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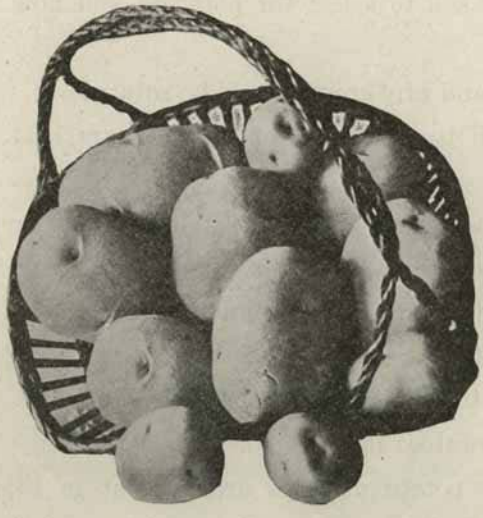

GROWING THE IDAHO POTATO

BY E. R. JENNETT

Field Horticulturist

COOPERATIVE EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS OF THE STATE OF IDAHO
UNIVERSITY OF IDAHO EXTENSION DIVISION AND U. S. DEPARTMENT OF AGRICULTURE COOPERATING

HORTICULTURAL SECTION

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This Bulletin Tells

Why Idaho acres grow twice as many potatoes as the average acres in the United States.

What soil to select for potatoes and how to prepare it.

How and why crops should be rotated.

Which two varieties of potatoes are best in this state.

How to select seed potatoes, how to cut them, how to "green" them, how to treat them for disease.

How to plant, cultivate and irrigate.

How to harvest.

How to build and use a storage dugout, and how many potatoes it will hold.

What potato diseases are present in Idaho and how to fight them.

What insect pests attack Idaho potatoes.

How to grow seed.

What the standard seed requirements are.

What really happens when potatoes "run out."

What to do with culls.

And a hundred and one other things that will help almost any grower to solve his specific problem.

See the index on the back of the bulletin.

GROWING THE IDAHO POTATO

By E. R. BENNETT.
Field Horticulturist.

IDAHO IS EXCELLED by only one state in the union in its yield of potatoes per acre, although its total production is only four or six million bushels of the annual crop of approximately four hundred million bushels in the United States. New York, Michigan, Wisconsin and Minnesota produce from thirty to fifty million bushels each. Total production figures, however, are of interest to the grower only in their bearing on market demands and prices. To the grower, the statistics of cost per unit measure and production per acre are more significant. The 1918 yield, which was not far from the average, was one hundred and eighty bushels per acre in Idaho, as compared with ninety-five bushels, the average for the United States.

This yield is the average for the whole state and includes not only the high-yielding irrigated lands of the state, but also a very considerable area of unirrigated land that is usually too deficient in moisture to produce a maximum yield. Few, if any, districts of the United States can produce greater yields per acre than the irrigated lands of Idaho, nor can the crop be produced in other sections of the country at a less cost per unit measure.

Quality in potatoes is difficult to measure, yet it is well known that the quality of potatoes of any given variety differs materially with conditions of soil and climate. In this respect, properly grown potatoes from all parts of Idaho will compare favorably with those grown in any other part of America. This advantage may be partly due to favorable climatic conditions, but we believe it is much more influenced by the chemical constituents of Idaho soils, which are generally abundantly supplied with the mineral elements of fertility which the potato demands.

The industry in Idaho as yet is but in its infancy. As more desert lands come under cultivation and as more profitable rotations take the place of the old systems of farming, the Idaho potato may take its place in the markets of the country in quantities comparable with those from the great potato-producing states of the east. In the meantime it behooves the grower to learn the peculiarities of climate and soil with which he must contend, to the end that he may profit by the experience of those who have learned the essentials for success.

I. BOTANY OF THE POTATO

The so-called Irish potato (Solanum tuberosum) belongs to the nightshade family. It is sufficiently closely related to the tomato that the stems of the two species may be so grafted together that a plant will bear potatoes below ground and tomatoes above. The potato differs quite materially, however, from all other members of the family both in general botanical structure and in habit of growth and reproduction.

The edible portion of the plant, the tuber, is really an enlargement in an underground stem or stolon. We frequently hear the tuber spoken of as a root. If a plant be examined, particularly at about the time it is in bloom, it will be readily seen that, whereas the plant up to that time has had no indication of tubers, there will be small stems growing out from the main stem a short distance above the old seed piece. Disease or mechanical injury may cause

STUDYING THE POTATO WHERE THE POTATO GROWS

these stems to grow above ground or at the junction of the leaves and stem. The habit of growth of these stems varies with the variety of the potato. In some cases they are short, so that the tubers of the plant are clustered closely around the old seed piece. In other varieties the tuber stems may be very much elongated or may continue thru and beyond the first tubers, giving the potatoes the appearance of having been strung on a thread.

These stems never grow from a root, however, nor do roots grow from the tubers. In the early stages of growth of the tuber there is probably little more starch and other plant food in its structure than is contained in other parts of the plant. But, at the end of the growing season, the plant food that has been elaborated by the leaves during the growing season has largely been transferred to the tuber or perennial part of the plant. This habit is practically the same as is followed by asparagus, rhubarb, and the Canada thistle and all other plants that retain their living parts from year to year below ground. This being true, the potato, tho treated as an annual, is a true perennial and each year's crop may be considered a continuation of the plants of the previous year's crop.

The potato is normally propagated asexually: i. e., by cuttings of the tubers. In other words, when we plant a piece of potato we are propagating by a cutting just as surely as does the florist when he multiplies geraniums or carnations by cuttings of these plants. In its primitive state, the potato may have been normally reproduced by true seed. Under favorable conditions some varieties still produce fruits and viable seed. The production of this seed is of no particular importance to the commercial potato grower, however, for while new varieties may be secured by this means, it is impracticable for anyone to grow potatoes from seed, except it be for the purposes of plant breeding.

The potato, altho closely related to the tomato and egg plant, is again quite unlike both of them in that it does not take kindly to a warm climate but reaches its highest degree of perfection in districts where cool weather prevails during the growing season.

II. SOIL AND CLIMATE REQUIREMENTS

IDAHO CLIMATE AND SOILS ADAPTED TO POTATO GROWING.

Cool nights with moderately warm, clear days make ideal potato growing weather. The potato is grown in the most humid sections of the country, but there it is not at its best and is subject to many serious fungous diseases that are unknown where dryness of the air prevails. Either high latitude or high altitude produces desirable conditions, so far as temperature is concerned, for potato growing.

Again, the potato can be grown more or less successfully in all

types of soils. That soil is most congenial to the potato, however, which contains a high percentage of the mineral salts of fertility, such as phosphorus and potash. Where these are not present in abundance, they must be supplied in the form of commercial fertilizers, which necessity adds very materially to the cost of the production of the crop.

Whatever may be the type of soil, it must have such a physical character that it will retain a high degree of porosity; that is, it must remain friable (loose) thruout the growing season. In the districts of the west, particularly in Idaho, there are many different types of soils, ranging from light sand to a rather fine, heavy, ashy clay, that have this characteristic of mellowness.

In general, Idaho climate and soils are admirably adapted to the growing of high yields of high quality potatoes. The altitude and latitude combine to provide the cool nights. Lack of humidity, particularly in the southern part of the state, prevents leaf fungi from causing trouble. The soils, because of their origin and from the fact that there never has been any leaching from excessive rainfall, contain such amounts of the mineral elements of fertility that the addition of commercial fertilizers does not tend to increase the yield of the crop. In the north, or unirrigated parts of the state, this may not hold true, but even in those districts of greatest rainfall the mineral elements of fertility are abundant as compared with the soils of humid parts of the country.

The ideal potato soils are those that tend toward a sandy loam, altho the highest yield of potatoes yet observed by the writer was grown on a soil largely composed of decomposed lava, which more nearly approximates a heavy clay loam. The essential quality for a good potato soil is that it shall remain mellow or porous till the end of the growing season. Heavy soils may, by careful handling, be kept in this condition, providing heavy rains do not occur between the planting and maturity of the crop.

As a general statement, the type of top soil is of less importance in potato growing than is the sub-soil or underlying soil. An impervious sub-soil prevents the drainage of surplus water so that the upper soil, even tho of light, sandy nature, may become waterlogged, while a heavy soil with good under-drainage is not liable to serious packing from rains or irrigation.

PREPARATION OF LAND FOR POTATO GROWING.

Newly broken sagebrush land will produce good potatoes. A maximum crop, however, is seldom, if ever, obtained from such

lands. Raw soils cannot be put in a condition of physical tilth that is most desirable, but the more probable reason for the inability of such lands to produce a full crop is that such soils are deficient in nitrogen, and the other elements of fertility in new soils are, while present, not available to the plants. Growing potatoes on new land puts the soil in fine condition for seeding to grain and alfalfa and the quality of the potatoes from new land is good both for seed and for domestic use.

The best preparation of land for potatoes is to precede the crop with alfalfa or clover. Pasture land, while harder to prepare, is also good potato land. Land on which peas or vetch has been grown is usually well fitted for potato growing, tho there is less vegetable fibre left in the soil than where alfalfa or the clovers have been grown . Grain stubble usually gives the poorest results in yields, and potatoes grown on such lands seem more subject to scab.

MANURING LAND FOR POTATOES.

It is generally conceded that fresh manure applied to land just before planting to potatoes tends to induce scab on the potatoes. Notwithstanding this belief, many of the most successful potato growers in Idaho, and in other western states as well, cover the land heavily with fresh manure during the winter previous to potato planting. Where the manure is handled with a spreader, so as to be evenly distributed, there seems to be little danger of increasing the tendency toward scab from its use. Well rotted manure is to be preferred and if the land can be thoroly disked before plowing, the beneficial effect will be greater and the danger from scab lessened. Twenty tons of manure per acre is not too much, if a heavy yield is desired.

ROTATION OF CROPS.

In any rotation of crops, several objects should be kept in view. The principal one of these, the one which ultimately includes all the others, is to secure the greatest yields per acre of our most profitable crops. This is done by first maintaining the fertility of the soil, which is difficult without a proper rotation. A proper rotation also eliminates or reduces weed troubles and retards the multiplication of insect pests and plant diseases. A successful rotation anywhere includes a legume crop, a grain crop and one that is cultivated or hoed so as to keep out weeds for at least one growing season.

Potato growers in Idaho practice several different systems of rotation, yet all of them conform to this rule. Where potato growing is the major or money crop, the most common rotation is alfalfa or clover from two to four or more years; potatoes, one or two years; grain, one or two years; then back to alfalfa or clover. Where sugar beets are grown, potatoes are best followed with beets and the beets with grain.

Alfalfa provides the nitrogen and organic matter which are necessary to stimulate the potato into making its best growth, yet the potato does not remove any great quantity of the fertility from the soil and grain or other crops following the potato are as good as or even better than if the land had not been cropped to potatoes.

FITTING THE SOIL FOR THE POTATO.

