph. The variety has shown a tendency to set a large number of tubers per hill. Under Missouri conditions this is often detrimental in that it may result in a high percentage of small potatoes.

Chippewa is a comparatively new variety. It is about ten days to two weeks later in reaching maturity than Cobbler. It has a smooth, white skin and shallow eyes. Both Warba and Chippewa have shown considerable resistance to mosaic. Neither of these varieties have, however, been grown a sufficient number of years to determine their adaptability to Missouri conditions.

## SEED

In the growing of a successful potato crop, one of the most important factors is good seed. Although all other conditions might be ideal for a bumper crop, if the proper seed has not been used the crop may be a failure. Good seed should be free from both internally and externally borne seed diseases, free from variety mixtures and be of a high-yielding strain. Most of the potatoes grown in Missouri are produced from northern grown seed because it is generally more free from diseases and produces larger yields.

**Seed Certification.**—Seed certification is a practice which has developed in northern seed producing states with the aim of designating those potatoes produced in fields which are free from diseases and therefore satisfactory for seed. That seed which passes inspections made at specified times is marked certified. These inspections are for the purpose of detecting varietal mixture, and such diseases as rhizoctonia, mosaic, black-leg, spindle tuber, curly dwarf, leaf roll or others. Seed which passes these inspections is marked by a tag which carries the state certification seal. If these inspections are rigid and thorough and adhere strictly to the certification requirements, the potatoes are well adapted for use as seed.

Commercial growers in Missouri have learned that certified seed is far superior to locally grown potatoes or seed which is not eligible for certification. Therefore certified seed is recommended, provided the grower is certain that it has passed the rigid certification requirements.

**Cutting the Seed.**—Only well-shaped, disease-free potatoes should be used for seed purposes. Each seed piece should contain one or more healthy eyes and average from  $1\frac{1}{2}$  to 2 ounces in weight. In general, blocky seed pieces as shown in Figure 1 are to be preferred to wedge-shaped pieces. The potatoes should be planted soon after they are cut. Where the acreage planted is large, it is often necessary to cut a considerable quantity of seed before planting operations start. Under such conditions the seed pieces should be stored at a temperature between 70° and 80° F. and at a humidity of 85 to 95 per cent. With such treatment the cut seed should cure properly and show resistance to deterioration in case of unfavorable growing conditions. In storing cut potatoes they should not be piled too deeply as under such conditions heating is likely to take place and their vitality will be greatly reduced.

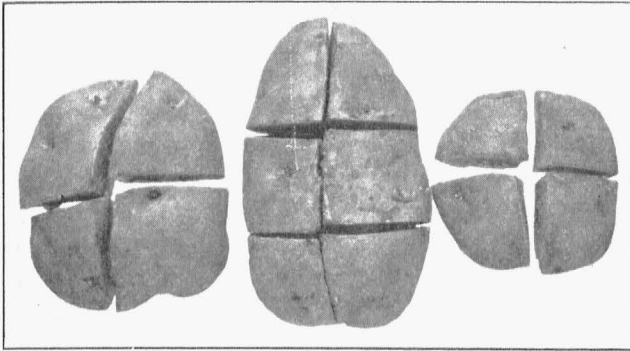


Fig. 1.—Showing correct method of cutting potatoes for seed. Irish Cobbler on the left, Early Ohio in the center, and Bliss Triumph on the right.

**Seed Required.**—The amount of seed required per acre will vary with the variety, size of potatoes used for seed, and planting distances. The Irish Cobbler, having fewer eyes than the Early Ohio, will usually require a few more bushels per acre. For this variety the commercial growers in Missouri plant from 12 to 18 bushels per acre.

### PLANTING POTATOES

Having a thoroughly prepared seedbed is very essential in the planting of potatoes. In a good seedbed the soil moisture, soil temperature, aeration, availability of mineral nutrients and soil structure are as near optimum as it is possible to get them under existing conditions. These factors play an important role in determining the shape, quality and yield of tubers.

**Date of Planting.**—The date of planting will vary with the weather conditions, but in general there is a definite relation between date of planting and yield. Experiments and observations extending over a series of years have shown that both yield and quality are generally increased by planting as soon after the middle of March as the soil and weather conditions will permit. The potato should pass its critical period; namely, when the plant is blossoming and setting tubers, during the latter part of May or the first of June. If this period comes during the hot days of late June and July, low yields will usually result.

Results from the Missouri Agricultural Experiment Station indicate that on the average the highest yields will be received from potatoes planted between March 20 and April 1. In some years when we have what is known as an early spring, it is possible in Central Missouri to plant potatoes earlier in March. Such plant-

ings should produce good yields if conditions are favorable, but if such early plantings are followed by cold, wet weather, the chance for rotting of the seed pieces in the soil is increased.

