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Potatoes

John Noonan

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Additional References

In a short leaflet such as this, many special or technical problems cannot be covered. Many good bulletins on insects and insecticides, diseases and fungicides, storage, and other subjects are available. A list of these follows:

Late Blight—(SD) S. D. Exp. Station Circular 89.
Seed Treatment—(SD) S. D. Agri. Experiment Station Pamphlet No. 8.

Bacterial Ringrot of Potatoes—Oregon Agri. Exp. Station Cir. of Information 491.
Potatoes for Livestock Feed—PMA, Fruit & Vegetable Branch, Misc. Publication 676.
Potato Irrigation, Costs, etc.—Cornell U. Agri. Exp. Station Bulletin 862, Ithaca, N. Y.
State of Maine—Potato Cook Book—Maine Development Comm., Maine Dept. of Agri., Orono, Me.
Handling Storage and Transportation and Utilization of Potatoes—U.S. D.A. Division of Fruit and Veg. Crops and Diseases, Bibliographical Bulletin 11.
Handling Early Potatoes—Union Pacific Ry. Traffic Dept., Omaha, Nebr.
Description and Key to American Potato Varieties—U.S.D.A. Circ. 741, Revised.
Harvesting and Shipping Potatoes—Union Pacific Ry. Dept. of Traffic, Omaha, Nebr.
Potato Storage—Union Pacific Railway.
Main Potato Diseases, Insects, and Injuries—Bulletin 469, Maine Agri. Exp. Station, Orono, Me.
Trade Paper—The Packer, Kansas City, Mo.
American Potato Journal, New Brunswick, N. J.
Wire Worms and Their Control—S. D. Exp. Station Bulletin C 77.
Potatoes, a low cost energy food, were first mentioned in the chronicles of the Spanish conquerors of Peru around the year 1586. These Spanish sailors took the tubers to Spain and gradually they were grown all over Europe. They were not popular at first, but by the 18th century became a staple part of European diet. Now, potatoes are one of the most important food crops of Europe, and they are grown in nearly every country in the world.

In former years, potatoes were grown on most farms in South Dakota and by many small growers, but in the past 10 years the acreage has gradually shifted to the larger growers in the northeastern part of the state.

This area has an ideal soil for the growing of potatoes, a Sinai-Kranzburg-Barnes type sandy loam. Sinai soils are silty clay loams, Kranzburg are soils of silt loam wind-blown deposits, and Barnes soils are loams over limy clay loam glacial till. The high altitude causes cool nights which are good for potato production, and the rainfall is sufficient in most years. Potatoes should have one to two inches of moisture per week during the growing season for the best yields.

Popular Varieties

**Bliss Triumph:** An early maturing red potato of good table quality, grown extensively for the southern seed trade. The Triumph is round with fairly deep eyes, and it is an excellent yielder. It yields highest under good moisture conditions, but suffers severely from dry weather.

**Red Pontiac:** This is a medium maturing red potato, a heavy yielder with fair table quality. It is a cross between a white potato, the Katahdin, and the Triumph, a red potato. The red Pontiac is now generally grown instead of the regular Pontiac which had a dull color. They are identical except for color. The Pontiac has heavy, vigorous vines and, under ideal moisture conditions, will produce large tubers.

**Irish Cobbler:** An early white potato, maturing a little later than the Bliss Triumph. The Cobbler has excellent table quality and is in demand for potato chips. The tubers are round, tending to be flat in heavy soils. It is resistant to mosaic, but susceptible to fusarium and blackleg. It is a good keeper in storage.

**Early Ohio:** A long type early potato, in demand by gardeners, but not a heavy yielder, so commercial growers shy away from it. A very excellent table quality potato but susceptible to scab and to second growth.

**La Soda:** A new pink or light red potato, originated by Dr. J. C. Miller of Louisiana. Medium in maturity and a heavy yielder. Very good table quality.
In demand for the southern seed trade The La Soda is a cross between the Triumph and the Katahdin. The plants are vigorous and upright with purple flowers. The tubers are semi-round to slightly oblong, with shallow to medium depth eyes.