In fitting alfalfa or pasture land for potatoes there are two objects to be attained. One is to kill the alfalfa or sod and the other to pulverize and loosen the soil so that it will be mellow to the bottom of the furrow.

WELL PREPARED SOIL
Shallow Fall Plowed Alfalfa Land, Deep Plowed Just Before Planting

In some districts of the west, alfalfa can be turned under just before planting time without trouble ensuing from the growth of the cut-off alfalfa crowns in the field of potatoes. In other districts much trouble is experienced when this system is followed so that it has been found more satisfactory to double plow the

land. This is best done by plowing in late fall or very early spring just deeply enough to cut the roots of the alfalfa a short distance below the crown. The plow should be followed by the harrow, which will, in case of alfalfa land, drag out most of the short crowns which have been cut off. These crowns soon dry out and die, hence no further trouble will be experienced from their growth. In case of pasture land the shallow plowing should be followed, possibly in early spring rather than immediately after the plow, by a disk harrow, with which the turned up turf should be chopped as fine as possible. The second plowing is done shortly before planting time. This time the plow is run as deeply as is practical, from eight to twelve inches, depending on the depth and type of soil and the horse power available.

With the second plowing, two exceedingly desirable soil conditions must be kept in mind. First, the retention of the soil moisture that has accumulated during the winter is of the utmost importance. No subsequent watering or rains can take the place of it. This is of especial importance in the more arid districts that are subject to heavy, drying spring winds. Second, while this is being kept in mind, the grower must not lose sight of the particular object of the second plowing, which is to secure a loose, mellow seed bed. The alfalfa crowns or fine chunks of sod that were left on the top of the land by the first plowing and harrowing will be turned to the bottom of the furrow by the second plowing, where they will be out of the way of the subsequent work and where they will help maintain that porous condition of the soil that is needed by the potato.

The importance of thoro preparation of the soil for the potato can hardly be over-emphasized. No subsequent cultivation or treatment can make up for poor or careless preparation of the seed bed. The potato is different from most other agricultural crops in that, where most seeds start soonest and grow best when planted in a soil well compacted just under the surface, the potato demands a loose condition of soil at planting time and all during the growing season. Notwithstanding this fact, there is a greater loss of the potato crop in the arid districts because of planting the potato in soil that has an insufficient amount of moisture than from any other cause excepting disease. This being true, great care must be exercised, particularly in dry, windy weather, to harrow potato land as fast as it is plowed. A rule followed in some of the most successful potato growing districts, and one that should be adhered to everywhere, is never to let the teams

leave the field either at noon or night till the land that has been plowed during that half day has been thoroly harrowed.

III. SEED POTATO REQUIREMENTS

SEED AND VARIETIES.

Planting "just potatoes" is not profitable. In some districts it is claimed that potatoes can be grown but that there is no market for them. In most cases, except where there are no shipping facilities, the reason for the lack of market is that there are too many varieties grown and many of them undesirable. Four or five varieties are enough for the whole state. In eastern markets the reputation of Idaho potatoes is based on two varieties—i. e., the so-called Idaho Whites (Idaho Rurals) and the Idaho Russets (Netted Gems). These are both main crop or late potatoes. Both

NETTED GEM POTATOES
Shallow Eyes and Square at the Stem End

are high quality potatoes and one or the other is adapted to all the potato growing soils of the state. Either of them will yield as well as or better than any of the other one thousand or more named varieties, many of which are being tried each year. The market does not like varieties mixed in a shipment and buyers do not favor communities where several varieties are grown. As a result, those potato growing districts are most prosperous which have the fewest varieties other than the two standards mentioned.

For early maturing varieties, the old standard Early Ohio and Bliss Triumph that have been known for several years all over the United States, are found satisfactory in all districts of the state where we have seen them tried. Both these varieties are of high

quality and as early as any known. Some markets are partial to either a red or white potato, depending on the traditions of the place. Fortunately there are strains of both these varieties that are white (bud variations), tho those most commonly grown are red.

SELECTION OF SEED POTATOES.

Generally speaking, the yield of the potato crop in any locality is determined more by the quality of seed selected than by the variety planted. There are two ways of selecting potatoes for seed—from the cellar and from the field. Selecting from the cellar does not secure the best seed, but it is much better than not selecting at all. In selecting from the cellar, keep in mind the best type of the variety. Use only those that conform to this type and that are free from all indications of disease, as Rhizoctonia, scab, etc. It is safest to select those of a size between two and ten ounces. The size of seed that is best, however, depends somewhat on the yield of the field from which the potatoes came. Potatoes grown on poor land or land that had insufficient water during the growing season, so that they did not reach full size, may be better seed—in fact, they are likely to be better seed—than overgrown tubers. The same may be true of potatoes that are rough and knobby. If the protuberances or knots are the result of irregular watering or other checks in growth, the rough potatoes may produce smooth, good-type progeny.

One cannot always tell, however, whether the roughness is the result of adverse growing conditions or of degenerate heredity—run-out stock. Hence, the safe way is to use only those tubers for seed that conform in every way to the desired type.

SEED FROM THE FIELD.

In selecting seed potatoes from the field, more than just the character of the individual tuber should be considered. Many apparently perfect tubers may be found on plants that did not make a satisfactory growth or yield and on plants that have succumbed to disease before full maturity is reached. A good percentage of the medium, uniform, healthy plants that are typical of the variety will be found to have tubers that are likewise uniform, typical and satisfactory in size and numbers. The person who makes the selection must learn the discriminating factors, so that a majority of the plants selected and dug can be retained for seed. In this work, it is not expected that all the tubers from these best plants will be retained for seed, altho those tubers which may

not be entirely perfect in every way, if from perfect plants, will tend to reproduce perfect potatoes.

Every grower should select seed potatoes from the field, saving only the best tubers from the most perfect plants, so as to have enough of such seed to plant at least a seed plot each year. In this way only can the type and yield of a variety be brot up to its highest standard and maintained there. The average field is composed of a mixture of types and, in many cases, of varieties that can hardly be distinguished in the bin but which are evident to even the casual observer if the plants in the field are given a bit of study at the time of maturity.

KEEPING SEED POTATOES.

The ideal method of keeping seed potatoes over winter is to leave them in the ground till spring. Unfortunately this is only possible when the soil does not freeze because of lack of cold weather during the winter or because an early snow blanket prevents freezing deeply enough to destroy the tubers. The next best method is to approximate this natural condition, by holding the tuber, as nearly as possible, in a uniform condition of temperature and moisture during the dormant period. This is best accomplished by keeping the potatoes in bins in a well ventilated, earth-covered dugout. The temperature should be held as nearly as possible at forty degrees Farenheit, above zero, altho no harm will be done if the temperature of the cellar goes down as low as thirty-two degrees Farenheit. Potatoes piled deeply in bins, particularly if there is no rack floor under them or if there are many decayed potatoes in the pile, will generate a considerable heat so that the tubers in the center of the bin may be many degrees warmer than at the surface. No exact data is available as to the effect of heating of potatoes in pits or bins, but observation indicates that heated potatoes are much more likely not to grow when planted, than are those that have been subjected to a low temperature. In any case, so-called "chilled" or "frozen" potatoes can be detected, while those that have been killed from heating may appear firm at planting time.

TREATMENT OF SEED POTATOES.

From six to eight weeks before planting time, seed potatoes should be sorted over to remove defective tubers and those that show signs of disease. Those badly infected with the sclerocia of Rhizoctonia (black spots on the tubers) had best be discarded

from the seed as the larger masses of the fungus are not likely to be killed by the treatment. It is also well to cut a thin slice from the stem end of several hundred of the tubers to ascertain if there is any great amount of infection in the vascular tissue (sap wood of the tuber) which is indicated by a circle of brown or discolored tissue. Tubers affected with this disease should not be planted, and should therefore be sorted out before treating, to avoid waste.

The most commonly recommended treatment for seed potatoes is corrosive sublimate (mercuric chloride) in water, at the strength of four ounces of corrosive sublimate in thirty gallons of water. The tubers should remain in the solution ninety minutes. Dissolve the corrosive sublimate in an earthen receptacle with hot water before placing the material in cold water. In this work,

TREATING VAT AND "GREENING" TREATED SEED POTATOES

use only earthen or wooden receptacles, as the treating material is corrosive to metals. Corrosive sublimate is poisonous to all animals; hence, care must be exercised to prevent any animals from drinking the solution or eating the treated potatoes. The potatoes may be treated in barrels or, in case of a considerable quantity, in a tank.

The chemical is rapidly weakened by use, hence, if the solution

is used a second time, one ounce of dissolved corrosive sublimate should be added to each thirty gallons of water.

The corrosive sublimate treatment retards the development of the buds to some extent, so notwithstanding the fact that the treatment is usually given just previous to planting, it is best if done at least ten days before the seed is cut. In any case, care must be exercised to prevent the recontamination of the seed by keeping the potatoes in a clean place and handling them in clean baskets or sacks. It must be remembered that this treatment kills only the spores or germs of scab and Rhizoctonia and does not prevent these diseases if the potatoes are planted in infected soil, nor does it prevent the Fusarium wilt or other diseases of the interior of the stem or tuber. Because of this, the same precautions are necessary in growing the crop as tho the seed had not been treated.

Another treatment frequently used is: Formaldehyde (40 per cent in water) one pint to thirty gallons of water. Soak the potatoes ninety minutes in the same manner as with the corrosive sulbimate treatment. This material is less likely to destroy the Rhizoctonia, and if, by mistake, the solution is made too strong the potatoes may be pickled by the treatment.

GREENING SEED POTATOES.

After seed potatoes have been sorted and treated it is good practice to spread them on a clean floor in the dugout, barn or open shed, where they will be exposed to the light for a few weeks before planting. In high altitudes where the day temperature does not run high in the spring, some growers leave their seed potatoes exposed to the direct rays of the sun for many days. Either direct or indirect sunlight causes the tissues to become toughened and green and, while this exposure injures the potato for culinary use, it makes it more resistant to disease and apparently increases its growing power. This system of treating seed potatoes is known as "greening" seed and, where it can be done without too much inconvenience, it is unquestionably desirable.

CUTTING SEED POTATOES.

Some growers advocate the planting of whole potatoes. Repeated experiments in Idaho indicate that this is not a profitable practice, for two reasons. First, unless very small tubers are used the system is extravagant in that an excessive amount must be used. Second, this process produces so great a percentage of small

tubers that the total weight of marketable potatoes is less than where cut seed is used. One argument in favor of whole seed is that there is less danger of its rotting or drying out in the soil before the sprouts are rooted, than with cut seed. It is also quite possible that there is less internal infectious disease in fields planted with whole seed. For seed plots, therefore, there may be an advantage in planting potatoes whole.

As a general statement we may say potatoes are usually cut into too small pieces. Experiments extending over long periods show that the greatest yield of marketable-sized potatoes is obtained when seed pieces weighing two ounces are used.