**Depth of Planting.**—The depth of planting will vary to some extent with the type of soil. Light sandy loam soils will warm up quicker and therefore planting can be deeper on these than on the heavier types of soil. For the average potato soil in Missouri 3 to 3½ inches is the proper depth.

**Distance of Planting.**—The distance for planting potatoes in Missouri will vary from 36 to 42 inches between rows and from 12 to 18 inches in the row. There is a close correlation between planting distance, total yield, and the per cent of No. 1 potatoes. It is possible by closer planting to increase the total yield of potatoes and yet decrease the total value of the crop by decreasing the yield of No. 1 potatoes. Individual growers must determine the distances best suited for their conditions.

### CULTIVATION

Experiments have shown that weeds compete very seriously with the cultivated crop for the available soil moisture and plant food. This emphasizes the fact that cultivation has as its primary object weed control. Since many of the feeder roots of the potato plant grow near the surface of the soil, cultivation of the crop should be as shallow as possible to avoid severely injuring the plant by tearing off these roots. Shallow cultivation becomes increasingly important as the plants grow and the roots extend into the spaces between the rows.

Cultivation of the potato field should be started just after the potatoes begin to show above the ground. About the time the potatoes are breaking through the soil, the ridge should be worked down with a section harrow, going diagonally across the field to keep the harrow on the ridges at all times. This is one of the important cultivations, for if the soil is well worked at this time, most of the small weeds which have started will be killed and subsequent cultivations will be easier and more effective.

The last cultivation should be just before the potatoes show full bloom. At this time a low ridge should be thrown to the potatoes, care being taken not to form too much of a ridge which would cause the soil to dry out more rapidly and result in a decrease in yield. Although it is customary to discontinue cultivation just before blooming, it is sometimes necessary to continue shallow cultivation between the rows to keep down weeds.

## POTATO DISEASES IN MISSOURI

The annual loss from potato diseases in Missouri amounts to many thousands of dollars. Although disease prevention and control is only one of the important factors in potato production, it is, nevertheless, essential that the grower recognize the symptoms of the more common potato diseases.

The potato grower has to deal with three types of diseases: (1) Those which are carried within the tuber, such as mosaic and spindle tuber; (2) those usually carried on the surface of the tuber, as common scab and rhizoctonia; and (3) those that affect the foliage of the plant, such as tip burn.

The more important tuber-borne diseases affecting potatoes under Missouri conditions are: Rhizoctonia, common scab, black-leg, wilt, mosaic, and spindle tuber. The only foliage trouble of importance is tip burn (hopper burn). The blights which affect the foliage are seldom serious in Missouri.

**Rhizoctonia (Black Scurf).**—The fungus which causes this disease is responsible for such common symptoms as black scurf, dry stem rot, russet scab, "little potato," and "dwarf rosette." The most common form is the black scurf which is characterized by the small

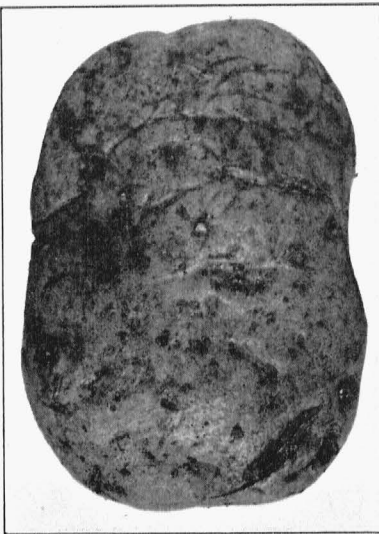


Fig. 2.—Rhizoctonia (black scurf). The sclerotia stage of this disease is shown by the dirt-like masses on the tuber.

black dirtlike masses, Figure 2, which adhere to the surface of the potato. This stage is believed to be the main source of infection under Missouri conditions. The form of rhizoctonia which causes

the greatest damage in this state is the dry stem rot as shown in **Figure 3**. This stage is characterized by the small sunken area of a brownish black color which attacks the surface of the underground stem, often girdling the plant at the surface of the soil. Missing hills and small sickly plants are often caused by this disease.



**Fig. 3.**—Dry stem rot, the form of *Rhizoctonia* which causes the greatest damage in Missouri.

*Control Measures.*—Use only seed which is free from *rhizoctonia* and treat the potatoes before cutting, as described under seed treatment. Although the main source of infection is diseased seed, the fungus also lives over in the soil. Crop rotation is therefore advised.