Warba: Red color or white with pink eyes. Earlier than the Triumph and of excellent table quality, but the eyes are deep. Sets heavy and yields good, if rainfall is sufficient in July. Very good for the early potato market and gardeners. Keeps well in storage. The tubers tend to roughness in heavy soils.

Kennebec: A new, late variety, with resistance to late blight. The tubers are white with shallow eyes. Keeps well in storage and has excellent table quality but will grow too large under good moisture conditions.

Cherokee: Another new white variety, with a high resistance to scab, about 10 days later than the Cobbler. Has good cooking qualities and may replace the Cobbler in some areas.

Waseca: A very early red variety from the Minnesota Experiment Station. The tubers are medium to large, oblong to round with fairly shallow eyes. Does good in sandy soil with plenty of moisture. The Waseca is a cross between the Triumph and an inbred seedling of Katahdin parentage. Produces a high percentage of medium and large tubers.

Satapa: Another Minnesota introduction from a cross of the Red Warba and a seedling. It is medium early, pale red in color with shallow eyes. Popular with hotels and cafes because of the smooth round tubers and shallow eyes.

Columbia Russet: A selection from the Wee McGregor. A late Russet, round to long shape, with a nice appearing russet skin. Late in maturity, but yields good. Must have a steady supply of moisture, or the shape will be poor.

Potatoes require a sandy loam soil, not too heavy, with at least one to two inches of moisture each week during the growing season. Best results are secured if potatoes are not grown on the same field more often than once in five or six years. Bacteria and fungi build up in the soil if potatoes follow potatoes. Summer fallowed fields are ideal since fallowing stores moisture and controls weeds. A green manure crop of sweet clover should be plowed under in June and the field kept black the rest of the season.

Potatoes require potash and nitrogen as well as phosphorus for their best growth. Our South Dakota soils are high in potash, but a complete fertilizer is recommended. However, good results have been secured from nitrogen and phosphate, without potash.

Soils vary so much no general formula will meet all conditions. The county extension agent should be consulted in regard to local requirements.
Seed Bed
The seed bed should be well prepared and packed to retain soil moisture. Planting seed pieces in dry soil will almost certainly result in many decayed seed pieces and poor stands.

The depth of planting will depend on the soil and moisture conditions, but the usual depth is three to four inches. In sandy soils the furrows can be completely covered, but in heavy soils the covering should be shallow. This will act to check rhizoctonia and blackleg infection.

Seed Treatment
Authorities are not in accord on the value of seed treatment, but experience in South Dakota has proven that seed treatment pays. Surface borne diseases on the seed pieces will be controlled and better stands will result.

A good, easy to apply treatment is Semesan Bel. This is an instant dip and can be purchased at drug stores and supply houses. Other seed treatments are outlined in Experiment Station Pamphlet No. 8.

It must be remembered that seed treatment will not guarantee a scab free crop. If the scab bacteria are in the soil, the tubers may be scabby.

Cultivation
Many potato fields are ruined or seriously damaged by deep cultivation. The only deep cultivation should be the first time over. After that, surface shovels should be used, so the feeder roots will not be cut. Some growers use disk tillers the last time through, and this serves to keep the tubers covered, avoiding sun-burn, but heavy ridging causes a loss of moisture, and should be avoided.

Two, 4-D may be used on the Bliss Triumph variety to control broad leaved weeds. The potato vines should be 12 to 14 inches tall, and if the small tubers are three-fourths to one inch in diameter, the red color will be made a deeper red. Some distortion of plants will appear, but no noticeable loss of yield will occur.

Harvesting
Many good potatoes are ruined in digging, handling, and storing. It should be remembered that a potato is a living thing, very perishable, and cannot be thrown around like coal. The digger should be adjusted so that enough dirt is carried on the chain or conveyor to prevent bruising. Every bruise or cut on a tuber means a defect and in storage these defects grow into rots, making No. 2 or cull potatoes.

Persons picking potatoes and sack handlers should be cautioned not to drop the tubers. Truck beds should be padded with carpets or old sacks. Then the sacks should not be dumped into bins except through a canvas chute, where they can be directed to the bin without dropping. Unloading conveyors are now used by a number of growers. Care should be taken in feeding the tubers to the conveyor and it should not be run fast.