We must bear in mind that the tuber is a stem and, like the stems of other plants, most varieties of potatoes have more buds than can be supported by the plant food of the tissues. With the system sometimes practiced of cutting out the eyes of the potato to plant, there is not enough plant food planted with the bud to support the young shoot till it develops a root system. A spindly, weak plant results, that never reaches the size and productivity that would be attained if the seed piece had been larger. In cutting most varieties of potatoes, it does not pay to examine the tuber for eyes before cutting. If the potato is cut so as to have as little cut surface as possible and into pieces that weigh from one and one-half to two ounces, there is almost sure to be at least one bud, which is enough, on the piece. The best way to cut the potato is to make first a longitudinal cut beginning at the apex (seed end), then cut the tuber again at right angles into as many pieces as is necessary. Very large potatoes sometimes need to be cut longitudinally first into four pieces before the cross cuts.

Several machines for cutting seed potatoes are on the market, but comparatively little is gained in time by using them and it is doubtful if as good work can be done with them as by hand work. A simple yet efficient contrivance for cutting seed potatoes is to drive a case or paring knife into the end of a piece of board in such a way that the operator can sit on the board and push the potato across the upright blade of the knife. An elaboration of this knife in the board is used extensively in some districts in the form of a slat bottomed hopper in which several sacks of potatoes can be placed. The potatoes roll down to the hand of the operator in front of the hopper and the knife is set up on the edge of a sack-holding frame so that as the potatoes are cut the pieces fall into the sack. By this means the number of motions used in cutting

the seed is reduced and the amount of work turned off in a given time increased.

Potatoes should be planted as soon as is convenient after they are cut. Some growers prefer to let the cut surfaces heal—dry over—before planting. This is sometimes effected by sprinkling unslacked lime, sulphur, gypsum or road dust, on the freshly cut pieces. The pieces may be handled rather better if dried off in some such way, but we have no evidence that anything is really gained by such practice. Most growers take care not to cut a very great quantity of potatoes ahead of the planter for fear that rains or accident may cause a delay, in which case the cut seed may deteriorate.

IV. PLANTING, CULTIVATION, HARVESTING

PLANTING.

The land should be thoroly prepared, of course, before the seed is cut. In arid sections there always is danger that heavy winds will dry the soil out before or during planting time to such an extent that a poor stand of plants results. The depth of planting is frequently determined by this factor.

Where potatoes are grown under irrigation methods and anything more than a garden patch is to be planted, a machine planter should be used. This is particularly true in the arid districts, as the machine opens the furrow, drops the seed piece and covers it up without exposing the bottom of the furrow to the dry air except for the fraction of a minute. Where hand planting is done by dropping the seed in a furrow, much drying occurs before the pieces are covered.

There are many types and makes of planters, all of which do good work on properly prepared soil. With all types of automatic planters greater accuracy of dropping will result if the seed pieces are of uniform shape and size.

Practically all potato fields in Idaho are planted in rows but one way. The distance between rows varies somewhat, but usually as a matter of convenience in cultivating, irrigating and digging, the rows are planted thirty-six to thirty-eight inches apart. For early potatoes, the distance between rows can just as well be cut down to twenty-eight or thirty inches if the crowding does not interfere with the machine work.

The distance between plants in the row is determined by the fertility of the soil or amount of moisture. For unirrigated land, considerable space must be given, else lack of moisture will cut down the size of the potatoes. Thirty inches in the row where the rainfall is scant is not too much. The distance in the row for irrigated potato land is anywhere from eight inches on excessively rich land to fifteen inches where the growing conditions are not so good.

DEPTH TO PLANT.

The depth to plant also varies with conditions. For unirrigated land and where the planting is done very early in the spring, five inches under the level surface is not too much. With irrigation, two and a half inches is probably as deep or possibly deeper than the average grower plants. In any case, however, it is wise to plant sufficiently deep to make sure that the seed is placed in moist soil and also covered by moist soil. If this cannot be done, planting had best be discontinued till the land has been irrigated, as the chances of a satisfactory stand of plants from potatoes planted in dry soil are exceedingly poor.

CULTIVATION OF THE POTATO CROP.

Various systems of cultivation of the potato are followed in Idaho, the desirability of which depends largely on the type of soil and moisture conditions. With land which, because of its sandy texture has but little tendency to compact or bake, it is cheaper and equally effective to harrow the field with a smoothing harrow till the plants are so large as to be injured by the work. The harrowing may be commenced as soon as the planting is finished. With soils that are inclined to pack easily, better results are obtained if a deep cultivation is given soon after the planting is done. Machine planters leave a ridge over the potato row which can easily be followed, so the first cultivation can be made as well before the plants are up as after.

WHY CULTIVATE?

There are two fundamental objects to be attained by cultivation. The first is to aerate the soil; the other to make plant food available. The killing of weeds is incidental and, hence, a secondary matter. While deep cultivation is desirable, especially for the first time and on heavy land, it necessarily tends to allow the soil moisture to escape and, as that is nearly always undesirable in Idaho, the deep cultivation should be immediately followed by the

smoothing harrow to re-establish the soil mulch that is broken by the cultivator.

TYPE OF CULTIVATOR.

In some potato-growing districts a special cultivator with heavy frame and fourteen-inch bull-tongue shovels, that requires four horses, is used. With this tool the soil is loosened as deeply as the plow was run. None of the soils of Idaho seem to need this drastic treatment to prevent soil packing, providing the previous preparation has been right. For the most part, the common four- or six-shovel, two-horse cultivator is used for potato work in Idaho.

Where irrigation is not to be practiced, any cultivator can be used that will leave the surface of the soil fine and not ridged, as the less the ridging of the soil the less will be the loss of soil moisture. Neither ridging nor hilling of the potatoes is desirable for potatoes on unirrigated land, for if the seed pieces were planted sufficiently deep the tubers will be formed well below the surface and hilling in any case necessarily causes a greater heating and drying of the soil than would occur where the surface of the soil is kept level. Frequent shallow cultivation will prevent loss of moisture and promote rapid growth. This may be continued till the plants are well in bloom or until the plant tops interfere with the work.

Where the potatoes are to be irrigated, it is well to set the cultivator from the start in such a way as to work the soil toward the row, thus forming a ridge at the row and a ditch at the middle of the inter-space between the rows. Deep cultivation from the start, of irrigated potatoes, is not likely to cause damage to the crop, for the ditching would necessarily expose the superficial roots of the middle of the spaces and if the cultivator has kept the soil worked deeply in the center between the rows the tendency will be for the roots of the plants to go deeper into the soil. The number of cultivations varies with the other conditions but, with most growers, it is from three to six. The opinion is quite common that cultivation of potatoes, after the plants get partly developed, is injurious because of damage to the roots. It is probable, however, that little, if any, damage is caused in this way where irrigation is practiced. Under irrigated conditions cultivating may be continued without damage till the size of the plants interferes with the work, which usually occurs before the plants are in bloom to any extent.

DITCHING FOR IRRIGATION.

Where irrigation is to be practiced the irrigation furrows must be made soon after the last cultivation. What tools are best to use for this purpose and how deep the furrows shall be made, depends both on the type of soil and the slope of the land in the direction the water is to be run. Of course, it is pre-supposed that all low spots in the potato field have been filled and all high places removed by leveling before the land is fitted for planting. If this work is not done, no system of ditching or irrigation can do other than to flood some parts of the field and leave other parts with little or no water.

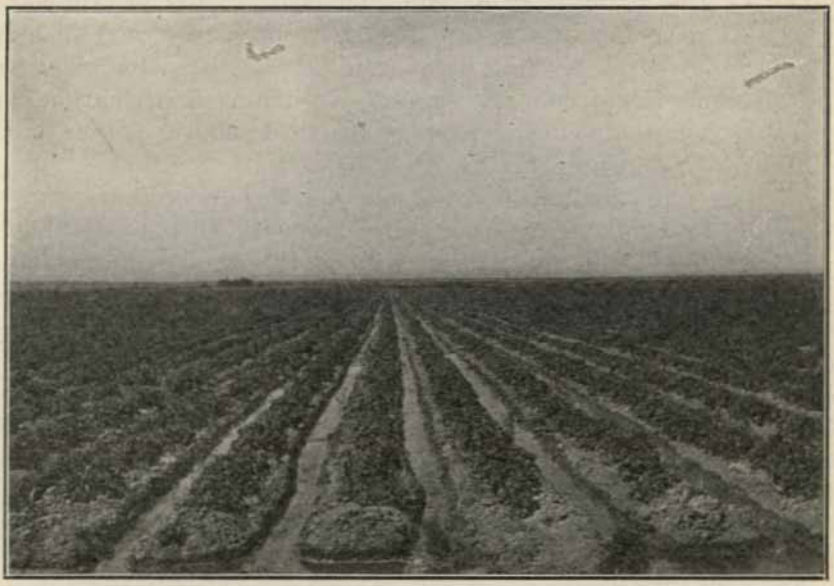
Where only shallow furrows are needed, an ordinary shovel plow or the common two-row cultivator with all but one shovel removed from each inter-space will do the work satisfactorily. For flat, heavy soils, the irrigation furrows must be deep and broad so that the water will in no place reach the top of the ridges of the rows, while at the same time there will be ditch capacity sufficient so that the water can be forced quickly to the far end of the rows. In fact, the variation in size of irrigation furrows will be all the way from a shallow furrow or groove at the center of the inter-space to a furrow eighteen or twenty inches wide at the top and eight or ten inches deep. Whether deep or shallow furrows are needed, make them as uniform and smooth as the nature of the soil will permit, so as to allow an even flow of water.

HOW TO IRRIGATE.

Only the most general directions can be given for irrigating, as the depth of ditches, time of application and amount of water will vary with nearly every farm and with each season. The object of irrigation is to give the soil just the degree of moisture that will enable the plant to make a maximum and continuous growth. The ideal condition is to have all the soil except the top of the ridge continuously moist without filling the inter-spaces of the soil with water so as to drive out the air—in other words, to have the soil moist without having any free water in it.

The water in the furrows tends to move, first, down in response to gravitation and, second, laterally in response to capillarity. In sandy, coarse soils the tendency to go down is greater than with heavy soils, hence the furrow does not need to be so deep. Likewise, as sandy or coarse soils take up water more rapidly than heavy soils, the flow in the furrow may be more rapid. Again, steep slopes, causing the water to flow rapidly, do not absorb water

as fast as flat land. Hence, the steeper the slope the smaller should be the irrigation stream and correspondingly the longer the time of the flow. Because of this fact, flat lands sometimes require water in the furrow only an hour or two to give the required amount of moisture, while steep slopes may need from



IRRIGATION OF POTATOES; KEEP THE ROW RIDGE DRY

forty-eight to seventy-two hours' continuous flow to secure the same degree of soil moisture. In either case the water should be run till the soil directly under the growing plants has all become moist.

WHEN TO IRRIGATE.

