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BETTER POTATOES FOR MICHIGAN

By H. C. MOORE

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Better Potatoes for Michigan

By H. C. MOORE

The potato is Michigan's most important cash crop. For the 10-year period 1929-38, the average value of the crop was \$15,027,600. Favorable soil and climatic conditions, combined with relatively close markets make Michigan one of the leading potato growing states. In 1938 it ranked second with a production of 30,000,000 bushels.

Competition among leading potato-producing states in growing and marketing potatoes is keen. In Michigan, as well as in out-of-state markets, Michigan potatoes must sell in competition with those from other states. Detroit and vicinity with an annual potato consumption of about 5,000,000 bushels is Michigan's largest nearby market. In the 1937-38 shipping season this market used approximately 2,000,000 bushels of potatoes from other states. In most instances potatoes from far distant states outsold the Michigan product by a wide margin. The consistently better grade, quality and packaging of the out-of-state potatoes were some of the reasons why they met with greater consumer preference than much of the Michigan stock which too often was of poor quality and grade and in unattractive containers.

That Michigan potatoes can be sold favorably on the Detroit and other markets in competition with potatoes from other states has been demonstrated many times in recent years. Many state growers have sold potatoes of high quality and grade on the Detroit and various other markets and have obtained prices comparable with those brought by the better out-of-state stocks.

Successful competition for the Michigan potato industry involves not only the marketing of high quality potatoes, but also their production at relatively low cost per bushel. Increased yields per acre help to reduce production costs per bushel. Cost account records on 142 Michigan potato farms showed a reduced cost of 11 cents per bushel when the yield per acre was increased 43 bushels.

Michigan's 1942 potato crop averaged 98 bushels per acre. Many growers, however, obtained 200-bushel yields and 154 growers qualified for the Michigan 300-bushel club by producing 300 bushels or more per acre. The average total yield per acre for the 154 club members was 408 bushels. The average number of acres per grower was 21.7.

Good cultural practices, including careful soil selection, thorough fitting of the seedbed, adequate use of manure and fertilizer, the plant-

ing of disease-free seed, clean cultivation and effective spraying to control insect and disease pests were some of the most important factors that accounted for the high yields of superior quality obtained by the 300-Bushel Club members. The more general adoption of these practices by Michigan growers would make the production of potatoes more profitable and would better the potato industry of the state.

The purpose of this bulletin is to emphasize the cultural practices that have proved most effective in Michigan in the production of better yields and better quality potatoes.

SOIL REQUIREMENTS

1. Select a sandy loam, gravelly loam, or silt loam soil, that is deep and mellow, well drained and well supplied with organic matter. Potatoes grown on heavy soils are likely to be dark-skinned and of poor type.
Soils deficient in organic matter dry out quickly in seasons of drouth and usually produce low yields and off-type potatoes.
2. Do not plant potatoes more often than once in 4 or 5 years on the same piece of ground. A long rotation may aid in producing potatoes clean from scab, black scurf, and other soil-borne diseases.
3. Alfalfa, sweet clover or red clover are good crops to precede potatoes in the rotation. They add fertility to the soil and increase its moisture-holding capacity.
4. Do not plant potatoes on old timothy or grass sods that are often infested with wireworms and white grubs. Alfalfa, sweet clover, and red clover sods are generally free from those pests.

MAKE THE SEEDBED DEEP AND MELLOW

1. Plow in the fall or early in the spring. Late plowing of the seedbed is often responsible for poor stands and poor yields.
2. Plow as deeply as possible without turning up the subsoil.
3. If necessary to plant potatoes on a quack grass sod, kill the quack grass in August and September previous to the potato planting season by thorough shallow cultivation with a quack grass drag or harrow. Make frequent cultivations to prevent the development of green leaves. Plow deeply early in the spring and turn under the dead quack grass roots to a depth of 6 or 8 inches.
4. Disk or harrow the seedbed early in the spring and continue at frequent intervals until planting time. Five or more harrowings should be made to destroy weeds and grass and make the seedbed deep and mellow.