Vine beaters are now used to destroy the vines so that digging and picking are made easier. Beaters are also used in early digging, so that the tubers will mature and the skin will set.

The latest in potato harvesting is the combine, which digs and loads in the same operation. This machine digs two rows, elevates the tubers to a picking table, where workers pick off the vines and roots before the potatoes are elevated into a hopper box. This box has an endless apron in the bottom which unloads the tubers into a conveyor to the washer or bin. The potato combine is used by large growers and each year
they are being improved. Their advantage is that sun scald is held in check, and hand picking is eliminated, but it still requires a lot of help to man the machine.

Sun scald is the worst enemy in the early harvesting of potatoes. High temperatures and windy weather will cause sun scald even if the tubers are in the shade. A dry wind removes the moisture from the feathered spots which results in a discoloration. Growers should stop digging when the air is dry and the wind is blowing on warm days. Potatoes should not be left on the ground longer than 10 to 20 minutes in 80 to 85 degree temperature. Before potatoes are dug, they are cooler than the surface temperature, but as soon as they are dug they absorb heat. Potatoes should never be left in uncovered sacks, exposed to the sun or wind, in warm weather.

Storage

Winter storage for potatoes is necessary if growers plan to stay in the potato business. Cheap storage houses can be constructed in a dugout in the ground. This type of storage requires heavy timbers to support the roof which is covered with straw and earth. Many of the first underground storage houses in South Dakota have now been reroofed with shingles, or rubberized roofing, and insulated.

The size of the storage house needed can be determined by figuring that one square foot of space stored six feet deep will hold four bushels. Potatoes require cool storage with the humidity about 90 percent. Potatoes go through a "sweat" when first placed in storage and lose moisture. If the right temperature and humidity is maintained the shrinkage should be low. The ideal storage temperature is around 40 degrees. Potatoes will sprout early in the
spring if the temperature is above 40 degrees.

At 36 to 40 degrees, the starch in the potatoes turns to sugar. If they are cooked immediately after taking out of this cool storage, they have a tendency to turn black. This can be corrected by storing a supply at 60 degrees for a week or two before using. Potato chip manufacturers always warm up their stock before chipping, and some even like to see the sprouts coming out the sacks, as they then know the potatoes are warm. Storage of potatoes is very important. Growers should consult the bulletins on storage listed in this booklet.

Seeds Plot

A seed plot planted by the tuber-unit method should be maintained, unless new certified seed is purchased each year. The tuber-unit method means planting the seed pieces from one tuber in consecutive places in the row and then the unit is marked by skipping one space. The tubers are sized first, so that each one can be cut in four pieces. They are then planted by hand, as a rule, in a furrow opened by a planter, without the covering disks being used. Large fields are planted with special planters and two to four men.

The advantage of the tuber-unit method is that all the plants from each tuber can be removed if they show disease. Sometimes only one or two plants may show symptoms of disease, but the whole unit should be pulled out. This should be done early in the season before insects spread the disease and before tubers form.

A further step in keeping up the seed is to select the best units and store them in separate containers and then mark them in the row when planted the following spring, preferably by the tuber-unit method.
In order to keep disease at a minimum, certified seed, or tubers from certified fields one year removed should be used. Virus diseases build up very quickly if the infected plants are not rogued out.

A virus disease is caused by what is known as a filterable virus. This is an invisible agent in the juices of the plant which can pass through filters which remove ordinary bacteria and fungi. Viruses are highly infectious and spread from plant to plant by contact or by insects. Mosaic, leafroll, and spindle tuber are the most common of the virus diseases in South Dakota.

Early blight, late blight, and rhizoctonia are fungus diseases. Fungi are one of the lowest forms of plant life. They are commonly called molds. Fungi reproduce by spores. Blackleg, ringrot, and scab are bacterial diseases. Bacteria are also a low form of plant life. They are mostly single-celled plants and multiply by simple division.

Mosaic causes the plants to be dwarfed, with the leaves mottled and yellowish. In hot sunny weather it is hard to see, if a mild case, but it is easily picked out on cloudy days if the field is moist. Mosaic can reduce yields as much as 75 percent.