To set any date when irrigation should be done is obviously impossible. In a general way we say, do not water till absolutely necessary. Most growers delay irrigation, when possible, till the plants are in bloom or till the crop of tubers is set. This rule cannot be adhered to strictly, for in some arid districts the plants would die of drought before blossoming if no irrigation were given. The best rule is not to apply water till necessary but, when watering is begun, the soil should be kept in as nearly the same condition of moisture as is possible till further need for water is past. Again, no time can be set as an interval between irrigations. This will depend on the weather and soil. The true test is to dig into

the row and determine by inspection if the soil under the plants where the roots are feeding, has as much moisture as the plants can use to best advantage. In hot, windy weather water is removed by the plants and by evaporation with great rapidity, hence, careful attention must be given to see that the plants do not suffer from lack of moisture. A check in moisture supply after irrigation is commenced is likely to result in misshapen or off-type tubers as well as a decreased yield.

In the irrigation of potatoes we must keep in mind the fact that the potato must have a loose soil in which to develop. Irrigation or heavy rains tend to overcome the loosened condition which we strive to obtain by our system of preparation and cultivation of the soil. The compacting of the soil of the potato row is much less if the irrigation water gets to the plant roots by first penetrating the soil in the bottom of the irrigation furrow than by capillarity, being carried laterally to the roots of the plant.

IRRIGATION AND FROST DAMAGE.

There is always more or less danger of damage to the potato crop in some parts of the state from frost. June or August frosts occasionally occur and, while the frosts that come when the plants first come up do less real damage than we anticipate, they do not improve the crop and the later frosts on the vines may cause an entire cessation of the growth of the tubers. Dry soils are much more subject to frost. Water contains six times as much latent heat as dry soil, hence, running water in the field is the best possible prevention of frost damage. If the irrigation water can be turned on, even in only every third or fourth row, so as to be running when danger of frost is imminent, the damage may be materially lessened. In districts where short seasons are the rule and freezes frequently occur, some growers throw additional soil onto the rows by running the ditches through row spaces in the fall just after frosts have killed the plants but before the tubers are sufficiently ripe to dig. This loose soil fills cracks made by the expansion of the growing tubers and covers those tubers that are frequently exposed at that time. This is also sometimes expedient because of the danger of heavy freezing between the time the potatoes are sufficiently ripe for harvest and the time of finishing the work.

Growers of but little experience also frequently have losses from frost because of leaving dug potatoes in the field over night and from improper pitting. The potato tuber is very susceptible

to freezes and every precaution should be taken to lessen liability to loss from this cause. The potato will endure a temperature in the bin of about twenty-eight degrees Farenheit, but if even a small area of the surface of the tuber is really frozen endless trouble ensues.

HARVESTING POTATOES.

While the harvesting of potatoes is a simple process, it requires a great amount of heavy work and is the most expensive operation in potato growing. Digging is nearly always done in the larger fields by a machine digger that elevates the potatoes over a carrier chain which separates the tubers from the soil but leaves them on the ground to be picked by hand. Of the many types of machines used for this purpose, all leave much to be desired. At the best, many tubers are cut or bruised or left covered with soil.

Except for the early, green potato market, potatoes should not be dug till tubers are thoroly ripe so that the skin will not peel off. Unripe potatoes scar easily and unless handled with exceptional care, they will make but a poor appearance on the market. Greater care should be taken than is common in handling potatoes both at digging and in the bins. Bruises, cuts or any abrasions of the skin are likely to be followed by dry rot in the storage. Probably the greatest amount of damage comes from the system sometimes used of pouring potatoes thru chutes into the storage cellar instead of carrying them to the bins.

DISPOSAL OF CULLS.

Without a doubt the greatest problem confronting the Idaho potato grower is that of the disposal of his cull potatoes. With this may be classed the disposal of the whole crop in years when, because of over-production, which will now and then occur, there is no demand on the market for the product. In other words, the great need is for some sort of stabilizer for the crop. In other countries, where great quantities of potatoes are grown, quite a large percentage of the total crop is used in the manufacturing of starch, alcohol, potato flour and stock food. Up to the present none of these methods of using surplus potatoes has solved the problem to the satisfaction of the potato grower. The reason for this is the inability of these products to warrant a sufficient price for the potatoes to cover the cost of growing the crop. At present there is a renewed interest in this problem and several factories have recently been established in the state that are manufacturing potato chips, potato flour and stock food.

The most common method of disposal of surplus or cull potatoes has been to use them as feed for stock. Where sufficient stock is available and a proper system of feeding is maintained, potatoes fed to stock undoubtedly will bring at least the cost of producing the crop. Potatoes in not too great quantities are good feed for practically all kinds of stock. Experiments have shown that for hogs and poultry, potatoes should be cooked, as raw potatoes are difficult of digestion for these animals, as they are for human beings. For all stock a small percentage of concentrates, such as wheat, should be fed with the potatoes, and a ration of alfalfa undoubtedly will increase the efficiency of the feed.

In recent trials some growers have secured returns from feeding cooked potatoes to hogs that were considerably greater than the average market price of the crop. Properly fed, the value of potatoes is estimated at about 25 per cent of that of corn. Altho the disposal of cull potatoes by feeding has not solved the problem to the satisfaction of all growers, it is the best method of handling them for by far the larger number of growers.

V. STORAGE AND STORAGE DUGOUTS

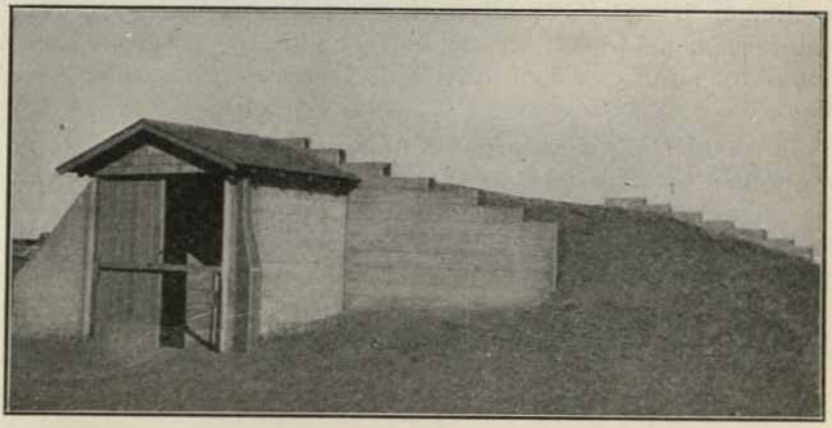
It is obvious that the whole potato crop of the country cannot be marketed at time of harvest. A large part of the crop must be stored either on the farm or at the centers of consumption.

Each grower has the question to settle each year as to whether he will sell from the field or store the crop, to be put on the market during the winter or spring. It is hardly possible for any grower, except one who grows only early potatoes, to get all his crop off at digging time every year. This being the case, every grower who aims to grow potatoes as a money crop, should have some provision for storing at least a part of the crop.

Storing potatoes in pits is practiced to some extent, but the system is only a makeshift at best and is open to several serious objections. Some of the difficulties with this method are that the cost of handling is increased, the crop cannot be gotten at when the weather is cold and the grower never can know whether the potatoes will be too warm to keep during the winter or freeze because of excessively cold weather.

THE WESTERN UNDERGROUND CELLAR OR "DUGOUT."

The most satisfactory storage cellars found in Idaho are those typically of western or arid country origin and development. This soil-covered cellar or dugout is practicable only in countries of comparatively light rainfall, as excessive soil moisture would render the cellar unfit for storage purposes as well as cause the rapid decay of the construction timbers. Under the moisture con-



CONSTRUCTION OF DUGOUT
Note End Walls and the Construction of Approach or Vestibule

ditions that prevail in the irrigation districts of Idaho, there is enough moisture in the soils to prevent excessive loss of weight from fruits or vegetables stored in properly constructed dugouts, yet condensation of moisture on surfaces in the cellar seldom occurs.

LOCATION OF THE DUGOUT.

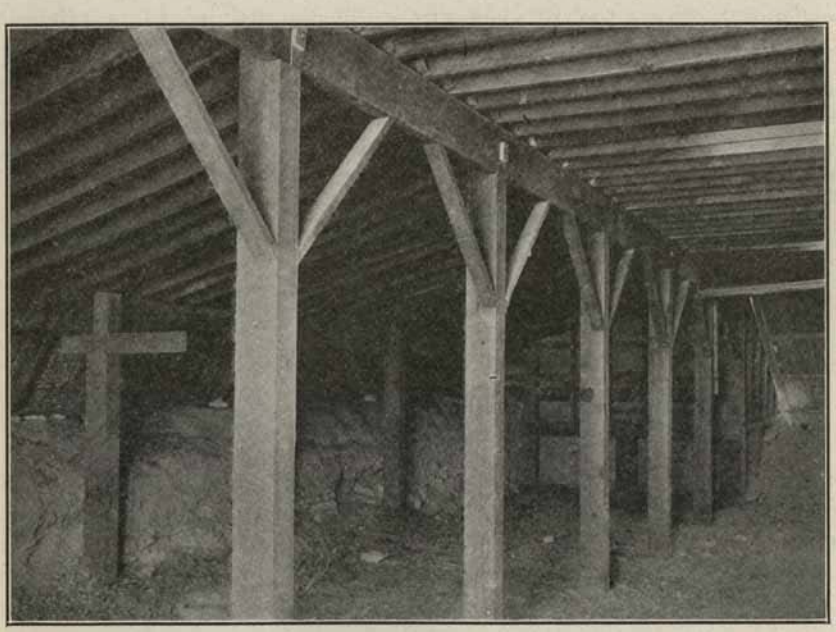
If the lay of the land permits, the dugout should be located where it will be convenient with relation to the other farm buildings.. This space is the most efficient storage on the farm and is used not only as a storage cellar for potatoes and garden produce but also as an incubator room for the poultry and to a great extent as a tool house for wagons and other farm tools during the summer.

From the standpoint of construction, a low knoll gives the greatest advantage. Perfectly level land can be used almost as well, however, and is much better than to try to utilize a side hill, which, tho sometimes used, is the poorest possible place. Other things being equal, an east and west direction, particularly if a

driveway goes clear thru the dugout, is to be preferred as giving the greatest ease of ventilation and greatest protection during the winter.

SIZE OF THE DUGOUT.

Each square foot of floor space will carry forty pounds of potatoes piled one foot deep. With good, sound potatoes there is no harm in storing at least six feet deep, hence, one can safely estimate the capacity of a cellar at two hundred forty pounds per square foot of floor space. Thus a cellar 36x50 feet with a twelve-foot driveway will have a capacity of 288,000 pounds or about 2800 sacks. With the driveway filled to the same depth, as is frequently done, this size of house will hold 4200 sacks.