**Potato Scab.**—Potato scab (**Figure 4**) is one of the very common potato diseases with which most potato growers are acquainted. It can be distinguished by its rough, corky brownish areas on the surface of the tubers. In severe cases these corky areas may form a crust over the entire potato. Although the effects of this disease may not be noticeable on the growing plant, the blemishes and roughening of the tubers greatly reduce their market value and often make them unsaleable.

*Control Measures.*—The organism causing this disease is known to live over in the soil. When soil once becomes infected with this disease it is necessary to practice at least a three or four-year rota-



tion. The use of some of the legumes as a green manure crop will aid in conditioning the soil. Infected potatoes should not be used for seed and all seed should be treated.

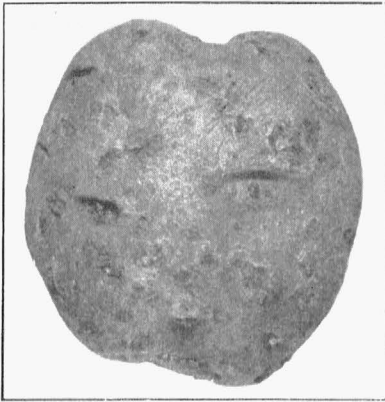


Fig. 4.—Common Scab lesions on potato tuber.



Fig. 5.—Ring discolorations caused by *Fusarium* wilt.

**Fusarium Wilt.**—This disease affects both the plant and tuber. On the plant it is characterized by the gradual rolling and discoloration of the lower leaves. This condition continues until the whole plant wilts. Affected tubers show the characteristic discoloration of the water vessels of the tuber, Fig. 5. A cross section of the stem end of an infected tuber will show the discoloration, which extends through the potato toward the “seed” end. The extent of the discolorations will depend on the severity of the infection. The organism causing the disease is carried in the tuber and is known to live over in the soil.

*Control Measures.*—The use of disease free seed and crop rotation are the two principal methods used in controlling wilt.

**Black-Leg.**—This disease, Figure 6, while not as common in Missouri as rhizoctonia, is quite prevalent during years having a cool damp spring. Both the young plant and seed piece are affected. Black-leg attacks the young plant producing a black slimy rot, while rhizoctonia causes a dry rot, brownish in color.

*Control Measures.*—Since the bacteria which cause this disease are carried in the tuber, the use of disease-free seed is of first importance. The seed should be treated by one of the methods suggested under seed treatment.



Fig. 6.—Black-leg injury on the young potato plant.

**Mosaic.**—The disease commonly called “running out” is in reality an accumulation in the tubers of one or more of the virus diseases. There are a great number of virus diseases which may affect potatoes and each has its particular symptoms. Mosaic is the most common in Missouri and is characterized by the crinkled and mottled appearance of the leaves, affected plants being of a lighter green than healthy plants.

*Control Measures.*—The use of certified disease-free seed is the only practical means of eliminating this trouble.

**Second Growth—Growth Cracks.**—These conditions are shown in Figure 7. Observations indicate that the same weather conditions which cause hollow heart are associated with second growth (knobby growth) and growth cracks. The Early Ohio variety is much more subject to second growths than the Irish Cobbler.

**Hollow Heart.**—This trouble is quite common with some varieties during unfavorable seasons. The hollow tuber cannot be distin-

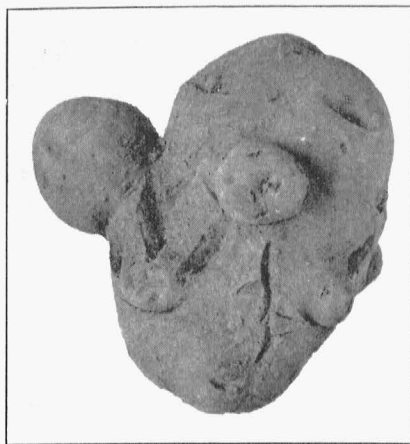


Fig. 7.—Second growth (knobby growth) and growth cracks on Early Ohio potato.

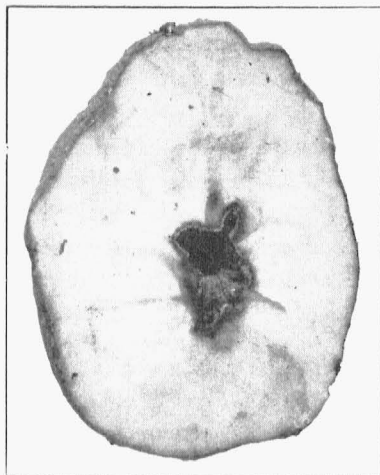


Fig. 8.—Hollow heart.

guished from healthy tubers until the potato is cut, Fig. 8. Hollow heart seems to be more prevalent during years having alternate dry and wet periods. The dry weather tends to ripen the tubers prematurely while the tops are still green. A wet period following causes the potato to resume growth with the hollow centers resulting. Since this trouble is seemingly due to natural climatic conditions, no control can be given.

