Montana Extension Service in Agriculture and Home Economics
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The goal of every 4-H potato club member should be to produce the highest yield possible of a high quality product and when marketing to put up grades that will attract the buyer. This means practicing the best known cultural methods and planting the best seed obtainable.

Good clean, healthy seed, plus good cultural practices, make it possible to produce high yields of high quality at a low cost of production per unit. Montana is so far from the main markets that it is essential to grow a high class article as cheaply as possible in order to successfully compete with farmers who have lower freight bills.

If profits are to be made it is necessary to market the crop to the best advantage and the advantage lies with the one who has what the buyer wants. This answers the question of what variety to grow—grow a variety the market demands.

**Planting Potatoes**

*Four Favored Varieties*—The Netted Gem is an outstanding commercial variety and is adapted to the inter-mountain sections of Montana. But in eastern Montana the tubers grow rough and knobby and become unprofitable. The Bliss Triumph, Irish Cobbler and Early Ohio are the principal varieties grown in Montana east of the Continental divide. There generally is a fairly good local demand for the table stock and also a demand for out of state shipment of good certified seed stock for the Bliss Triumph and Cobbler varieties. These varieties do not command a premium as does the Netted Gem on the main commercial markets. If profits are to be made from these on the eastern commercial market it must be done through low per-unit cost of production.
Deep, Light Soils Are Best

Potatoes will grow on most any kind of soil; so no farm needs to be without home-grown potatoes. They will not do well on all soils however, and for commercial purposes should be grown only on soils that produce high yields of good type tubers.

A fertile, deep, sandy loam soil is to be preferred. Heavy, cold, clay soils should be avoided for commercial production. Potatoes grown on a heavy soil are likely to be rough, ill shaped, and of low commercial value. The physical condition of heavy soils can be improved by applying manure, preferably a year in advance rather than the same season potatoes are grown. A good supply of humus in any soil improves conditions for this crop. It is best to use ground that has not grown potatoes for three or four years.

Preparing Seed Bed

Thorough preparation of the soil means extra labor but it pays. A deep, mellow seed bed is preferred. It is best to fall plow to a depth of 10 inches and if the soil packs too hard over winter turn again as soon as the ground dries in the spring. If a soil is inclined to be heavy the action of frost will tend to mellow it when plowed in the fall. Thin soils or soils that have never been plowed deeply should be deepened gradually. Turning up too much cold subsoil at one plowing is injurious to plant growth. Such soils may be safely deepened by plowing an inch deeper each year until the required depth is reached. Alfalfa ground properly prepared produces good crops. It should be crowned rather shallow in late growing season and then plowed again in the spring to a greater depth. This second and deeper plowing tends to bury the crowns so that they will not be so troublesome in planting and cultivation.

The reason for crowning alfalfa in late growing season is that by turning under a good growth of green alfalfa, humus and plant food are added to the soil. Fall plowing should be left rough but it is well to harrow spring breaking close behind the plow to pulverize surface clods. A deep, mellow seed bed can be prepared by disking and harrowing until all clods are pulverized to the depth of the furrow. The seed bed should be firm, to insure prompt germination, but not hard. Putting it briefly, a deep, mellow, firm, seed bed is best. Low yields and ill shaped tubers can be expected from hard, cloddy soils.
Use Only Best Seed

The ideal way for producing good disease-free seed is to plant a special tuber united seed plot. For such a plot select good type tubers about eight ounces in size. Cut each tuber in four pieces and drop them in the furrow consecutively then cut and drop the next tuber. It is advisable to leave one plant space between each unit. During the growing season the patch should be gone over frequently and all diseased and off-type units should be pulled and carried from the patch for some distance. This is called rogueing. At harvest time the remaining plants should be dug by hand and units showing low yields should be discarded.

Picking seed from a bin of table stock is generally a poor practice, but in case it is necessary to do so, select tubers of good type ranging from six to ten ounces in size. The small tubers from such a bin are more likely to carry a virus disease than the medium sized ones. Tests also indicate that extremely large tubers are not as desirable as the medium size for seed purposes. Better stands usually are secured from medium sized tubers than from large ones.

Treat All Seed

Treating the seed with a standard treatment for control of scab, and rhizoctonia is good insurance. Instructions for treating
potatoes can be found in Montana Experiment Station Bulletin No. 300 or they can be secured from any county agent.

Treating the seed just prior to planting burns young sprouts that have just started and delays germination to some extent. Hence it is advisable to treat three or four weeks before planting. When treating so far in advance be sure and store the seed in containers or bins that have been disinfected to avoid reinfecting some of the tubers.

