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Growing the Idaho Potato

Figure 1.—Seed potato test plots in the field where samples of the seed to be used for growing seed stocks are tested.

COOPERATIVE EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS OF THE STATE OF IDAHO UNIVERSITY OF IDAHO EXTENSION DIVISION AND UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

Horticulture Section

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This Bulletin Tells

Why Idaho acres grow more potatoes than 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 varieties of potatoes are best in this State.

How to select seed potatoes and how to cut them.

How to plant, cultivate, and irrigate.

How to harvest.

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

How to grow seed.

What really happens when potatoes "run out."

What to do with culls.

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

Growing the Idaho Potato

By

E. R. BENNETT*

Introduction

EVERY Idaho potato grower is interested in the future trend of potato production in Idaho. No other state has shown such a phenomenal rise in potato growing. The first record of acreage and production of potatoes in Idaho was in 1882. At that time 2,000 acres were grown, with a production of 250,000 bushels. At the beginning of the century, the acreage had climbed to only 10,000 acres, with a production of something over 1,000,000 bushels. Not until 1909 had the yield per acre gone above 150 bushels, with a total production of 4,500,000 bushels. Thus, for the first 25 years of potato growing in Idaho, the industry drew little attention in the markets of the country. During that time a large proportion of the crop was produced without irrigation or on newly broken, irrigated lands low in organic matter, which partly accounts for the low yields as compared with the present, although the yields from the beginning of the industry were consistently above those of the United States as a whole.

The Idaho potato crop became an important factor in the United States markets with the advent of the premium paid for the distinctive Idaho potato—the Netted Gem. Twenty years ago the acreage was 42,000, with a yield of something over 7,000,000

Acreage of potatoes in Idaho and acreage yields in bushels by 5-year periods from 1883 to 1938.
(Compiled from the Federal Crop Statistics)

Year	Acreage	Total Production (bushels)	Bushels per acre	5-year average (bushels)
1883	3,000	366,000	122	122.0
1888	5,000	505,000	101	113.8
1893	7,000	770,000	110	102.0
1898	8,000	1,032,000	129	112.0
1903	16,000	2,080,000	130	116.0
1908	26,000	3,536,000	136	136.4
1913	34,000	5,270,000	155	152.2
1918	42,000	7,350,000	175	161.0
1923	68,000	12,240,000	180	180.0
1928	104,000	19,136,000	184	193.0
1933	111,000	25,530,000	230	217.0
1938	115,000	28,750,000	250	222.0

Approximate home consumption .... 1,500,000 Bushels } 9.3%
Seed requirements .... 1,150,000 Bushels }
Excess of crop .... 25,950,000 Bushels, 43,250 Cars, or 90% of the crop to be marketed outside the State.

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bushels. From 1918, the rise in production and importance in the market has been such as no other state has experienced. The increase in yield per acre also has risen along with the increased acreage, rising from 175 in 1918 to 250 bushels in 1938, with a total production for the latter year of 28,000,000 bushels.

Botany of the Potato

The botany of the potato is of interest to the potato grower only as it helps him to understand its characteristics, habit of growth, its weaknesses and the methods by which it may be improved in production and quality.

The potato, *Solanum tuberosum L.,* is normally a perennial. If the tubers were not dug and did not freeze in the ground, the plants would continue growing from year to year as do the artichoke, horseradish, asparagus, etc. Under congenial conditions the potato, at least some varieties, may produce fruits which contain viable, true seed. On the other hand, many of our present varieties produce but few blooms and still more produce no fruits or fruits with little or no viable seed.

The normal reproduction of the potato is from the tubers which are the part of the plant that lives over winter. The tubers are, from the standpoint of the botanist, merely enlargements of an underground stem. A comparison of a cross-section of a tuber with one of the main stems of the plant will show that each consists of bark at the outside, an area of sapwood next to the bark called the cortical layer in the tuber, inside this another area known as the outer medullary layer that corresponds to the body wood of stems, and at the center the inner medullary area or pith.

If we consider the potato from this standpoint, it is obvious that the planting of potatoes is more nearly like the propagation of willows which are grown from cuttings of a twig or stem rather than from a true seed. This being true, we should expect that each succeeding generation would be normally the same as the preceding one. In other words, while there may be a change as a result of disease, we have not introduced any new or different characters as may be the case when plants are grown from true seed.

Structurally the tuber is made up of cells as are the other parts of the plant. From 20 to 25 per cent of the weight of the tuber is dry matter composed of cellulose, starch, proteins, etc., and the remaining 75 or 80 per cent is water. The higher the percentage of dry matter, the better the quality of the potato is, so far as amount of food is concerned. The quality of the potato, from the standpoint of starch content, also is indicated by the ratio of the cortical and outer medullary layers to the pith tissues, as these parts contain a higher percentage of starch than the pith at the center. The latter is prone to break down in some varieties, particularly in overgrown tubers, or during wet seasons, resulting in hollow tubers.