**Tip burn.**—Tip burn may be due to a number of causes, but in Missouri it is usually the result of severe attacks of a small leaf hopper. This accounts for the term “hopper-burn,” often applied to this trouble. Although not occurring every year, when present it is capable of causing a considerable decrease in yield by drying up the vines before the potatoes mature.

*Control Measures.*—Experiments have shown that tip burn can be controlled through the use of a 3-4-50 Bordeaux spray. For satisfactory control it is essential that both the upper and lower surfaces of the leaves be covered with the spray material.

### SEED TREATMENT

Seed treatment consists of disinfecting the potato tuber in such a way that all disease organisms carried on the surface of the tuber will be killed. It should be understood that internal diseases of the potato such as mosaic and wilt cannot be controlled by seed

treatment. Tubers showing signs of any of the internal diseases, when potatoes are being cut, should be discarded. All treating should be done before the tubers are cut. Sprouted potatoes should not be treated.

The methods recommended are the cold corrosive sublimate, acidulated mercury, and the hot formaldehyde. For the grower who plants only a few bushels of seed, either the corrosive sublimate method or the acidulated mercury treatment is the most practical. The acidulated mercury treatment has increased in popularity because of its relative simplicity and convenience.

**Corrosive Sublimate Method.**—Metal tanks or tubs should not be used for the metal containers will be corroded and the solution weakened. When only a few bushels are to be treated, a wooden barrel may be used. In mixing the solution, 4 ounces of corrosive sublimate should be used to each 30 gallons of water. As corrosive sublimate dissolves slowly in cold water, it should first be dissolved in a glass jar of hot water and then poured into the 30 gallons of water. The temperature of the water should be approximately 60° F. The potatoes must be immersed in this solution for 1½ hours and then allowed to dry before cutting. The seed may be treated in crates or sacks, using the same sacks each time, since too many sacks tend to weaken and waste the solution. Never place the treated potatoes in sacks which have not been disinfected. When the solution is to be used over a number of times, it should be strengthened by adding ½ ounce of corrosive sublimate and enough water to bring it up to the original volume after each four bushels have been treated. After treating 12 to 16 bushels in this manner, the entire solution should be emptied where stock cannot reach it and a new solution prepared. **CAUTION!!—CORROSIVE SUBLIMATE (BICHLORIDE OF MERCURY) IS A POISON, IF TAKEN INTERNALLY, BUT WILL NOT INJURE THE HANDS.**

**Acidulated Mercury Method.**—The potatoes are immersed in the following solution. Dissolve 6 ounces of corrosive sublimate in 1 quart of commercial hydrochloric acid (muriatic acid). Add this mixture to 25 gallons of water and stir solution thoroughly. The 25 gallons of solution will treat 40 to 50 bushels of potatoes unless they are very dirty. After this quantity has been treated, the solution should be strengthened by dissolving 1½ ounces of corrosive sublimate in ½ pint of hydrochloric acid and adding this mixture to the solution and also adding enough water to make the original volume of

25 gallons. After another 40 bushels have been treated, the solution should be thrown away, USING THE SAME PRECAUTIONS AS SUGGESTED ABOVE FOR DISPOSING OF THE CORROSIVE SUBLIMATE SOLUTION. The length of treatment will vary with the condition of the seed. The usual length of time is 5 minutes. If, however, there is considerable scab or black scurf, the time should be longer. If the potatoes are completely dormant they may be soaked for 30 minutes providing they are planted immediately or dried out carefully.

**Hot Formaldehyde Method.**—By this method the seed is treated for four minutes in a solution of 1 pint liquid commercial 40 per cent formaldehyde to each 15 gallons of water at a temperature of from 122° to 124°F. When this method is practiced, the potatoes are usually treated in their original sacks. Wooden or metal tanks may be used for this purpose. The temperature of the liquid can be maintained by passing steam from a stationary or steam traction engine boiler through a coil of 1 or 1½ inch pipe near the bottom of the tank. False bottoms for the tanks should be used to keep the hot pipes from direct contact with the potatoes. For treating smaller quantities of seed, smaller tanks may be used with oil or gas burners supplying the heat. It is necessary that the solution be kept at the proper temperature and a good grade Fahrenheit thermometer should be used for testing the solution.