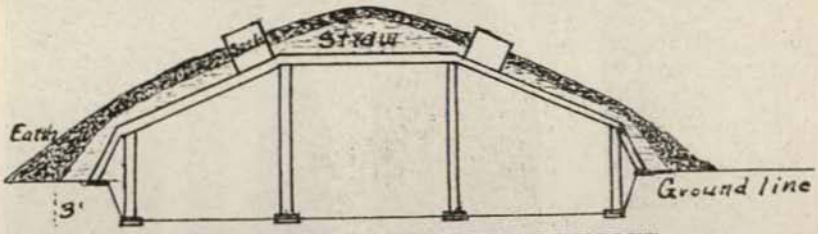
CONSTRUCTION OF DUGOUT
Note Line of Posts and Rafter Arrangement; Braces Not Needed

Dugouts are made of various dimensions. Cellars of thirty-six feet width have two bins and a driveway each twelve feet in width. A wider cellar will have a correspondingly greater depth of bins to width of driveway, but such cellars are open to the objection that a greater depth of bin space makes an increasingly greater distance to carry sacks to the back walls. But the greatest objection is that if the total width of the dugout is greater than

thirty-six feet, it is necessary to have four rows of supporting posts, whereas up to thirty-six feet, but two rows are required. Because of this and also because the narrower cellar is easier of construction, the thirty-six foot cellar is generally being preferred.

DEPTH OF CELLARS.

Tho dugouts may be found of various depths, a close study of the subject has shown that there is seldom any advantage in making the excavation more than three feet deep. A greater depth is nearly always undesirable, as it tends to make the cellars more difficult to ventilate and more likely to be damper than desired. A still greater objection is that it necessitates either a steep pitch in the vestibules or an unnecessarily long covered vestibule. Three feet of excavation will usually provide sufficient soil for covering the top and ends of the cellar, which is all that is required. Where the soil water is close to the surface, it is sometimes necessary to build the cellar mostly above the ground, in which case the soil for covering has to be obtained elsewhere.



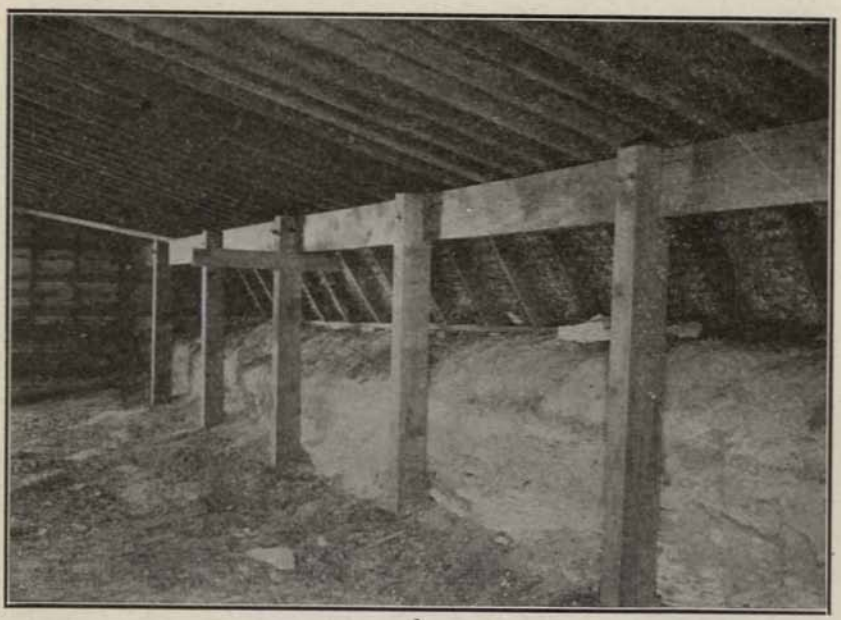
END ELEVATION OF STORAGE DUGOUT

It is always best where possible to have the driveway clear thru the cellar, with covered approaches and doors at each end. This adds to the total cost of the cellar, but it makes for greater efficiency and ease in ventilation. In excavating, pile the soil along either side as closely as possible to the excavation so that it can be used conveniently in covering.

In many parts of Idaho, sidewalls are not necessary and, where this is true, the cost of construction will be less than where concrete or stone walls are required. If sidewalls are not to be used, it is well to excavate so as to have the sides slope a little, for by so doing there is less likelihood that the soil will cave.

Some cellars are constructed by placing the sills for the rafters on the ground. This method is not recommended. A better method is to set a line of solid five-foot posts, or if the sill is to be mortised into the posts, six-foot posts, in place of the outside wall. These

should be not less than eight inches in diameter at the small end, in case of round timbers, or eight inches square if sawed timber is used. Place these posts not more than ten feet apart on the line just inside the excavation. Set on solid foundations of stone or concrete so that there will be no possibility of settling. Have the foundations come somewhat above the cellar floor so as to avoid danger of decay in the bottom of the posts, which occurs when the posts are set in the ground. If the cellar is not more

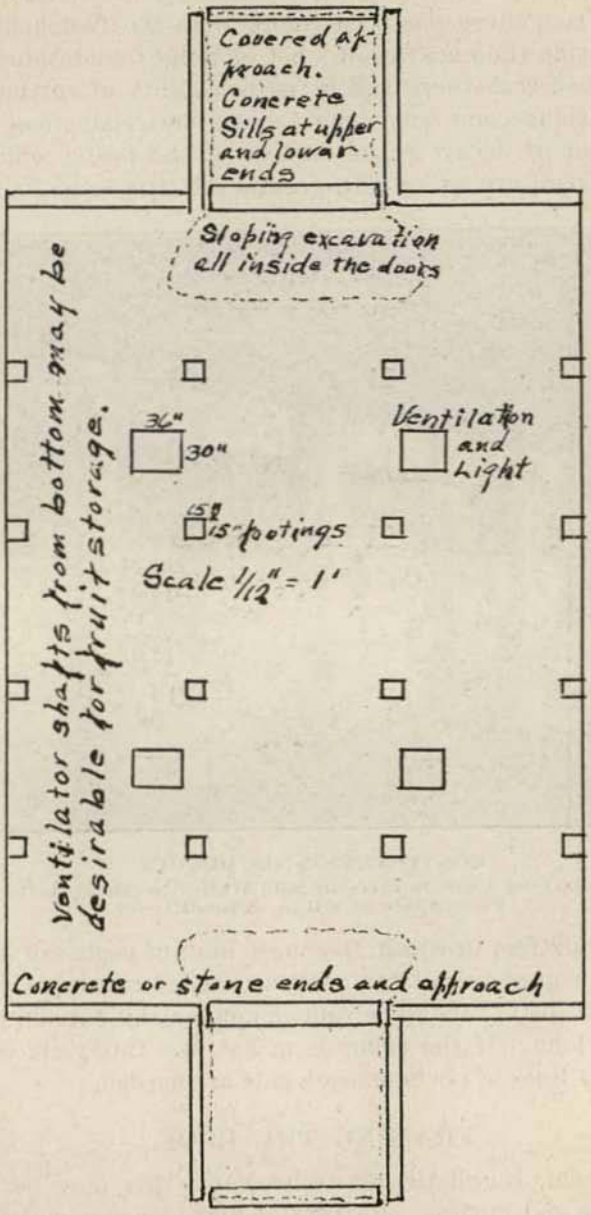


CONSTRUCTION OF DUGOUT
Note Line of Six-Foot Posts in Place of Side Wall; Also Short Rafters Running From Plate to Sill on Ground Level

than thirty-six feet in width, two more lines of posts six feet either side of the center are all that will be needed to support the roof. These should be of the same dimensions as the outside posts but eleven feet long. If the cellar is more than thirty-six feet wide, intermediate lines of posts on each side are needed.

FRAMING THE ROOF.

When good, round timber is available this may be used for both rafters and purlins. Rafters should be sound poles not less than four inches in diameter at the small end and purlins should be not less than one foot at the small end. If sawed timbers are used, three 2x12 planks nailed together make good purlins. Sawed



GROUND PLAN OF STORAGE DUGOUT

stuff 2x12 also makes good rafters where poles are not convenient. Place rafters not farther apart than fifteen-inch centers. If posts are used instead of sidewalls, short rafters must be extended from the plate to a sill on the ground outside the line of excavation to form the sidewall. For this purpose it is best to lay a shallow sill wall of concrete two or three feet from the outside line of posts. This type of construction gives a bit more storage space and makes the cellar equally as good as one made with solid outside walls.

The ends of the cellar may be constructed in the same manner as the sides but, as here greater difficulties are encountered, it is better where possible to make substantial end walls of concrete or rock. Vestibules are made in various ways. The best construction is to continue the end walls at least a part of the length of the approach to act as a bulkhead against which the soil may be banked. The vestibule must be roofed, as rain or snow falling in the approach must necessarily run directly into the cellar.

The roof is covered with straw and earth. This is not as a matter of economy, but because soil and straw make the best possible nonconductor of heat. Where the rainfall is heavy, it may be necessary to have a tight roof over the soil, altho a properly made earth roof cellar will not leak for several years except in case of prolonged heavy rains. It has seemed to the writer that a soil roof could be cheaply water-proofed with but little cost, by applying a coat of crude oil and sand on the finished roof. This scheme has never been tried, however, so far as we know.

COVERING THE ROOF.

Over the rafters is placed hog fence, poultry fence or plain wire to support the straw and earth. Roofing boards have sometimes been used for this purpose, but wire is to be preferred, as boards tend to hold any moisture that gets into the straw, and the early decay of straw, boards and rafters is encouraged. On this covering of wire, two or three feet of straw is placed. If, in the construction of the cellar, the driveway has the rafters laid flat across the purlins, the center should have enough straw to give the roof a rounded top when the earth has been placed and settled. With a properly made cellar, the earth covering may be driven over with a team after the work is started, as there should be no danger of the roof breaking thru. This soil covering need not be more than ten or twelve inches deep.

VENTILATORS.

Ventilators or chutes had best be provided when making the cellar, tho in the opinion of the writer the importance of ventilators, from the standpoint of ventilation, is usually over-estimated. These ventilating shafts are made in various ways. If it is desired to unload potatoes into the cellar thru chutes, such chutes may take the place of ventilators and should be placed near the outside walls of the cellar at intervals of fifteen or twenty feet. For convenience in working in the cellar, provision should be made for plenty of light. This may be combined with the ventilating system; hence, if the ventilators are to be used exclusively for lighting and ventilation the openings had best be located just outside the center line of posts so as to admit light to both alleyway and bins. It may be well also to have one or two good sized cupolas or openings over the center of the drive. It should be remembered, however, that the greater the number of these openings the greater will be the danger from freezing during the cold weather.

These shafts may well be made 2½x2½ feet and should project at least one foot above the soil covering. Tight board caps are made for both top and bottom and it is well to have a sash of glass fitted at the center of the shaft so that light may be admitted to the cellar when desired without letting in the outside air.

DOORS.

Frequently the doors are the weakest feature of a dugout. If the doors are not properly made or do not fit properly, freezing of the cellar is quite likely to occur. Some very satisfactory cellars have doors that are hinged at the top and are drawn up with a pulley. Double doors that swing in from hinges at the sides are probably the most satisfactory. The doors should be double in thickness with a good grade of building paper between. If the doors are cut in sections so that the upper half can be opened while the lower parts are closed, it will aid in ventilating.