Leafroll plants have leaves rolling upward and they feel leathery when touched. The plants are usually dwarfed, and do not grow as fast as a normal plant. Leafroll causes net necrosis in the tubers of some varieties. Leafroll is transmitted from one plant to another by insects, especially the green peach aphids.

Spindle tuber shows up in the tall spindly plants, with the branches coming from the main stem at sharper angles. The leaves also have a dull appearance. When the plant is pulled up, the tubers will show pointed ends and have prominent eyes. Red potatoes will also show a paler color. Spindle tuber also greatly reduces the yield.

Early blight never causes much damage in South Dakota. Dark brown spots appear on the leaves and on close inspection they look circular with rings around the center. Occasionally the blight affects the tubers causing small brown round spots on the surface. This damage is not serious, but the injuries provide an entrance for rot-producing organisms.

Late blight develops in cool moist weather when the vines have a certain degree of maturity. Dry sunny weather with temperatures 80 degrees or over will check the spread of fungus. Tuber rots result when the fungus is washed through cracks in the soil, onto the tubers. Watch out for late blight when the vine growth is heavy and the weather is moist and cool. Don't confuse late blight with tip-burn or hopperburn, which shows up after a dry spell.

Blackleg causes the plants to die early, as a rule, but it can also attack older plants. The stalk of the plant...
Potatoes in South Dakota

turns black and the center rots out. Blackleg causes much loss in wet seasons. Healing of seed pieces will lessen blackleg injury. Since the bacteria are present in the soil, avoid using potatoes for seed which have any rot in them. Treat with a good disinfectant.

Ringrot is caused by bacteria that overwinters in diseased tubers, storage bins, old sacks, or grading equipment. In South Dakota it does not keep alive in the soil because of our cold winter temperatures. Ringrot is probably the worst disease South Dakota growers have to contend with because it is so highly infectious. The rot first appears in the tuber in the vascular ring, showing up as a thin discoloration. When this ring is squeezed, a yellowish white and cheesy rot shows. As the rot increases the entire interior may decay, leaving only a shell of flesh outside the vascular ring. Cracks may show up on the outside of the tuber. In the field, the plants wilt and often die. Plants can be infected and not cause rotted tubers the first season, making the disease very hard to control. There is no tolerance for ringrot in certified stock so one infected tuber or one plant would cause the field to be rejected.

If ringrot is found in a warehouse, thorough disinfection is necessary to eliminate the disease. All grading equipment, knives, sacks, and storage bins must be disinfected. Use copper sulphate, formaldehyde, or Lysol. Complete instructions can be found in South Dakota Experiment Station Pamphlet No. 7.

New seed should be secured for three years, and all stock should be sold and not planted.

Rhizoctonia causes young plants to die, but some survive and grow into rough, stiff-looking vines. Tubers develop near the surface of the ground, close to the main stem. Small black specks, which will not wash off, are found on the tubers in the ground. These spoil the appearance of the tuber and can be a serious grade defect.

Common scab shows up on the tubers as surface defects which may be shallow or deep. When deep, it is called pit scab. Scab bacteria is present in most soils and develops on the tubers when the soil is hot and dry while the tubers are forming.

No treatment can control virus diseases. In certified fields the diseased plants are pulled out and destroyed. Late blight and early blight can be controlled with a good fungicide such as Dithane, Zerlate, or Parzate, if applied at regular intervals. Blackleg and rhizoctonia can be lessened by seed treatment. Scab bacteria on the tubers can be killed by treatment, but the bacteria in the soil can cause scab on the new tubers. Avoid putting fresh manure on potato ground. Rotate the fields so that potatoes are not planted more often than every 5 or 6 years. The planting of "B" size tubers from certified seed, will also keep down rhizoctonia and blackleg, and insure better stands. Planting of "B" size seed from uncertified stock is not recommended because the diseased plants which are not rogued out produce small tubers.