## FERTILIZERS

Phosphorus is the plant food element needed on most Missouri soils for increasing the yields of potatoes. The largest yields have been produced where a high grade complete fertilizer containing a high percentage of phosphorus has been used in combination with barnyard manure and a green manure. For the average farm potato crop where the potatoes are usually grown in a fertile soil, barnyard manure plus 300 pounds of superphosphate will usually increase the yield most economically.

In the commercial sections where it is not possible to manure the entire acreage, a green manure in combination with a complete fertilizer such as a 4-12-4 or a 4-16-4 is recommended. The kind of green manure to use will vary with the locality. Soybeans, cowpeas, sweet clover, and red clover are the principal green manure crops. Rye, which has been used for a green manure to a considerable extent in the past, is not as well suited for this purpose as the legumes. Spring plowing, which is necessary with rye, usually

delays planting and generally leaves the soil in a much poorer physical condition than when fall plowed.

**Rate of Application of Fertilizer.**—The amount of fertilizer to apply is not governed entirely by the maximum returns received, but rather from the amount that will give the most economical returns.

Although increased yields are obtained where as much as 1200 pounds of fertilizer are used, after a certain point is reached the addition of more fertilizer is not economically feasible. It is probable that on all Missouri soils of average fertility, 400 to 600 pounds of a high grade fertilizer such as a 4-12-4 or 4-16-4 will give paying returns.

**Method of Application.**—Recent experimental work has shown that the method of application is frequently as important as the kind and amount of fertilizer used. The fertilizer is best applied in ribbons on both sides of the row. These ribbons should be two inches from and at the same level as the seed piece.

### POTATO INSECTS

Although there are not a great many insects which attack the potato, it is nevertheless absolutely necessary that the insects be controlled if profitable yields are to be obtained. The insecticides most commonly used for the chewing insects are arsenate of lead and calcium arsenate. For sucking insects such as the aphid, nicotine sulphate may be used. Bordeaux is used as a repellent for the control of the leaf hopper.

**Colorado Potato Beetle.**—This is the most common potato insect in Missouri. Most of the injury is done by the leaf-eating larvae. Since this is a chewing insect, the control must be in the form of a stomach poison. Arsenate of lead may be applied as a dust or a spray. When a spray is applied, use 1½ pounds of powdered arsenate of lead to 50 gallons of water. When applied as a dust, use 1 part of powdered arsenate of lead to about 10 parts of air-slaked or hydrated lime. Calcium arsenate at the rate of 1 pound to 12 to 15 pounds of gypsum, applied as a dust, is being used in some of the commercial sections.

**Leaf Hopper.**—This is a small, pale green, leaf-sucking insect which causes what is known as "tip burn". It can be controlled by the use of a standard 3-4-50 Bordeaux spray. Bordeaux, to be effective against the leaf hopper, must be applied at the proper time and in such a manner that both the upper and lower surfaces of the leaves will be covered. The first application is generally

made when the vines are about 6 to 8 inches high and the succeeding 3 or 4 applications at intervals of one week to 10 days.

Standard Bordeaux mixture, commonly known as 3-4-50 Bordeaux, is composed of 3 pounds of copper sulphate (blue vitriol) and 4 pounds of stone lime to 50 gallons of water. To prepare a small quantity of a 3-4-50 Bordeaux, dissolve 3 pounds of copper sulphate in a few gallons of water and add additional water to make up to about 40 gallons. In another vessel slake 4 pounds of stone lime. If hydrated lime is used, 6 pounds are required. This should be made into a thin paste. Pour the lime mixture into the copper sulphate solution and add enough water to bring it up to 50 gallons. Bordeaux mixture is also prepared by using powdered copper sulphate and hydrated lime.

If more detailed information regarding Bordeaux mixture is desired, it may be secured by seeing your County Agent or by writing to the Department of Horticulture, College of Agriculture, Columbia, Missouri.

When it is necessary to control the Colorado potato beetle and leaf hopper at the same time, lead arsenate at the rate of  $1\frac{1}{2}$  pounds to 50 gallons can be added to the Bordeaux mixture.

**Flea Beetle.**—The damage from these little beetles is often overlooked, but they are responsible for the small round holes in the potato leaf. The adult is a bright, black, hard shelled insect about one-twentieth of an inch long. The adult beetles overwinter in trash, emerging in the early part of summer. Thorough spraying on both the upper and lower surfaces of the leaves with Bordeaux mixture and arsenate of lead will control the flea beetle. If the flea beetles are abundant, the first application should be made when the plants are 3 to 4 inches high, as they are most destructive in the early stages of plant growth.