VENTILATION OF THE DUGOUT.

It should be remembered that the farm potato storage dugout is primarily a cold storage. The space is partly below the surface of the ground and is well insulated to keep out heat. Ventilation should be, then, largely for the purpose of letting out heated air and letting in colder air. If the cellar has doors at both ends, this may be quickly accomplished as there is at nearly all times enough

current of air to change the air quickly in the building if the doors of both ends are opened. In winter it may be desirable to change the air in the cellar, which may be done during the middle of the day when the temperature is above freezing. It is usually better, however, not to molest the cellar in winter except to see that the temperature does not go below the freezing point, which, for most fruits and vegetables, is about twenty-eight degrees Farenheit. Fall and spring are the times when attention must be given to ventilation. If the doors are thrown open late at night and closed early in the morning the temperature in the cellar may be held uniformly low even till late spring or summer. A thermometer should be kept in the dugout at all times, as one cannot place much dependence on the "feel" of the air in the cellar.

Most dugouts have only an earthen floor. Concrete floors are more easily kept clean, otherwise they are not necessarily of any particular value. Some growers use a rack floor under the potatoes, made of narrow strips of two-by-fours. This allows a circulation of air under the potatoes. In case of potatoes being stored in sacks, it also prevents the rotting of the sacks, which takes place in only a few days where sacks are in contact with the earth. Other than this, there seems to be but little difference in the keeping of potatoes, providing they are kept dry and cold.

VI. POTATO DISEASES AND PESTS

There are many diseases that attack the potato. For the most part these are the effects of the growth of parasitic fungi or bacteria, tho there are diseases of potatoes that as yet cannot be attributed to any of these vegetable organisms. Much confusion prevails in regard to the various potato diseases in that all potato diseases are commonly spoken of as "blight." Originally, the term blight of potatoes indicated either one of two diseases that prevail in the humid sections of the country. These were the early blight (Macrosporium solani) and late blight (Phytophthora infestans).

In a very general way we may divide the diseases of potatoes into two classes, viz: those diseases caused by organisms that develop from infection of the leaves (top diseases) and those diseases that attack the plant or tuber from below ground (soil or stem diseases).

The top diseases, including both the early and late blight, seem to require a humid atmosphere for their development; hence,

while they are always more or less prevalent and destructive in the eastern potato growing states, they have not occurred so far as we know in the arid potato growing districts of the Rocky Mountain states. The more humid districts of the Northwest might occasionally be troubled, particularly with the early blight, under certain weather conditions, but ordinarily neither of them is of much importance to the Idaho potato grower. The universal remedy for these two diseases is spraying the plants with Bordeaux mixture.

Unfortunately the soils of the arid West seem to be peculiarly favorable to the development of various types of fungi and bacteria that attack the potato from the root and tuber.

KNOWN DISEASES THAT ARE PRESENT IN IDAHO.

Potato Scab—Potato scab prevails more or less in all parts of the state. It is more noticeable on white and thin-skinned varieties, as the Rural, and more likely to occur on them than with the more resistant Netted Gem. If clean seed is treated with corrosive sublimate and planted on land that has not been in potatoes for a few years, this disease is not likely to give serious trouble.

Rhizoctonia—Rhizoctonia is almost universally present in Idaho soils. Under certain conditions of soil and temperature, it may cause serious damage. On the tubers, it may be seen as a black scurf or dots—the winter or resting state of the fungus. The damage from this disease comes from the rapid growth of the fungus, which attacks and feeds on the young stems of the potato plant about the time the plants emerge from the ground. In this way the bark of the stems is badly pitted or completely girdled, causing a weakening or death of the plant. Discarding or treating infected tubers will retard the infection for a time and the later attacks that come after the stems become toughened are not apt to cause injury that seriously interferes with the normal development of the plant. Deep cultivation, aeration of the soil and care to prevent flooding of the ground help materially in the control of this disease.

Curly Dwarf—This is one of the diseases, the cause of which has not been determined. It apparently occurs only when tubers from plants that were affected with the disease were planted. The disease may be readily identified by the curling and dwarfing of the plants. The remedy is obvious. Destroy all plants that show signs of the disease or do not plant any potatoes that were grown in fields where the disease was known to occur.

Potato Wilt—The disease generally known as potato wilt, or stem blight, is at present the most serious potato disease of Idaho. The cause is usually attributed to one or more of the Fusaria, altho other fungi, especially Verticillium, have also been found in the infected plants. This disease is characterized in advanced stages of the disease by a wilting of the plants, altho many of the plants affected never wilt perceptibly. These plants usually show yellow leaves, at least at the base of the plant. An inspection of the stem, however, shows the vascular tissue (sap wood) at the base of the plant to be discolored. Microscopic examination of this diseased tissue shows the presence of filaments of the fungus in the water tubes of the plant. The wilting of the leaves is undoubtedly due to the clogging of these tubes, thus preventing the free flow of water to the foliage.

Tubers from badly infected plants usually show a similar discoloration in the vascular tissues at or near the stem end of the tuber. Not all the tubers from diseased hills show the discoloration.

This disease may reach the plant either from the infection in the seed tuber that was planted or the plant may be infected from the soil in which it is growing. The larger part of the disease is apparently the result of planting infected seed.

Because of the fungus being inside the tuber, there is no remedy that can be used to prevent the disease other than to avoid planting potatoes known to be infected with it.

Blackleg of the Potato—A potato disease which at least has some of the characteristics of blackleg, has been quite prevalent in some of the fields of the irrigated districts of Idaho during the past two years. This disease has not been noticeable till about time of maturity of the plants. Plants affected with this disease become prostrated, as a result of the rotting of a section of the stem a few inches above ground. This part of the stem becomes black and soft. The plant above the affected part may still appear more or less normal except that it will usually lie flat on the ground instead of upright, so that even after the vines are killed with frost many of these plants can be identified. The infection does not necessarily show to any extent on the outside of the stem below the surface of the soil, altho the vascular tissues are discolored.

In the tubers, the disease is as characteristic as in the stem. Badly diseased plants may have a full number of good sized tubers, showing that the disease did not affect the plant till about the time of maturity. In nearly all of the diseased plants examined just before harvest, one or two tubers in each hill were badly

discolored at the stem, with the remainder of the hill entirely normal, so far as could be seen. A section cut across near the stem end of the tuber shows a characteristic water-cored condition of the central area, with the vascular ring normal. The rot of those tubers affected was soft and slimy, similar to that following an attack of late blight.

From the nature of this disease, we are led to believe that it is transmitted by planting diseased tubers. The fact that a number of potatoes from each diseased plant appear healthy makes a good probability that some of the best potatoes selected from the bin of potatoes, that came from a field where the disease was present, will carry the disease to the next year's crop.

This disease, which is undoubtedly bacterial, has not as yet been thoroly investigated in Idaho. Until more is known of it, the safe thing for the grower to do is to refrain from planting any potatoes that were grown in fields where the disease was known to exist, unless they be hill-selected stuff.

Jelly End Rot—A disease or condition known as jelly end rot occasionally occurs in fields of Netted Gems. So far as the writer's observation goes, this only occurs with potatoes that for some reason have become off-type—i. e., pointed at the stem end. Under these circumstances, the tubers seem to lose their typical structure at this pointed end. The narrow tip, for an inch or more from the stem, lacks the characteristic russeting of the skin. The tissue is soft, apparently composed mostly of pith cells and not infrequently this tissue breaks down with a jellylike rot and sloughs off. This gives the potatoes a bad appearance and may encourage further rots to attack the potato. So far as we know, this trouble is not caused from the work of any specific organism. The remedy is obviously to correct the type of tuber by a change of seed or cultural practices.

Internal Brown Spot—Now and then a crop of potatoes is produced, many specimens of which, tho appearing sound on the outside, have spots or irregular streaks of a brown discoloration thruout the tissue. This trouble is supposed to be caused by weather or soil conditions, as no disease organism has been found associated with it, and affected tubers when planted, do not necessarily reproduce the trouble.

Chlorosis or White Leaf—It is not uncommon to find from one to twenty per cent of the plants in Idaho fields with a part of the leaves almost destitute of chlorophil—that is, without any color. This condition, so far as known, is not a definite disease, altho the

condition undoubtedly weakens the plant and ultimately reduces the yield. It has been supposed that the trouble was inherited and it undoubtedly is to a certain extent, tho the condition is much more prevalent in some seasons than in others. Many fields showed a high percentage of affected colored plants early in the season of 1918, where a little later in the season but little of the trouble was observed. Another interesting observation was that in a field, one end of which had been in alfalfa with the other end in grain the previous year, the alfalfa land potatoes had a higher percentage of plants affected than on the grain land.

While this condition is not fatal to the plants, in many cases it is not desirable and tubers from plants known to have been affected should not be used for seed.

Cellar or Dry Rot—Serious losses are sustained some seasons from dry rot in storage during the winter. This rot is usually caused by a Fusarium fungus. This fungus is not the same as, tho similar in appearance to, the fungus that causes the interior infection in the plants and tubers in the field. The disease gains entrance to the tuber almost entirely thru cuts or bruises. Few tubers will be found decayed by this fungus that have not previously received some injury.

The remedy for this trouble is obvious. Handle the crop in such a way as to avoid the cuts and bruises. As the fungus remains in the cellar in dirt and on the walls and timbers, it is advisable to clean and disinfect the cellar thoroly each year before the crop is stored.

Susceptibility to this trouble is greater with some varieties than with others. Idaho Rural seems to be particularly susceptible to dry rot, while the Netted Gem is not commonly troubled extensively.

Hollow Potatoes—The hollow in potatoes may be a characteristic of the variety, altho occasional hollow individuals of any variety may be found. It most usually occurs in overgrown specimens or those of irregular shape. It is caused by the breaking down of the pith cells of the potato, of which the center of the potato is mostly made up, and is more or less a natural condition, the same as the hollow in a radish or other pithy stem.

OTHER POTATO DISEASES.

Wart Disease—There are several other potato diseases which, fortunately, up to the present time, are unknown to the Idaho farmer. One of the worst of these is the wart disease of the

potato. This trouble, which has caused a great loss to growers in parts of Europe, is caused by a fungus which attacks the tubers, distorting them into a shapeless, warty mass.

Powdery Scab—This is another disease of potatoes that, tho it has not been reported in Idaho, has been found in some of the eastern states. The disease differs somewhat from the common scab in that the spots on the tubers are first covered, then break out into brown, powdery masses.

KEEPING DISEASES OUT.

There are also other potato diseases that cause damage to the crop in various parts of the world which are as yet not known to Idaho growers. Every potato grower is vitally interested in preventing the introduction of any of these diseases and insect pests into the state and nation. The surest way to keep them out is not to bring seed potatoes here from other states or countries unless such seed was grown and sold under certification of the state from which they came. Even then it is wise not only carefully to inspect such seed when it is received, but also carefully to watch the pest during the growing season, where such seed is planted, so that any suspicious appearing condition may be noted and steps taken to destroy any disease that might appear.