A condition known as tip-burn is often confused with late blight. In tip-burn the tips and edges of the leaves turn brown. This condition is caused by dry, hot, sunny weather, and aggravated by leaf-hoppers and flea beetles. The remedy is to spray or dust with a fungicide and insecticide.
Insect Pests

The common insects attacking potato plants in South Dakota are the Colorado beetle, the flea beetle, and the leaf hopper. Grasshoppers and blister beetles were very severe in South Dakota in 1932 to 1935, and aphids or plant lice cause damage some years. White grubs are not much of a problem in South Dakota, but wire worms are serious in many fields. The wire worm is the larvae of the click beetle. They injure the tuber by boring holes in it, causing a serious defect.

The insects attacking plants can be controlled with a DDT dust or a spray. Spraying or dusting should start when the plants are eight to 10 inches tall. Then it should be repeated at seven to 10 day intervals for best results. After the first spraying or dusting with DDT, a fungicide should be added to control diseases.

Stalk borers also attack potato plants but the damage is not usually serious. One stem of the plant will start to wilt, and upon examination it will be found that a borer is doing the damage.

In the tubers, the insects causing the most damage are wireworms, grub worms, and flea beetles. Potatoes should not be planted on alfalfa ground. Soil insects build up in land which is not worked each year. Early fall plowing and working the land before the winter freeze-up will help to control soil insects. Summer fallow land should have a low insect population.

Grub worms are the larvae of the May beetle or June bug. They have a three to four year cycle. As a rule they are not too serious in South Dakota. The larvae of the flea beetle burrow under the skin of the tuber and cause winding trails on the surface and sometimes in the tuber one-fourth to three-fourths of an inch deep. A five percent DDT dust or a .25 percent DDT spray is usually effective in controlling flea beetles.

Certification

Certified seed means potatoes from fields which have been entered for certification, and have passed all the field and tuber inspections. The certification of potatoes in South Dakota is handled by the South Dakota Potato Growers Association under a cooperative agreement with the State Seed Certification Board.

The grower starts with certified or approved seed stocks and enters the acreage with the secretary of the association. Members are assessed modest annual dues and certification fees. Two or three field inspections are made by an experienced man, working jointly for the South Dakota Potato Growers Association and the Pathology department of the Experiment Station at South Dakota State College.
### Field Inspection Allowable Disease Tolerances

<table>
<thead>
<tr>
<th>Disease</th>
<th>First Inspection Before Blossoming</th>
<th>Second Inspection After Blossoming</th>
<th>Third Inspection Before Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spindle Tuber</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Mosaic</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Leaf Roll</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Total of above or any other virus diseases</td>
<td>3%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Fusarium Wilt</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Blackleg</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Bacterial Ringrot</td>
<td>0%</td>
<td>0%</td>
<td>Disqualifies</td>
</tr>
<tr>
<td>Early Blight</td>
<td></td>
<td></td>
<td>Severe infection disqualifies</td>
</tr>
<tr>
<td>Late Blight</td>
<td></td>
<td></td>
<td>Severe infection disqualifies</td>
</tr>
</tbody>
</table>

In actual practice, the percentage of disease is usually far below the tolerance allowed. Growers are advised to pull out or rogue the diseased plants if the percentage is near or below the tolerance. Good seed stocks should have none or less than .5 percent of disease.

There are three grades of South Dakota certified seed potatoes available. The Blue Tag grade is the same as U. S. No. 1, except for hollow-heart and size. There can be five percent of the tubers seriously damaged by hollow-heart in the Blue Tag grade, but not over 10 percent can be over 14 ounces in size. The Red Tag grade is the same as U. S. Commercial, except that 15 percent can be seriously damaged by hollow-heart. The Green Tag grade is the same as U. S. No. 2 except for hollow-heart. The reason for the increased tolerance for hollow-heart is that it is a growing condition and does not hurt the tubers for seed purposes.

The certified seed is inspected after being graded and then the sacks are tagged and sealed. Tags and seals are available at the secretary's office.

The inspection of potatoes to establish the grade is available to South Dakota growers. Federal-state inspectors are stationed at Watertown, Clark, and Garden City. Federal certificates are written establishing the grade and size. Requests for inspection can be made to the secretary of the South Dakota Potato Growers Association at Watertown.