**Blister Beetle.**—These insects are often called the old fashioned potato beetles. They move about in large numbers and can do a great deal of damage to a potato field in a single day. Driving them from the field with the aid of brush or other means has proven to be one of the most effective methods of control. Arsenicals are also generally helpful if used at about double strength as sprays and dusts.

**White Grub.**—The white grub, which is the larvae of the common June bug, causes considerable loss by eating holes in the surface of the tubers, Figure 9, and thus decreasing their market value. The insect is most troublesome on new land or on fields

having been in sod the previous year. It is better to follow sod or new land with some cultivated field crop before planting to potatoes. Considerable injury may be expected when potatoes are planted in sod or new land after the first breaking.

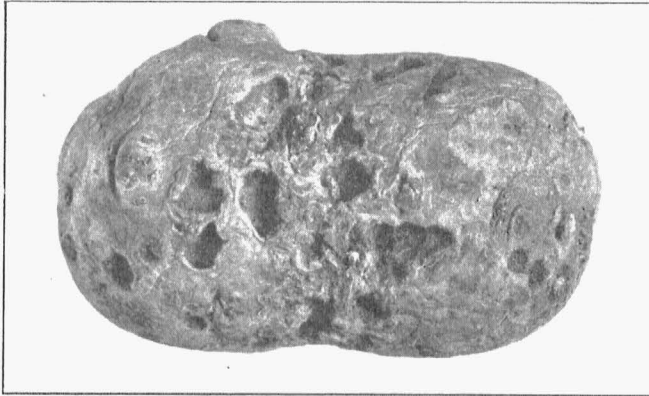


Fig. 9.—Potato showing holes made by white grub.

### HARVESTING

The potato continues to develop until the vines are almost dead. However most of the seasons in Missouri are such that the potatoes must be dug while the vines are still alive. This is because either the excessive temperature in the summer or the wet condition in the fall will cause rotting of the potatoes if they are permitted to remain in the ground.

In the commercial potato districts, digging starts around the first of July, at which time the potato tubers are still immature but are harvested to take advantage of the earlier markets which generally pay a better price than the later markets. If potatoes from the commercial districts can be harvested the first part of July, they may be on the market before the bulk of the early crop from other districts. On the average farm where potatoes are being grown for home use, it is best to leave them in the ground as long as possible. The actual length of time they should be permitted to remain in the ground depends upon the temperature and whether the vines are dead or still living. High temperatures for extended periods of time result in an injury to the foliage that subsequently leads to death of the entire potato plant. When the vines are almost dead, there is nothing to be gained by permitting the potatoes to remain



in the ground; therefore they should be dug and placed in the best available storage.

Regardless of whether the potatoes are dug for commercial or home use, they should not be exposed to the hot, direct rays of the sun. Digging the potatoes early in the morning or late in the afternoon is one means of avoiding sunburn. If it is necessary to dig at times when the potatoes are likely to be exposed to the direct rays of the sun, they should be picked up as soon as they are dug. They should then be put in a place where there is good ventilation but protected from the sun so that the soil on the tubers can dry and the skin become cured and toughened.

### STORAGE

Although most of the commercial potatoes grown in Missouri are marketed during the summer, there are many home gardeners who successfully store potatoes for their winter use.

Potatoes to be stored should be dry, free from dirt, and entirely free from mechanical injuries. Potatoes may be stored in out of door cellars or pits, having proper ventilation, low temperature, and all light excluded. The average house cellar or basement is too warm and lacks the proper ventilation. It is possible, however, where the house basements have a cool vegetable room to store potatoes successfully during the colder months of the fall and winter. The temperature for storage should not go above 40°F. nor below 35°F. Such conditions are not present at the time of harvesting the spring crop. If it is desired to store this crop, the potatoes should be placed in the coolest, well ventilated place available, care being taken to avoid piling them so high as to cause heating. In some years it is possible to delay digging the spring crop until late fall. The fall crop of potatoes which is harvested just before frost can be carried over the winter under the ordinary storage conditions.

The outside storage cellar is to be much preferred to the storage pit. If the storing of a quantity of potatoes is a yearly practice, it will pay to erect a storage cellar, which will be a permanent structure. A pit is for temporary use only and unless it is made and handled carefully, including good ventilation, the potatoes will not keep properly.