These cultivations previous to planting are usually of more value in controlling weeds and grass than are row cultivations made

after the plants are up. Thorough fitting of the soil before planting will help to reduce the number of row cultivations and will permit closer spacing of the hills.

USE CAUTION IN APPLYING STABLE MANURE AND LIME

1. Apply stable manure during the summer or fall previous to planting potatoes. Fresh stable manure applied late in the winter or spring may increase injury from potato scab.
2. Apply stable manure as a top-dressing, 6 to 8 loads per acre. The manure should be uniformly distributed. Do not place it in the row where it will come in contact with the seed pieces or the growing tubers.
3. If lime is required to grow alfalfa, sweet clover, or other legumes in the rotation make the applications 4 or 5 years before planting potatoes.

Potatoes will grow satisfactorily in acid soils. The scab disease is also less severe in soils that are acid. Applications of lime just previous to planting potatoes may result in severe scab injury.

USE COMMERCIAL FERTILIZER

1. Apply 400 to 600 pounds of commercial fertilizer per acre on good soils well supplied with organic matter.
On poor soils deficient in organic matter apply approximately 300 pounds commercial fertilizer per acre.
2. Use a high-analysis fertilizer, such as 3-12-12, 2-16-8.
3. If potatoes are planted with a planting machine having a fertilizer attachment, apply the fertilizer in the furrow at time of planting.

The fertilizer should be placed in bands 2 inches on either side and on a level with the bottom of the seed piece.

Care must be taken that the fertilizer does not come in contact with the seed pieces, because the sprouts may be injured and a poor stand result.

4. Where the planting is done by hand, the commercial fertilizer should be applied broadcast or drilled in with a fertilizer drill just previous to planting. If applied broadcast it should be worked into the soil to a depth of about 3 inches with a drag or harrow.

PLANT VARIETIES ADAPTED TO SOIL AND CLIMATE

1. The best late varieties are Russet Rural, Pontiac, Katahdin and Green Mountain.
2. The best medium-early variety is the Chippewa.

3. The most important early variety is the Irish Cobbler.
4. The **Russet Rural** is Michigan's most important variety, though in many sections it is being supplanted by white-skinned varieties. It requires 120-130 days to mature. It is particularly adapted to sandy loam soils in sections where hot dry weather frequently occurs. Russet Rural is somewhat more resistant to scab than smooth, white-skinned varieties.
5. The **Pontiac** is a red potato, round to oblong in shape with medium-deep eyes and crisp white flesh. It was introduced by the Michigan Experiment Station in 1938. Its good yielding and cooking qualities have made it a favorite with many growers.
6. The **Green Mountain** is grown mostly in the Upper Peninsula where the seasons are generally cool with ample rainfall. It is not recommended for sections that may have long spells of dry hot weather.
7. The **Chippewa**, which matures about 3 weeks before the Russet Rural, is a new variety that has found much favor in Michigan. It is a round to oblong potato with white skin and shallow eyes. It generally cooks whiter than Russet Rural and has usually brought a premium on the market.

The Chippewa should be planted on sandy loam or other mellow types of soil and preferably on acid soil. It is more subject to scab than the Russet Rural.

Many growers have found the Chippewa an excellent variety to plant in April or early May for the August market.
8. The **Katahdin** is another new variety closely resembling the Chippewa, but matures about 10 days later.

In seasons of drouth the Katahdin often surpasses the Russet Rural in yield of U. S. No. 1 potatoes. Its chief characteristic is its consistent producing of good type tubers under unfavorable weather conditions. The Katahdin should be planted on mellow deep soil that is not infested with scab.

It sets its tubers close to the surface. The seed should be planted 4 to 4½ inches deep and when the potatoes begin to crack the ground an inch or two of soil should be thrown over the row to prevent sunburn injury.