**Cut Seed Carefully**

When cutting seed, make cuts at right angles to each other so as to have blocky seed pieces. It is important to have at least one eye to a seed piece. For dryland planting seed pieces weighing from one and a half to two ounces are about the right size. On fertile irrigated land, where many of the tubers grow too large for good commercial size, seed pieces up to three ounces in size may be profitably planted.

A large seed piece generally produces more stems per plant. An increase in number of stems per plant usually means an increase in tuber set, and this tends to hold down size of individual tubers. The total yield may not be increased so very much but such a practice does increase net yield of medium sized tubers on fertile soils. This is especially important in the production of certified seed. The same results may be secured by using one and a half to two ounces of seed pieces and spacing closer in the row. Closer spacing to hold down size is satisfactory for production of table stock but it makes rogueing more difficult in certified fields. When it is necessary to hold down size, in growing certified seed, it is better to use larger seed pieces in preference to close spacing. Too heavy a rate of seeding on dryland may result in too high a percentage of small tubers.

Do not cut seed until ready to plant. Seed which is cut and allowed to stand around for several days loses its vigor, consequently thinner stands are secured and yields reduced.

**Time to Plant**

The County Extension Agent will be glad to advise in regard to planting dates. The time of planting is directly dependent upon the frost period of a given locality. It should be the aim to so plant that the young plants will not appear above ground before the time of the last spring frost. This varies materially in different sections of the state.
Depth to Plant

In dryland culture seed should be planted to a depth of four inches. Shallow planting subjects the new set tubers to injury from sunburn and fall frosts.

Under irrigation seed need not be covered deeper than two and a half to three inches. Sufficient dirt is thrown over the tubers when furrowing out for irrigation to prevent sunburn and frost damage.

The use of horse or power planters is economical in planting large acreages. There are several makes on the market all of which have their advantages or disadvantages. Some may be designed as one man or picker type. Others require two men to operate them, one to drive and one to watch the feed. While growers prefer different types, many report better stands with the two-man planters and that the additional stand more than pays for the extra labor involved. Pathologists also claim that there is a possibility of transmitting some of the virus diseases from diseased to healthy seed pieces by the picker type planters.

Fig. 2—A 4-H club certified seed potato grower removing diseased plants.
It would hardly pay to buy a planter when growing only an acre or two of potatoes. For small scale production the seed bed should be prepared the same as when a horse planter is used, then furrow out rows with a middle buster or a breaking plow. Drop the seed by hand and cover with a corn cultivator. Do not furrow out more than one row at a time to avoid loss of moisture. Seed must be dropped in moist soil. When dropped in dry soil seed may rot, thereby resulting in poor stands and weak plants.

A third method that is sometimes used is to plow about four inches deep and drop the seed in every third furrow. This is not as satisfactory as either of the first two methods.

Whatever method is used, the soil should be firmed about the seed pieces. A light roller or subsurface packer may be run over the field immediately after planting to firm the soil.

**Space Between Rows**

On non-irrigated land the rows may be spaced from 36 to 42 inches apart and the plants spaced from 15 to 18 inches in the row.

Spacing plants 11 to 14 inches in the row appears to be quite satisfactory on irrigated land. Spacing 42 inches between rows is desirable as this permits building up a wide, square shouldered ridge. Such a ridge is helpful in preventing injury from sunburn and fall frosts.

**Improving Seed**

**Certified Seed**—Certified seed potatoes often bring a premium over table stock prices, but there are greater hazards connected with this phase of potato culture. No one should start certified seed production on a large scale without market connections.

Montana Experiment Station Bulletin No. 300 is helpful in identifying diseases under field conditions. A copy of this bulletin and rules governing certification can be secured from County Extension Agents.

Certified seed may be grown on either irrigated or dry land. Tests indicate that there is virtually no difference in yielding power of seed stocks produced under either condition. There is some unwarranted prejudice against irrigated seed in certain sections. This is partly due to size of tubers produced under irrigation. Seed buyers prefer medium to small tubers for seed. Dry-
land seed usually falls in these classes while irrigated seed is mostly from medium to large. Some also have the idea that irrigated seed carries a higher percentage of virus diseases than dry-land seed but this is not true where careful rogueing is done.

Whether it pays to grow certified seed under irrigation will depend upon the individual and the variety he can grow best. Where a premium bringing commercial variety, like the Netted Gem, can be produced the question is debatable. If one is growing potatoes on a large scale he should have sufficient acreage certified for his own seed or else purchase certified seed each year from one who specializes in production of high quality seed.