The making of a storage pit is a very simple procedure. Select a well drained spot and remove the soil to the depth of from 1 to 3 feet. Place a 6 to 8 inch layer of straw in the bottom of the

pit to keep the potatoes from coming into direct contact with the soil. If a large quantity of potatoes is to be stored in this way, the pile should be narrow and the potatoes should not be piled over five feet deep. Openings should be always left in the top for ventilation. These may generally be left open, but when the temperature is low it is well to close them with burlap bags or other material. The potatoes should not be placed in the pit until late fall or until the days have become fairly cool. The first covering should be of coarse straw or hay. As cold weather approaches, an inch or two of soil should be placed over the straw. It is a good plan not to put all the soil on at one time but to add soil at intervals so that the potatoes will be covered with a ten-inch layer of soil before hard freezing weather occurs.

### GRADES\*

Potatoes well graded as to size and quality command a better price than ungraded stock. There may have been a time when ungraded potatoes could be shipped in bulk car lots and not be discriminated against. Such practices are now obsolete and with the increased competition and modern methods of handling, it is absolutely necessary that all commercial potatoes be graded according to the standard grades for potatoes.

**U. S. No. 1** shall consist of potatoes of similar varietal characteristics which are fairly well shaped, free from freezing, blackheart and soft rot, and from damage caused by dirt, other foreign matter, sunburn, second growth, growth cracks, air cracks, hollow heart, cuts, shriveling, sprouting, scab, blight, dry rot, rhizoctonia, other diseases, insects, mechanical, or other means.

Unless otherwise specified, the diameter of each potato shall be not less than  $1\frac{1}{8}$  inches.

In order to allow for variation other than size incident to proper grading and handling, not more than 6 per cent of the potatoes in any container may be below the requirements of the grade but not to exceed one-sixth of this amount or 1 per cent shall be allowed for potatoes affected by soft rot or wet breakdown. In addition, not more than 5 per cent may be damaged by hollow heart.

When potatoes are designated as U. S. No. 1, U. S. Commercial, or U. S. No. 2, without specifying a size classification, it is understood that the potatoes meet the minimum size specified in the grade

\*Handbook of U. S. Standards for Grading and Marketing Fresh Fruits and Vegetables. Miscellaneous Publication 190, U. S. Department of Agriculture, June, 1934.

but that no definite percentage of the potatoes is required to be larger than this minimum size.

When potatoes meet the requirements of either size A or size B, as described below, the size classification may be specified in connection with the grade.

Size A.—For round and intermediate shaped varieties such as Irish Cobbler, the minimum size shall be not less than  $1\frac{1}{8}$  inches and not less than 60 per cent of the potatoes in the lot shall be  $2\frac{1}{4}$  inches or larger in diameter.

Size B.—For all varieties, the size shall be from  $1\frac{1}{2}$  inches to not more than 2 inches in diameter.

**U. S. Commercial** shall consist of potatoes which meet the requirements of U. S. No. 1 grade except that they shall be free from serious damage by dirt and except for the increased tolerance for defects specified below.

Unless otherwise specified, the diameter of each potato shall be not less than  $1\frac{1}{8}$  inches.

In order to allow for variations other than size incident to proper grading and handling, not more than a total of 20 per cent of the potatoes in any container may be below the requirements of this grade, but not more than 5 per cent may be seriously damaged by hollow heart and not over 6 per cent may be below the remaining requirements of U. S. No. 2 grade provided that not more than one-sixth of this amount or 1 per cent shall be allowed for potatoes affected by soft rot or wet break-down.

**U. S. No. 2** shall consist of potatoes of similar varietal characteristics which are free from freezing injury, blackheart and soft rot or wet break-down and from serious damage caused by dirt, other foreign matter, sunburn, second growth, growth cracks, air cracks, hollow heart, cuts, shriveling, scab, blight, dry rot, other diseases, insects, mechanical or other means.

Unless otherwise specified, the diameter of each potato shall be not less than  $1\frac{1}{2}$  inches.

In order to allow for variation other than size incident to proper grading and handling, not more than 6 per cent of the potatoes in any container may be below the requirements of the grade but not to exceed one-sixth of this amount or 1 per cent shall be allowed for potatoes affected by soft rot or wet break-down. In addition, not more than 5 per cent may be seriously damaged by hollow heart.

## DEFINITION OF TERMS

As used in these grades:

“**Mature**” means that the outer skin (epidermis) does not loosen or “feather” readily during the ordinary method of handling.

“**Bright**” means free from dirt or other foreign matter, damage or discoloration from any cause, so that the outer skin (epidermis) has the attractive color normal for the variety.

“**Well shaped**” means the normal shape for the variety, and that the potato is not pointed, dumb-bell shaped, excessively elongated, or otherwise ill-formed.

“**Soft rot**” means any soft, mushy or leaky condition of the tissue, such as slimy soft rot, leak or wet break-down following freezing injury or sun scald.