The Katahdin should be planted close to reduce over-sized, hollow potatoes. On good soil the hills should be about 12 inches apart. The Katahdin and Chippewa have both proved very good varieties for muck soil.
9. The **Irish Cobbler** is a round, deep-eyed, white variety, that generally matures about 10 days before the Chippewa. It is the most important early variety for the July and early August Market.

It prefers a rich sandy loam soil, and is also a good variety for muck.

INCREASE YIELD—IMPROVE QUALITY PLANT CERTIFIED SEED

1. Planting inferior seed is largely responsible for crops of poor quality and low yields. Mosaic, leaf roll, spindle sprout, spindle tuber, and other virus diseases cause the "running out" or degeneration of seed.
2. Most virus diseases cannot be detected in the bin. They can only be discovered in the growing plants. Michigan certified seed is practically free from virus and other diseases. It is inspected in the field under the supervision of Michigan State College and is certified by the Michigan Crop Improvement Association. It is free of varietal mixtures and is grown from hill selected stock.
3. Certified seed often will enable the grower to increase his yield 50 bushels or more of U. S. No. 1 potatoes per acre.
The general planting of certified seed in a community will help the community to build up a reputation for growing and marketing potatoes of superior quality.
Certified seed can be bought most advantageously by pooling orders with the local farm bureau, seed dealer or other agency.
4. Sources of certified seed and detailed information on the seed potato inspection service may be obtained from the local county agricultural agent or from the Farm Crops Department, Michigan State College, East Lansing.

TREAT THE SEED TO REDUCE INJURIES FROM SCAB, BLACK SCURF AND BLACK LEG*

1. Corrosive sublimate is effective in controlling scab, black scurf, and black leg.
2. Corrosive sublimate is a deadly internal poison. Keep it out of the way of livestock or children. Do not use treated potatoes for eating purposes.
3. Treat the seed while dormant and before it is cut.
4. Use wooden barrels or tanks. Corrosive sublimate corrodes metals.
5. Dissolve 4 ounces of corrosive sublimate in about a quart of hot water and add the solution to 30 gallons of cold water.
6. Soak the potatoes in the solution 1 hour. When they are removed from the solution spread them in a cool place to dry quickly.
7. The corrosive sublimate solution loses its strength with use. Add one ounce of corrosive sublimate dissolved in one quart of hot

*Consult Michigan State College Extension Bulletin 162, "Michigan Potato Diseases and their Control."

water for each 30 gallons of liquid after each second batch of potatoes has been treated.

After six batches of potatoes have been treated, discard the solution and make up a fresh one.

One pound of corrosive sublimate is required to treat about 50 bushels of seed.

8. Formaldehyde is very effective in controlling scab and black leg. It does not lose its strength after repeated use and does not corrode metal.

Soak the whole tubers $1\frac{1}{2}$ hours in a solution made by adding 1 pint formaldehyde to 30 gallons of water.

After the potatoes are removed from the solution, keep them covered with burlap sacks 1 to 2 hours.

9. Organic mercury compounds such as Semesan Bel are satisfactory disinfectants. Seed treatment directions printed on the container label should be followed carefully.

Usually 1 pound of the chemical is mixed with $7\frac{1}{2}$ gallons of water to make a thin paste. The potatoes to be treated are placed in wire baskets and dipped into the mixture, so that all the tubers are thoroughly coated with the chemical. The basket is then placed on a platform to allow the excess mixture to drain back into the treating container.

GREEN-SPROUTING HELPS TO INSURE GOOD STANDS

1. After the seed is treated place it in a 6 to 8 inch layer on the floor of the barn and exposed to light. The temperatures of the green-sprouting room should be 60° - 70° F.
2. In 10 days to two weeks, short green sprouts will develop. Green-sprouted seed starts growth quickly when planted and is less subject to rotting than unsprouted seed.
3. Discard all tubers that do not have thrifty sprouts. Chilling injury and some diseases result in weak spindly sprouts.