INSECT PESTS OF THE POTATO.

Colorado Potato Beetle (Leptinotarsa decemlineata) — The most common and destructive insect pest of potatoes is the so-called Colorado Potato Beetle. This insect is so well known in most states as to need no description. The irrigated districts of Idaho, however, have so far been free from this pest. During the past few years it has become established in some parts of the state, where it will probably remain.

The adult beetle is oval in shape, about three-eighths of an inch long and somewhat narrower than long. The ground color of the beetle is yellow and the wing covers are distinctly marked with ten black lines or stripes. The eggs are yellow and are usually laid on the under side of the leaves in groups of from ten to fifty. The young are filthy-looking, reddish-brown grubs with black heads.

The insect lives over winter in the adult stage in the ground at a depth of from four to six inches. In the spring the beetles emerge at about the time early potatoes are coming up and on these they feed and lay their eggs. The eggs hatch in from four

to six days. The larvae feed on the surface of the leaf but soon tend to emigrate to the more tender tips of the plant. These larvae feed and grow very rapidly, reaching full growth in about three weeks. These go into the soil at the base of the plant where they pupate and emerge for the second generation. There usually are two broods in a season.

The remedy for this insect trouble is simple, as both adult and larvae are voracious feeders. One pound of Paris green or four pounds of arsenate of lead paste in one hundred gallons of water sprayed on the plants will kill the insects. Paris green takes effect more quickly but should not be used except with two or three pounds or stone lime which has been made into the milk of lime, added to the water. Paris green, by itself, contains more or less free arsenious acid which, without being neutralized, may burn the foliage. In districts where such leaf fungi as early blight prevail it is found profitable to use the poison in Bordeaux mixture.

Flea Beetle (Epitrix cucumeris)—Another insect that does an untold amount of damage to both potatoes and other vegetables of the solanum family is the little black flea beetle. This insect is less noticeable than the potato beetle, both because of its small size and also because the insects have a habit of jumping off the plants and hiding when disturbed. When tomato plants are first set or when potatoes first emerge from the ground these insects frequently attack them in great numbers, eating little holes in the leaves or eating the bark from the stems. The larvae live on the roots or underground stems of the potato and in some districts cause great loss of the potato crop by interfering with the normal setting of the tubers.

The remedy for this pest is the same as that for the potato beetle but is less satisfactory in that the insects are hard to kill or do not eat the poison. They do not take kindly to sprayed plants, however, so by their leaving them the same result is accomplished.

Other Insect Pests—Several other insects work on the potato some seasons or in some districts. Probably the most persistent and destructive of these is the wire worm, which injures the appearance and value of potatoes and probably also cuts down the yield. This insect is the larva of a snap beetle and is a serious pest in some parts of the state, particularly on river bottom lands. So far, no satisfactory remedy has been devised.

Cut worms sometimes damage the potato crop early in summer.

They are more troublesome some years than others and the damage is not usually as great as the damage from this insect to other crops.

Newly broken up timber land is apt to contain many white grubs that may cause some damage from eating holes in the tubers. This trouble is not persistent nor commonly of sufficient importance to warrant any remedial measures.

Eelworm—Two serious enemies of potatoes—animal parasites—are more or less prevalent in some of the southwest states. One of these, the Eelworm of the potato, is indicated by brown spots about the size of a pin head just inside the flesh of the tuber. These spots are infested with minute worms that make the potato unfit for human consumption.

Tuber Moth—The tuber moth of the potato, an insect pest, is causing serious damage in various sections of the country. This moth feeds on both the foliage and the tubers of the potato and where it once gets a foothold is difficult to eradicate. So far the insect has not been reported from any part of Idaho.

VII. GROWING POTATOES FOR SEED

The importance of good seed potatoes can hardly be overestimated. A poor crop of potatoes seldom pays the cost of production. A big crop may give a net return of two hundred dollars or more per acre. The difference in yield is frequently a matter of good or bad seed potatoes.

It has been demonstrated time and time again that, other things being equal, the best seed potatoes are those grown in short season districts and on unirrigated land. Good seed may be grown on irrigated land by planting the crop late in the spring, close in the row, and by giving insufficient water to make the greatest growth. All these conditions tend to cut down the total yield, hence few growers on irrigated lands can afford to make a business of growing seed potatoes.

The more unfavorable conditions of the unirrigated lands of Idaho tend by the struggle of the plant for existence to eliminate the weaklings, hence the average of the crop thus grown is improved in vitality.

In Idaho there is a great quantity of land in the north and in the footihlls of the various mountain areas that is ideally adapted to growing seed potatoes. This land will not ordinarily grow a big yield, but one hundred bushels of good seed potatoes from such

lands will bring a greater return than any other crop that can be grown on them.

For this purpose the deeper loam soils that are retentive of moisture should be selected. A north or east exposure, if level land is not available, is preferable, as such lands are less affected by the hot south winds of midsummer. The chief essential for success in growing potatoes under these conditions is to keep the soil loose and retain the moisture. All items of culture must be planned and executed with these principles in mind.

Unless the soil is particularly light and mellow, the plowing should be deep (not less than ten inches) and had best be done in late fall. Leave the ground rough till spring so as to hold as much snow as possible. Harrowing had best be done as early in the spring as the ground is fit to work, in order to prevent the loss of the accumulated soil moisture. Notwithstanding the fact that it is desirable to have immature potatoes for seed purposes, the chances of getting a crop of potatoes from unirrigated land are better if the planting is done very early in the spring.

It should be unnecessary to say that the value of any potato grown for seed depends entirely on what is planted. Culls, undesirable varieties, mixtures of varieties, diseased seed or undesirable types of good varieties planted and cared for in the best manner possible necessarily produce potatoes that are valueless as seed stock. Hence the greatest of care must be exercised in getting a start in the work of growing seed potatoes.

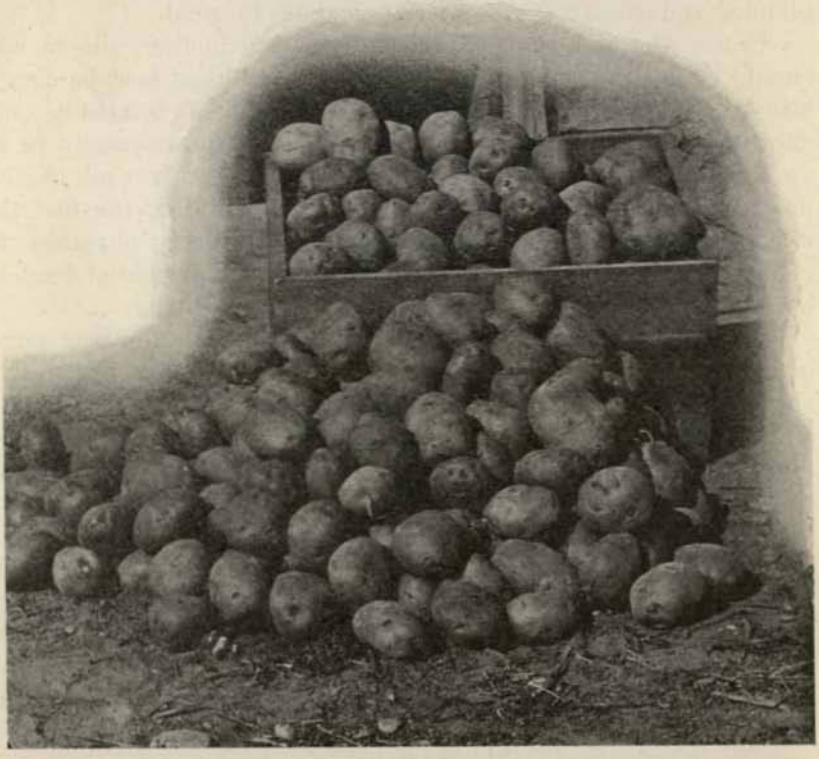
Further than this, if a grower is to attain the greatest measure of success he must improve and build up his strain of stock, by selecting seed each year from the best plants in the field for planting his own seed plot.

All seed stock should be treated to clean it of scab, Rhizoctonia and other disease germs that might be carried by the tubers as previously described in this bulletin.

For growing potatoes on unirrigated land it is even more essential to use good-sized seed pieces than for the ordinary field crop. If the seed is small, whole potatoes may be used to advantage.

Probably the one most vital point as to cultural methods in growing potatoes on unirrigated land is that of depth of planting. If they are planted shallow they are almost sure to suffer from lack of moisture at some time during the growing season and a large per cent of the seed pieces are apt to dry out before the plant is started. Five inches under the level surface is none too deep for unirrigated plantings.

The same machines may be used for planting as for the market crop, but the machine planter is not so essential as when planting on irrigated land. A distance of 30x30 inches or even three feet by three feet may not be too great for planting. Because of this and because of the necessity for thoro, frequent, shallow cultivation, it is good practice to mark the land both ways and plant in the checks with a hand planter. Hand planters costing a dollar



GOOD TYPE IDAHO RURAL SEED POTATOES
Four to Ten Ounce Tubers. (The Picture on the Cover of This Bulletin Shows a Basket of Idaho Rurals, All From One Plant, of Good Type, Uniform in Size and Sufficient in Number)

or two can be secured that will do good work and with which from one to two acres can be planted by one man in one day. Under this system but little if any extra investment for special tools is needed for the work.

Little need be said of the cultivation. The more thoroly and oftener this is done the greater will be the amount of plant food

available to the plant, hence the more rapid and greater the growth.

Early planting will necessarily result in early maturity, particularly of the early varieties of potatoes. Late spring frosts may occasionally appear to cause some damage to very early planted potatoes, but usually little real harm comes from this, while heavy frosts in the later part of the season do seriously cut down the yield of potatoes.

Digging of such seed stock may be done in any way that seems most feasible. For growers living at a considerable distance from shipping points, as many of them will, it is decidedly advantageous to get the crop to some shipping point for storage so that the potatoes may be delivered at any time when they are wanted.

VARIETIES FOR SEED CROPS.

Where excessively dry weather is the rule during August and September, there is much more probability of securing a satisfactory yield if one of the early maturing varieties is planted. Of these, Early Ohio, and Bliss Triumph are the most popular varieties, tho the Idaho Rural is almost as early and in most cases it will probably out-yield either of the other varieties mentioned. The demand for Idaho Rural seed is also good, particularly in the lower altitude districts of Idaho and Utah. Netted Gem seed is in great demand not only in Idaho but also in Washington, Oregon, Utah and California. The Netted Gem because of its habit of late maturity is likely to be smaller in size than the earlier maturing varieties, but the medium to small seed potato of this variety grown on the unirrigated lands is unquestionably unsurpassed in its ability to produce a profitable crop when taken to the irrigated districts.

DO POTATOES RUN OUT?

A discussion of seed potato growing would be incomplete if nothing were said about the running out of potatoes.