**Tuber Unit Seed Plot**

If one really would improve the quality of his seed potatoes, planting in tuber units is without doubt the best method. A seed plot should be separated from other fields by at least 200 feet. In planting a field according to the tuber unit method, all the pieces which come from a tuber are planted consecutively in the row. All the seed pieces from a tuber will produce similar hills. If the seed tuber was diseased, all the hills from it will be diseased. Also the difference in vigor between the units will be more easily noted. It is much easier to take out the diseased and inferior plants when planted tuber unit than otherwise. Since the reason for the tuber unit planting is to improve seed stock by eliminating poor, weak, and diseased hills, a definite program of rogueing must be followed. One may not know all diseases but still good rogueing can be done. Proceed on the basis that everything which is not strictly up to standard or shows anything wrong must come out. Following is a detailed plan by which a 4-H club member may operate a tuber unit seed plot.

1. Select potatoes from the bin that are uniform in size (6 to 8 oz.) and shape and typical of the variety. These should be free from disease as far as outward appearance is concerned. If, in cutting the seed, any black rings appear the tuber should be discarded.

2. Treat before cutting by soaking the tubers for one and one-half hours in a solution made by dissolving four ounces of corrosive sublimate in 30 gallons of water. Do not put treated seed back into old bins or sacks.
Fig. 3—Tuberuniting simplifies rogueing. The bare spaces are places from which diseased units have been removed.

3. Cut each tuber as it is planted. If 6 to 8 ounces potatoes are used, cut each tuber into four pieces, making sure to cut the seed end of each potato in two. Plant one piece in a hill making a section of four consecutive hills represent one potato. Then skip one hill. Cut another potato into four pieces and plant four hills, etc., until the plot is completed. NOTE: If potatoes are smaller or larger than 6 to 8 ounces, cut accordingly and plant as many hills as possible, designating the hills from one tuber as a unit.

4. Plant early in ground which has not been in potatoes for two or more years. On irrigated land plant in rows 42 inches apart and in hills 11 inches apart. On dry land plant in rows 36 inches apart and in hills 18 inches apart. Rogueing means the removal of diseased and degenerate plants by pulling them out. Rogueing should be done at the time any diseased or degenerate plants appear. It is important to rogue the field thoroughly at the following stages of growth:
a. When plants are 8 to 10 inches high and again at blossoming time: All units which seem to be different from the average in regard to color of blossom, time of blossom, or those with striking variation in the character of the leaf; wilted plants, dwarf plants mottled leaf, etc., should be pulled up.

b. Two weeks after blossom period: Remove all which do not seem to be normal, strong, vigorous, or typical of the variety. Also all units having characteristics named in (a).

c. As the vines begin to brown and before frost hits them, if they are a late variety: Remove all units with vines showing earlier maturity than the average.

5. Mark with stake with number on it, 20 to 30 units showing best characteristics. Vigorous plants with flat leaves, and healthy color should be chosen. Dig by hand all “top-notch” units and from these select 10 to 15 which give the highest yield and the maximum number of marketable potatoes. Sack the potatoes from each hill separately. Label with respect to number and store for next year’s use. Harvest remainder of plot in the usual way and dispose of them as market potatoes.

Caring For The Crop

Rogueing Is Necessary—By the term “rogueing” is meant the removal of all plants which are not desirable in the field. This would include odd varieties, diseased hills, weak hills, and generally those hills which are not normal. ROGUEING SHOULD BE CONTINUED throughout the year. At the time the plants are in bloom is the best time to find stray varieties. Blossoms vary with different varieties. An examination of the leaves and stems also will show marked differences. As far as diseases are concerned, the grower may not know them all, but everything which is not strictly up to standard or shows anything wrong must come out. It is mainly by rogueing seed plots that seed stock is brought to a higher level. It is important to rogue early. Diseases spread from one plant to another. If diseased plants are removed as soon as they appear the total amount of disease will be less than when these plants are allowed to remain in the field.
Cultivate Well and Often

Dry Land—Start cultivation early to prevent weeds from getting established. Weeds are more easily destroyed just as they are breaking through the ground than later. Frequently a light harrowing before the potatoes appear above ground will destroy many weeds. Level cultivation should be practiced for dryland potatoes. Cultivation should be shallow and frequent enough to keep down weeds. Toward the end of the cultivating season it is desirable to pull up a slight ridge. This will protect the tubers against sunburn.

Irrigated—Thorough and timely cultivation will take the place of much water. Deep cultivation may be practiced until the plants are six to eight inches high. After that it is well to cultivate shallow, especially close to the plants. With irrigated potatoes it is desirable to pull the dirt toward the plants with each cultivation until a ridge about 10 inches high is built up. It is advisable to cultivate as soon as possible after each irrigation or rain to break the crust which forms under most soil conditions. Continue cultivation until it can no longer be done without injury to vines.

Irrigation Most Important

When irrigating potatoes give them a drink instead of a bath. Make fairly deep furrows between the rows so that water can be held about on a level with the tuber set. It is better to have a small stream of water trickle down the row than to run the furrow full. Water should be left on until the soil underneath the plants becomes quite moist. Over-irrigation is injurious to plants and may result in low yields and poor quality.