LARGE SQUARE SEED PIECES ARE BEST

1. For seed select tubers about 6 to 10 ounces in weight.
2. Do not use pointed or ill-shaped potatoes.
3. Cut the pieces squarely or blocky with 2 or more eyes on each piece. Each seed piece should weigh $1\frac{1}{2}$ to 2 ounces.
4. Discard potatoes that show flesh discoloration.
5. Do not plant small seed unless it came from certified fields. Small potatoes from uncertified fields are more likely to be affected with disease than are larger tubers.



Fig. 1. Cut seed pieces large and blocky.

6. The planting of certified small whole seed $1\frac{1}{2}$ inch to 2 inch diameter usually gives good results. Under adverse soil conditions the whole seed often produces a better stand than does the cut seed.
7. Cut seed just previous to planting. Keep cut seed in a cool shady place. Do not store in bags or in large piles.
8. If necessary to keep cut seed several days before planting, spread the seed in a thin layer on the barn floor or other cool place to avoid heating and molding.

PLANT EARLY—PRODUCE MATURE POTATOES

1. For early market plant early varieties as soon as the soil can be put in good condition and as soon as danger from severe frost is past.
2. Late varieties generally require about 120 days to mature, and should be planted early enough to mature their tubers before killing frosts in the fall.
3. Immature potatoes bruise more easily in handling, shrink more in storage, and often cook darker than does matured stock.
4. Early planting will permit early harvesting, thus avoiding much injury from field frost.
5. Early planting may reduce losses from late blight by getting the crop developed before the late blight attacks the field.

PLANT DEEP—COVER SHALLOW

1. Plant the seed pieces $3\frac{1}{2}$ to $4\frac{1}{2}$ inches deep so they will be in cool moist soil, and so they will not be disturbed by subsequent tillage with a weeder or spike-tooth drag. Do not cover seed deep at time of planting.
2. Throw a shallow ridge ($1\frac{1}{2}$ inches) of soil over the seed pieces. The sprouts will penetrate the surface quicker with the shallow covering and are less likely to rot from black scurf injuries.



Fig. 2. Plant in deep mellow soil.

3. When the sprouts are above ground gradually fill in the furrow to the full depth with early cultivations.

REDUCE HOLLOW HEART—PLANT CLOSE

1. On good soil plant 20 bushels or more seed per acre. On poor soils plant at least 15 bushels.
2. Space hills 10 to 18 inches apart in row. The 10-inch spacing is recommended for fertile soils, the 18-inch spacing for the less fertile soils.
3. Space the rows from 30 to 36 inches apart.
4. Do not check-row potatoes. This practice favors hollow heart development, growth cracks and rough oversized potatoes.

CULTIVATE EARLY AND SHALLOW

1. Cultivate lengthwise of the rows with a weeder before the plants are above ground and until they get 4 inches high. This is important in controlling weeds and grass.
2. The first row cultivation should be made when the plants are well above ground. This first cultivation may be deep. Later



Fig. 3. Control weeds and grass early with a weeder.

cultivations must be shallow ($1\frac{1}{2}$ to 2 inches) to prevent root injury.

3. Cease row cultivation when the plants begin to blossom. Late cultivations may seriously reduce the yield.
4. Practice level cultivation. At the last cultivation an inch or two of soil may be thrown over the row to protect potatoes near the surface of the soil from sunburn and frost injuries and to prevent late growth of weeds and grasses.

This covering is especially important with a shallow-setting variety like the Katahdin.

CONTROL LATE BLIGHT—SPRAY WITH BORDEAUX MIXTURE

1. Bordeaux mixture is the best spray material for potatoes. It controls leafhoppers, flea beetles, early blight and late blight.
2. For the control of flea beetles and potato bugs, add 4 to 5 pounds of calcium arsenate to every 100 gallons of bordeaux mixture.
3. Make the first spray application when the plants are about 4 inches high. Repeat the application at intervals of 10 days to 2 weeks throughout the season. Five or more applications are usually required.
4. Use a sprayer with 300 to 400 pounds pressure, with three nozzles per row. Make sure that both the upper and lower surfaces of the leaves are covered with the spray. Each application will require 100 to 125 gallons of bordeaux mixture per acre.