We know that in certain districts a strain of potatoes changes its characteristic habit of growth and form of tuber and that the stock becomes generally attenuated when planted year after year in the same district. We also know that this so-called running out or degenerative change will take place in spite of any selection of the best plants or tubers that can be made. Again, we know that these same strains of potatoes may be kept at least for a great number of years without deterioration when grown under some

other climatic condition. In many cases, this environmental degeneration has never been satisfactorily explained.

The potato is native to the high altitudes of the mountains of South America. It is more at home and makes a more rapid normal growth in districts that approximate the conditions of its native habitat. This condition is secured with apparently equal success, either by the high latitude of the northern states and Canada or by an altitude in states farther south that, by its height above sea level, secures the temperature that is congenial to the plant.

Another factor that must be considered is the change that has been made in the potato thru domestication. The progenitor of our potato was a plant of similar habit of growth to the potato of today, but the tubers were small, irregular, and were probably more in number to the plant, considering its size and strength, than those of today. There has been a continuous selection, either consciously or unconsciously, to change this habit to produce a plant that yields larger tubers, even tho fewer in number, and those with a greater percentage of starch in their composition. In other words, nature produced tubers on the potato plant simply for the purpose of reproducing the plant and that as abundantly as possible. Man has, by selection, aimed to divert this tendency toward his needs, which require more edible tissue from each plant.

Under the most favorable conditions of climate and soil, nature tolerates this change, but where the environment is less congenial, there is an almost immediate attempt on the part of the plant to break up into forms, some of which may be adapted to the given conditions. Under such circumstances, we could not expect the resulting forms to be desirable from the standpoint of yield or quality of tuber.

Much of the so-called running out of potatoes is unquestionably due to bad selection. Sometimes the grower eats or markets the best of the crop, planting those that are too small to market. Some of the small potatoes are from high-yielding, healthy plants. Such seed will or should reproduce the characters of the parent plant. More of the undersized tubers are from weak, diseased or degenerate plants; these will also reproduce their kind. Each year, the percentage of bad heredity is increased till the original type and capacity to produce profitable yields is lost. Then we say the stock is run out. Planting culls is selection as surely as planting from the best plants. It produces results more quickly than good selection. We must bear in mind that our agricultural crops are made up of varieties and strains of plants that have been built

up by more or less careful selection. The common standard can be maintained only by continuing the selection. It is but natural that the tendency in all plants should be to get back to the general average or even to revert to the primitive standard, which may be far below that established by the work that has been done in developing the plant type.

Environmental influences will inevitably induce changes in the plant. These changes may be termed "running out" in cases where the climate is uncongenial, or under more favorable conditions we may get a less amount of variation and breaking up of the type and these changes may not be such as to be considered deterioration. Such changes, if more or less radical, we call "sports" or mutations. The Red Peachblow was derived from the White Peachblow in this way and the White Early Ohio is a color sport of the Red Early Ohio.

These changes in type or color of potatoes have given rise among many growers to the idea that potatoes mix or hybridize in the field. In other words, that if two varieties of different color or form are planted side by side some of the tubers or plants of the next generation will be affected so as to resemble both of the associated varieties. We have previously stated that the potato, as we know it, is propagated asexually (by cuttings), hence, each year's crop is but a continuation of the preceding crop. This being true, it is botanically impossible for any crossing to take place except it be when potatoes are produced from true seeds. Even then it is doubtful if most potato seed obtainable is the result of the fertilization of the flowers of one variety by the pollen of the other variety.

The writer has had considerable experience in growing many distinct varieties, side by side, in experimental plots and, altho this work was carried on for a term of years, no evidence of any influence of one variety on another was ever detected. Our conclusions then are, that while we need have no fear of potatoes mixing so as to change their character or type, there is a great probability of securing radical changes which may be either better or worse because of our methods of selecting the seed stock with which to plant from year to year. It is also evident that under certain climatic conditions, while potatoes may be grown with profit, it is advisable to secure seed from other sources rather than to save it from the home grown stock.

VIII. CERTIFICATION OF SEED POTATOES

Nearly all of the great potato producing states have established some system of inspecting and certifying to the purity and freedom from disease of potatoes grown expressly for planting. The following rules and regulations concerning this work were drafted by a committee representing the states of Idaho, Washington, Oregon, Montana, Utah, California and Arizona. These rules are now being used in Idaho and will probably be adopted in the other western states mentioned with but few minor changes. This uniformity of system of potato seed certification will give greater stability to the seed potato growing industry and be an aid to both the grower and purchaser of seed potatoes.

STANDARDS FOR CERTIFICATION.

It is understood that potatoes for seed certification should first conform to the general standards governing U. S. No. 1 market stock. This is interpreted as being practically free from dirt or other foreign matter, frost injury, second growth, growth cracks, cuts, bruises, or other damages caused by diseases, insects or mechanical means, with no more than a three per cent variation by weight from any of the above details. It is also recommended that certified seed be marketed in new sacks or containers.

Size—Inasmuch as oversized tubers are wasteful and less desirable than properly grown, uniform, seed-size potatoes, the seed-size standard shall be from two to twelve ounces, with a variation tolerance of five per centum by weight.

Varietal Purity—Since mixed varieties of seed potatoes are a potent cause of economic loss in potato production and marketing, a rigid adherence to trueness to name must be maintained. Furthermore, since the practice of renaming old varieties or changing the names of named varieties thru ignorance, or with malicious intention to defraud, is detrimental to the potato industry, there has been adopted, as a standard on nomenclature and use, the "Group Classification and Varietal Descriptions of Some American Potatoes," by Prof. William Stuart of the United States Department of Agriculture.

Since off type, or run-out strains of any given variety, are essentially as detrimental to successful potato production as mixtures of varieties, no stock shall be certified or planted with the expectation of producing potatoes for certification that are not

uniformly typical in all characteristics for that particular variety in the district where it is grown.

PESTS AND DISEASES THAT DISQUALIFY.

No potatoes shall be certified that show by inspection on vine or tuber the presence of the diseases known as black wart **(Chrysophlyctis endobiotica Schilb)**, powdery scab **(Spongospora subterranea Wallr)**, and violet rhizoctonia **(Rhizoctonia crocorum)**, and the pests eelworm **(Heterodera radicicola** Greef. Mul) and potato tuber moth **(Phthorinaea operculella** Zeller).

LIMITATIONS OF OTHER INFECTIONS.

Scab—No potatoes shall be certified which show upon the tuber at final inspection more than five per cent scab **(Actinomyces scabies** Thaxt.), with no deep scab pustules permissible.

Rhizoctonia (Black scurf)—More than twelve per cent shall disqualify and no scurf spot larger than one-eighth inch in diameter shall be permitted.

Vascular Infection—Not to exceed five per cent of the tubers, as determined by transverse sections of stem end of tuber in the final tuber inspection shall be permitted. Vascular infection shall be interpreted as meaning wilt diseases as **Fusarium oxysnorum** (Schlecht), **Verticillium alboatrum** (Rein & Berk), **Bacillus phytophothorus** (Appel) et al.

Late Blight—Not to exceed two per cent of the tubers infected with late blight rot spots, and no spot to exceed one-half of an inch.

REGULATIONS GOVERNING VINE INSPECTIONS.

Inspection of potatoes is not only necessary after the crop is harvested but also during the growing season to determine trueness to type and variety, and freedom from disease. This shall be accomplished by an inspection of the potato plants in the field at blooming time, and again just prior to maturity of the plant.

Bloom Time Inspection.

Variety—More than five per cent varietal mixture at this inspection shall disqualify for certification. Furthermore, a variation in type of plants in excess of ten per cent, indicating degenerate or inferior strains of a variety, shall disqualify for certification.

Diseases—More than ten per cent of the plants at this inspection affected by the following diseases or more than five per cent

affected by any one of the following groups of diseases shall disqualify the field for certification:

1. Well defined curly dwarf, leaf-roll, mosaic, or other inherited weaknesses, combined.
2. Wilt diseases and blackleg combined.
3. Rhizoctonia (Black scurf).

Immediately following the bloom time inspection all diseased or objectionable plants must be rogued.

Second Plant Inspection.

At this inspection the tolerances governing certification shall be: Not to exceed five per cent of mosaic, curly dwarf, leaf-roll and other inherited weaknesses; not to exceed two per cent of diseased plants from any one of the following diseases—wilt, blackleg, and rhizoctonia—nor a total of four per cent of diseased plants from these three causes. Rogueing of the field must again follow the second plant inspection. If ten per cent or more of the vines show serious infection of late blight, the field shall be disqualified for certification. The uniformity and quality of the product as seed shall be determined at the second inspection, at which time not to exceed five per cent of the hills shall each weigh less than 30 per cent of the average of 100 consecutive hills.

Final Tuber Inspection.

This inspection shall be after harvest and after final grading for the seed market and shall conform to the conditions as hereinbefore specified.

CERTIFICATE OF INSPECTION.

The following form shall be used for certifying seed potatoes, which certificate shall be furnished the grower:

This certifies that the potato field and seed stock of.....
.....
(Name) (Post Office) (County)
.....have been inspected, and that said
(State)
seed stock meets with the prescribed standards relative to varietal purity, type and freedom from disease.

This certificate covers only the seed stock inspected, and is given upon the signing of a statement by the above applicant.....
....., that he has fulfilled all requirements made by the certifying authority and that he will carry out the full intent and purpose of this certificate.

.....
Certifying Officer.

.....
Agency.

The following statement of conditions pertains to the potato seed stock covered by this certificate of inspection grown by.....

.....

(Name) (Post Office) (County) (State)

1. Varieties and acreage.....
   Certified stock does not exceed.....
2. Results of last field inspection:
   (a) Varietal purity.....
   (b) Freedom from disease.....
3. Results of final tuber inspection:
   (a) Varietal purity.....
   (b) Freedom from disease.....
4. Market condition and quality.....
5. Yields and other statements.....

THE CERTIFICATION TAG.

There shall be attached to each bag or container of certified seed a certification tag, stating thereon that the package contains certified seed potatoes, also giving name and address of the grower, the variety of the potatoes and the year grown; however, if the seed potatoes are grown under contract, and to be sold by a party other than the grower, they shall meet the requirements as set forth herein and the certification tag shall be marked either with a lot number or the grower's name and the name of the party for whom the potatoes are grown.

On the reverse side of the certification tag the following "Standards of Eligibility to Certification" shall be shown:

1. Freedom from varietal mixtures, and conformity to the correct vine and tuber characteristics of the variety.
2. Weight of seed tubers from two to twelve ounces, with five per cent variation tolerance.
3. Freedom from wart, powdery scab, eelworm and larvae of tuber moth.
4. Freedom from serious infection of common scab, rhizoctonia, wilt, and other important tuber borne diseases.
5. The holder of a certificate is responsible for all undesirable conditions which may develop after the date of the final tuber inspection.

A certificate of seed potato inspection in conformity with the above standards has been issued by.....

.....

to the person whose name appears on the reverse side of this tag.

At the bottom of the certification tag the name of the inspection official, or of the certifying organization, should appear.

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