Eating quality in the potato is another matter. Varieties of potatoes differ in flavor and texture as do apples and other fruits. Conditions under which potatoes are grown also influence eating quality. *In fact, in these matters of varietal quality and influence* *of soils and climate on eating quality rests the explanation of the superiority of the Idaho potato over those produced in many other districts.*

These general principles should be of more than passing interest to the commercial potato grower, as well as to the man who grows seed stocks, as the character of potatoes grown has much to do with the probabilities of success or failure of the crop from the standpoint of financial return.

Another botanical characteristic of the potato of interest to the potato grower is its way of setting tubers on the plant. The tuber is not a modified root, as is the sweet potato nor does it originate from a root. Before or about the time the potato plant normally blooms, underground stems grow from the main stem of the plant. The habit of growth of these stems varies considerably with the different varieties. These underground stems of necessity originate above the set or cut from which the plant grew. Most standard varieties send out short stems in a more or less horizontal direction that locate the new tubers at about the same depth as the seed that was planted.

The tuber is simply an enlargement at the apex of this underground stem. Under abnormal conditions, as where rhizoctonia attacks the plant stem below the surface of the ground, the tubers may be produced above ground at the axils of the leaves. From the standpoint of biology, or what we might designate as plant economy, the tuber is the vital part of the plant that receives the plant food developed by the plant during the growing season and that is stored in the tuber to continue the next generation.

With most standard varieties, the depth beneath the surface that tubers form is determined by the depth of planting. This, then, has a bearing on cultural practice in that the grower, knowing the habit of tuberization of the variety he is planting, can determine the most desirable depth at which to plant.

Potato Production

Soils and Climate

The so-called Irish potato is grown more or less in every part of the United States. However, its yield and quality are influenced profoundly by both the type of soil and the climate. In Idaho it is grown in all the various types of soils that are sufficiently porous to take water without becoming puddled. That soil is best which will remain most loose and friable throughout the growing season. The sandy loam soils probably best meet these requirements. The subsoil is also an important factor in determining potato lands in that good drainage is essential to maintain the desired degree of soil moisture.

The potato responds to a high content of plant nutrients in the soil. Increased yields are secured by the use of manure, other organic matter, or chemical fertilizers and crops following potatoes also are increased materially by the residual effect of these fertilizers on the potato ground. It generally is conceded that a neutral soil or one slightly acid is favorable to the potato; yet the most productive potato soils in Idaho are inclined toward the alkaline.

In general the soil type is of less importance than the physical condition in the way of humus content and general tilth. These factors are, or may be, controlled largely by the grower through the crop rotation practiced and by use of both green and barnyard manures.

Climatic conditions very largely determine the adaptability of a given district as a potato growing locality. The potato delights in a cool climate, particularly as to night temperatures. While it is native to the tropic countries, it is found there at an elevation that insures low temperatures at least a part of each day.

While the potato will not withstand actual freezing, night temperatures close to the freezing point are not injurious to the plants during the latter part of the growing season. Frosts that occur during the warm season are likely to cause serious damage to the plants.

Mean temperatures in Idaho vary from those of the lower altitudes that are too hot during mid-season to be most congenial, to those in the short season districts that are subject to frosts at all times although no part of the State where other crops are grown is too high in altitude to grow the potato more or less successfully.

Precipitation and percentage of humidity are factors that also profoundly influence potato growth and possibly the quality of the tubers. High humidity is conducive to the development of fungi—such as early and late blight—that affect the foliage of the plants. In the timbered districts of Idaho the humidity is higher than in the arid areas but sufficiently low during the growing season that these leaf fungus diseases are not a factor in potato growing. It is also possible that low humidity, accompanied by a high percentage of cloudless days, accounts for the phenomenal growth of the potato in the State.

Acres of Potatoes Per Farm, and Rotations

Economic potato growing in Idaho necessitates the use of efficient machinery. This machinery includes not only such tools as plows, harrows, discs, etc., that are the regular equipment of every general crop farm, but also planters, special cultivators, irrigation ditchers, diggers, and, in some cases, power driven sorters. These are all more or less expensive machines, so that their use is justified only where a crop unit of 10 or more acres is grown. In addition to this equipment, some provision must be made for storage space if the potato growing project is to be stable. In most cases this is cared for by either a storage cellar on the farm or an interest in a cooperative storage located at the most convenient shipping point. In some of the more important potato growing districts, potato storage can be rented in commercial storage cellars.