“**Diameter**” means the greatest dimension at right angles to the longitudinal axis. The long axis shall be used without regard to the position of the stem (rhizome).

“**Damage**” means any injury or defect which materially injures the appearance of the individual potato or general appearance of the potatoes in the container, which cannot be removed without a loss of more than 5 per cent of the total weight of the potato. Loss of outer skin (epidermis) shall not be considered as damage unless the skinned surface is materially affected by very dark discoloration. Any one of the following defects or any combination of defects, the seriousness of which exceeds the maximum allowed for any one defect shall be considered as damage.

“**Fairly well shaped**” means that the potato is not so pointed, dumb-bell shaped, or otherwise ill-formed that its appearance is materially injured.

“**Badly misshapen**” means of such shape as to cause appreciable waste in the ordinary process of preparation for use.

## LATE POTATOES

The high temperatures that exist during July and August present a distinct handicap to the fall crop of potatoes in Missouri. In some seasons, however, home producers may succeed equally as well with the fall crop as with the spring planting. In general the fall crop cannot be recommended as a profitable commercial venture.

The planting date for the fall crop is from the last week in June to the first week in July. The planting of the late crop at the proper time is just as important as getting the main crop planted early. The late crop must be planted early enough to produce a crop before frost, but late enough to escape injury at the tuber forming period from the hot dry days of the summer.

### Varieties

The varieties most used for the fall crop are the Rural New Yorker, Russet Rural, Peach Blow, Green Mountain and Katahdin.

**Rural New Yorker (White Rural).**—Rural New Yorker is a good late variety. The vines are medium large and upright. The stems are usually streaked with dark purple. The flowers range from a deep violet in the center to a faded violet as the other portions of the flower are reached. The tubers are round to round oblong, usually flattened. The eyes are few and very shallow. The skin is creamy white in color.

**Russet Rural.**—This variety is similar to the White Rural in many respects, its main difference being the color of the skin. As the name suggests, the skin is of a deep russet color, and usually quite heavily netted. It is one of the principal varieties for the late crop. Both the White and Russet Rural keep well in storage and are much in demand for baked potatoes.

**Peach Blow.**—A late variety grown to a considerable extent as a late crop for the home garden. Produces a large, healthy, vigorous vine with sturdy stems. The flowers, usually abundant, are medium purple in color. The tubers range from round to round oblong in shape. The eyes, which are medium in number, are fairly shallow on the main body of the tuber, but very deep in the eye cluster at the seed end. The potato is a very good keeper, staying dormant for the late crop under favorable common storage conditions.

**Green Mountain.**—This variety is used to some extent in Missouri. The tubers are oblong and flat with rather blunt ends. The skin is a creamy white with considerable russetting. The vines are vigorous growing and of a light shade of green. The flowers are white.

**Katahdin.**—Katahdin is a new introduction which matures a little later than Green Mountain. It is shallow eyed, glossy and white skinned and is resistant to mosaic. More information on the performance of this variety under Missouri conditions is necessary before recommendations can be made as to its general adaptability.

### **STRAW POTATOES**

The growing of Irish potatoes under a straw mulch has proven successful in some years under Missouri conditions. The seed pieces are covered with a thin layer of soil and about 8 inches of wheat straw. The chief advantages of growing potatoes under straw mulch are: It aids in the control of weeds, and in that way helps conserve the soil moisture. It also lessens the possibility of sunburning which sometimes occurs to the potatoes which are exposed to the sun during the latter part of the growing season. One disadvantage of the growing of potatoes under straw mulch is the increased labor and time necessary to apply the straw.



## POTATO GROWING

Use only high quality seed of a variety adapted to Missouri conditions.

Treat all seed potatoes, including certified seed, before planting.

Early planting is important. For Central Missouri the largest average returns will be obtained from potatoes planted from March 20 to April 1.

Thorough and timely cultivation is very important for the production of a profitable crop. The principal objective of cultivation is weed control.

Barnyard manure is one of the best sources of plant food for potatoes.

Turn under for green manure such crops as soybeans, cowpeas, clover and sweet clover.

On the average, for the soils generally used for potatoes in Missouri a complete fertilizer such as a 4-12-4 or a 4-16-4, applied at the rate of 400 to 600 pounds per acre, is recommended.

Control chewing insects by spraying or dusting with arsenicals. The flea beetle and leaf hopper may be controlled by thorough spraying with Bordeaux mixture and an arsenical.

Spray with Bordeaux mixture when leaf diseases are present.

All potatoes should be carefully harvested and properly graded before marketing or storing.