HOW TO MAKE BORDEAUX MIXTURE

1. Dissolve 50 pounds of copper sulfate in 50 gallons of water. Suspend the copper sulfate crystals in a burlap bag just under the surface of the water. Several hours are required for the chemical to dissolve.
2. In a separate vessel dissolve 75 pounds of chemical hydrated lime in 50 gallons of water.
3. These are stock solutions and will keep in good condition for several days if kept covered to prevent evaporation of water. They will be sufficient to make 625 gallons of bordeaux mixture.
4. When ready to spray, stir each of the stock solutions vigorously. Fill the spray tank (100-gallon tank) half full of water. Pour into the spray tank 8 gallons of the copper sulfate solution and stir thoroughly. Then add 8 gallons of the lime solution. Stir thoroughly and add enough water to fill the tank. Do not pour together the strong stock solutions.

COPPER-LIME DUST MAY BE USED FOR SMALL FIELDS

1. Mix 20 pounds of monohydrated copper sulphate dust with 80 pounds of chemical hydrated lime.
This will protect the plants against leafhoppers, early blight, and late blight. If monohydrated copper sulfate is not available use ready-mixed dusts with other copper compounds known as fixed copper.
2. For the control of potato bugs and flea beetles, add 15 pounds of calcium arsenate to every 100 pounds of the copper-lime mixture.
3. Begin dust applications when the plants are 4 inches high. Repeat application at intervals of 7 to 10 days throughout the season. At least 7 dust applications usually are required.
4. Use the crank type of hand duster for small fields. Apply dust when air is quiet.
5. Apply 30 to 50 pounds of dust per acre at each application.
6. Keep dust in tight dry containers.
7. Do not get the dust in wet clothing on the skin. Wear high boots in wet vines.



Fig. 4. Spray thoroughly with bordeaux mixture for the control of leafhoppers and blight.

REDUCE MECHANICAL INJURIES—HARVEST POTATOES CAREFULLY

Mechanical injuries seriously impair the keeping and cooking qualities of potatoes. Each year a large portion of the Michigan crop fails to meet U. S. grade requirements because of mechanical injuries caused by carelessness in harvesting and handling the crop.

1. Dig early to avoid field-frosted potatoes. Delayed harvesting increases the risk of frost injury.
2. If the ground is frozen delay digging until frost is out of the soil.
3. If the field is attacked by late blight delay digging until the vines are dead.
4. Drive the digging machine at a slow uniform speed.
5. Run the plow of the digger deep enough to prevent cutting the potatoes and to carry up enough soil over the elevator chain so the potatoes will not be bruised by riding on the bare chains.
6. When the soil is dry and sifts too quickly through the digger chain, replace the agitators under the chain with rollers.