No set rule can be laid down as to time of irrigation or the number of times to apply water. One must be guided by the condition of the soil. Good growing conditions should be maintained constantly. A good farmer never awaits for the plants to tell him they are thirsty, but digs into the soil to determine when to apply water.

Sometimes it is necessary to irrigate potatoes up. In that case furrow out and hold the water level below the seed pieces. Leave the water on long enough to allow soil about seed pieces to become moist. The field then can be leveled off by harrowing.

The first irrigation after the plants are up should normally come a little ahead of the bloom. Tubers start setting a little ahead of bloom and at this time moisture conditions should be
just right. If the soil is too dry the set will be light. Of course there is a possibility that there may be plenty of moisture in the soil. In that case additional watering might prove harmful. Irrigate as often as the ground needs it. The number of irrigations required will vary with the season and the soil.

Control Insects Early

The Colorado potato beetle is the principal insect that requires attention. The hard shell beetles appear about the time the plants are coming through the ground. The old bugs lay their eggs in clusters on the underside of the leaves. The eggs hatch into small reddish brick colored soft bodied nymphs. It is these young nymphs that do most of the damage to the plants. They can be easily controlled by dusting or spraying with arsenate of lead or Paris green. The poison can be dusted on with a dust sprayer or may be sifted on from a cheese cloth bag. If the poison is mixed with about four times its bulk of flour it will go farther. Paris green dusted on without diluting with flour may injure foliage. Remember this material is very pisonous and should not be left in reach of small children or animals.

Harvesting The Crop

Harvesting and Grades—Potatoes should be carefully dug and handled to avoid injury. Bruised and cut potatoes are unfit for exhibition and storage, and to a great extent they must also be eliminated from a Commercial U. S. No. 1 grade. After being
plowed out or dug out with a fork it is well to allow potatoes to lie for a few hours to dry. This sets the skin and less bruising will result from subsequent handling.

U. S. No. 1 potatoes are the only ones that have value from the seed and commercial standpoint. A U. S. No. 1 potato is nothing more than a good average grade of potatoes. Second growths, growth cracks, bad cuts, pitted and excessive amount of scab, rot, etc., must all be eliminated from the grade. The poorest potatoes in a load and not the good ones determine the grade. The cars of potatoes which are well up to standard as to grade are the ones that are making repeat sales for the grower. Poorly graded cars are frequently handled at a complete loss to the grower. Practice careful handling.

**Proper Storage Conditions**

Potatoes to be of real value for seed or cooking purposes must be properly stored. Good storage conditions mean a temperature of about 38 to 40 degrees F., absence of light and fairly humid conditions. Potatoes shrivel under dry conditions, sprout when they get too warm, and become green when exposed to light. Also the storage must be frost proof. A frosted potato loses its value both for seed and for eating purposes.
Exhibiting And Judging

**Potato Exhibit Pointers**—A good potato exhibit is one in which every specimen is a perfect potato and all similar. In selecting potatoes for commercial exhibit pick out specimens which range from ten to twelve ounces in size. Try to have every potato as near the same size as possible. They should also be typical of the variety and free from disease and insect damage, cuts, cracks, and second growths.

In preparing the exhibit, do not wash the potatoes. It is better to remove dirt with a soft brush. Washing will quickly cause the tubers to become discolored when exposed to the light.

Handle tubers very carefully and preferably pack each one separately for sending to the place where they are to be exhibited.

**Some Judging Suggestions**

1. Type—Select for trueness to varietal type and uniformity of type. Eyes should be few and depth characteristic of the
variety. For example, Triumph and Cobblers should be selected with fairly deep eyes as they are deep-eyed varieties, while the Netted Gem is a very shallow eyed variety.

2. Size—Desirable size ranges from six to twelve ounces in weight for commercial stock. The ideal size for show purposes is around eight to ten ounces.

3. Uniformity—An exhibit of potatoes meriting a perfect score on uniformity should be uniform in size, shape, color, and depth of eyes.

4. Condition—Broken skin due to rough handling or washing would be considered under “condition”. There is a difference of opinion in regard to washing, but it is doubtful if careful washing should ever be considered as reducing the quality of exhibition potatoes.

5. Disease—Some judges disqualify exhibits containing diseased specimens. The exhibitions of diseased potatoes should be discouraged, but judges will need to use some discretion on this point. Heavy cutting in the score will usually be found more satisfactory than eliminating.

The following score card may be helpful to 4-H club members in learning how to judge potatoes:

| Trueness to varietal type | 175 |
| Size | 150 |
| Uniformity of size, type, color, skin, etc. | 175 |
| Condition—State of maturity freedom from dirt and mechanical or other injury | 300 |
| Freedom from disease | 200 |

**TOTAL** ................................................................. 1000