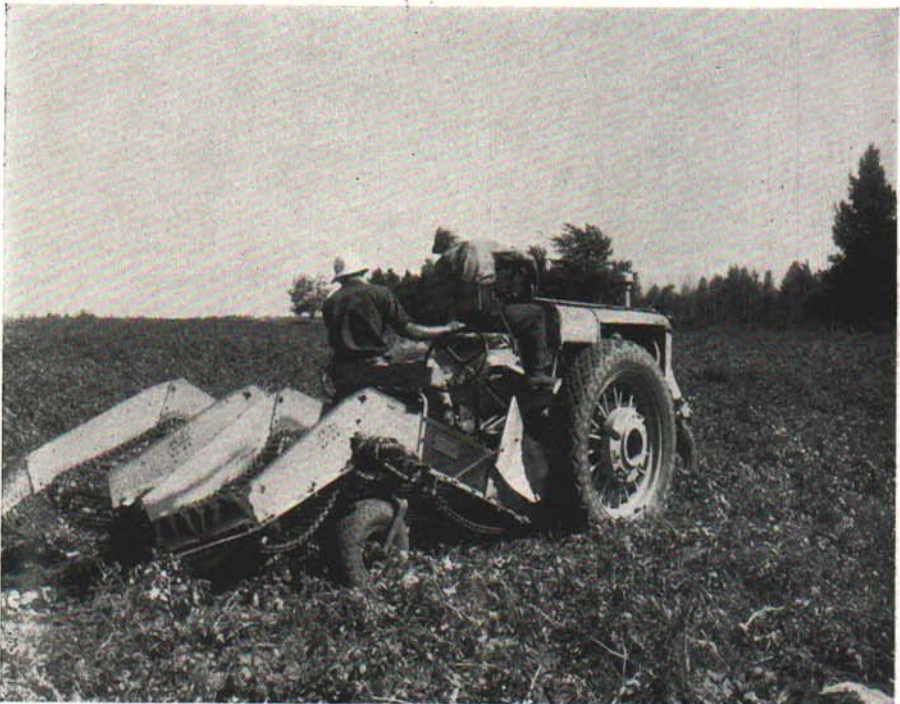


Fig. 5. Use care in digging and reduce mechanical injury.



Fig. 6. Padded baskets are the most satisfactory picking containers.

7. Combine the digger chains to make one continuous chain, thus reducing bruising injury caused by potatoes dropping from one chain to the next.
8. Pad with rubber hose or burlap, those parts of the digger against which the potatoes are likely to strike.
9. If the crop is dug with a fork, use special care not to puncture the potatoes with the fork tines.
10. After late potatoes are dug let them lie on the ground an hour or more so they will dry and their skins toughen. This practice will reduce much skinning and bruising injury.
11. Pick potatoes carefully. Do not throw them into crates. Wire or splint half-bushel baskets padded on the inside with canvas or rubber are preferable to slatted crates as picking containers.
12. Pick up the better grade potatoes first and store separately. Leave undersized, scabby, cut, off-type and other cull stock for the second picking. This practice will eliminate much bruising injury which occurs from running freshly dug potatoes over mechanical graders.

ESSENTIAL POINTS IN STORAGE

1. Store only sound potatoes that are relatively dry and free from dirt.
2. Do not place field-frosted or late blighted stocks in permanent storage. Place such stocks in temporary pits.
3. Keep the better quality stocks in separate bins. The practice in many commercial warehouses of putting good and poor lots in the same bin should be severely condemned.



Fig. 7. Equip the grader with a roller-picking table to facilitate the removal of defective potatoes.

4. Avoid bruising the potatoes when storing. Use gently sloping chutes padded with burlap to ease the fall of the potatoes into the bin.
5. Store in well insulated houses or cellars.
6. During the first few weeks of storage provide for a free circulation of air to cool the potatoes and remove excess moisture.
7. During the winter keep the storage cellar at a temperature of 40° F. with a humidity of about 85 to 90 per cent.
8. Keep the storage cellar dark to prevent the potatoes from turning green.

USE MORE CARE IN GRADING*

1. Managers of potato warehouses should encourage growers to do more hand sorting in the field at time the potatoes are picked up. This practice would reduce the need for so much mechanical sorting before the potatoes go into storage, and would reduce mechanical injuries caused by the grader.
2. Potatoes should be carefully graded when they are prepared for market.
Use the most improved types of grading machines. Have plenty of light so that defects in the potatoes may be seen.
Do not rush the work.
3. Equip the grader with a roller type picking table to facilitate the removal of scabby, off-type, cut and otherwise undesirable potatoes.
4. Remove all over-sized, rough, or growth-cracked potatoes. Hollow heart is generally most severe in this class of stock.
5. Know the U. S. standard potato grades and grade carefully to comply with their requirements.
6. Market potatoes in new clean attractive sacks or packages.

*For potato grades, consult "Standard Grades for Potatoes," Department of Foods and Standards, Michigan State Department of Agriculture, Lansing.

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