Because of this essential overhead, growers have found it unprofitable to produce potatoes on a small scale as is common in the unirrigated districts. Consequently, the great bulk of the Idaho potato crop comes from the larger unit farms and the acreage per farm usually is that percentage of the total area of adaptable land on the farm that is determined by the most efficient rotation of crops. While this rotation varies with the locality and the trend of crop production of the given district, it fundamentally consists of alfalfa 2 or 3 years, potatoes 1 or 2 years, or potatoes 1 year, sugar beets, 1 year, and grain 1 year, at which time the land is seeded back to alfalfa. In other words, the potato can occupy the land 1 or 2 years out of 5 or 6 years.

Where red or sweet clover is grown in place of alfalfa, the rotation may be shorter. The one most commonly found is clover 2 years, potatoes 1 year, grain 1 year. This allows for the utilization of 25 per cent of the land for potatoes in place of 18 or 20 per cent as for alfalfa. In districts where the wireworm is prevalent, the use of clover in the rotation may be of doubtful expediency because of the greater danger of wireworm injury to the potatoes that follow clover.

For various reasons, the potato as a truck crop has not been a factor in potato production in Idaho. This is partly the result of the need of special machinery, as previously mentioned, and also because of potato disease trouble (especially scab) which results from truck type of farming. Truck crop potato growing is limited largely to the early varieties of potatoes usually grown for local markets. These local markets are not of sufficient importance to make this phase of potato production any considerable factor in the industry.

Preparation of Land for Potato Growing

Leveling

Preparation of the land for potato growing includes a number of details. Possibly the one that can be considered most important for lands that are to be irrigated is leveling. Unless land is leveled in such a way that water can be applied uniformly to the whole area planted, desirable results in the way of yields and type of tubers cannot be secured. Rough or uneven lands result in some parts of the field being flooded, while other areas are watered insufficiently. Another common source of loss of crop results from a lack of drainage at the lower end of the rows so that the water backs up to a greater or lesser extent. Such land is a total loss so far as potato production is concerned as flooding is fatal to the potato plant. This is not only a matter of original preparation of land for potato growing, but there is a continuous tendency for soils to wash in at the lower end of the rows that prevents free escape of surplus irrigation water.

For land that is not to be irrigated, leveling is unimportant other than as a matter of convenience in other cultural practices.

New Land

Preparation of land for potato growing includes cultural practices that affect the land both as to its physical texture and available fertility. Newly broken soils, particularly in the arid districts of Idaho, are deficient in organic matter and available nitrogen to the extent that growth of potatoes is limited as compared with the same soils after alfalfa or other legume crops have been grown on them and turned under or where generous applications of stable manure are used. For this reason, new lands are seeded to some form of legume crop, usually alfalfa, before potato growing can be expected to assume commercial proportions.

In this condition of lack of organic matter in the soil, possibly more than in any other, the arid lands differ from those of the humid districts of the country. It is safe to say that the breakdown of organic matter in the soil is more rapid under southern Idaho conditions; hence, the need for organic-matter-producing crops at shorter intervals of time is even greater here, particularly on the lighter soil areas, than in the humid communities.

Plowing

Good potato culture presupposes that the grower has some type of legume crop as alfalfa, clover, sweet clover, etc., to break up for planting to potatoes. For the shallow rooted legumes as cover, etc., the best results usually are obtained when the plowing is done sufficiently late in spring that a heavy growth of green manure is turned under. In the arid districts this heavy growth of cover crop is likely to have depleted the soil moisture by the time the cover crop is turned under. In this case the plowing should be preceded by a liberal application of water as the necessary moisture is better applied then than after plowing. Whether the planting is done immediately after plowing or later, the plowing should be followed closely by the disk to fill up the air pockets that are caused by the plowing and to conserve the moisture that is needed to start the growing of the potatoes.

Whether or not to plant immediately after plowing under a heavy cover of green manure depends largely on the texture of the soil and amount of moisture. With plenty of moisture and deep plowing (not less than 8 inches) planting is best done soon after plowing and before there is an appreciable loss of moisture. Poor stands that occasionally follow immediate planting after plowing usually are due to a failure to get the green material plowed deeply enough in the soil or to a failure to conserve the moisture supplied by the previous irrigation.

In districts of light soils irrigation following plowing and previous to planting sometimes is expedient to replace soil moisture which is lost more rapidly from the lighter type of soils. In any case planting in any soil lacking sufficient moisture is inviting trouble in the way of a poor stand of plants.

After the land is plowed, the thorough fitting of the soil before planting is essential for securing a fine, deep seed bed. Cloddy land is not likely to produce good type potatoes. It may be worthwhile to correct any unevenness in the land surfaces as this can be done better at this time than previous to plowing. Disking and harrowing before planting tend toward economy in that this reduces the necessity for excessive cultivation after the plants are up.

Alfalfa lands are treated the same way where the season is sufficiently long for the alfalfa to make knee-high growth before plowing. When heavy growth is made before plowing, little trouble from subsequent alfalfa growth results. If such growth cannot be secured before plowing, the better system is to plow first just sufficiently deep to cut the alfalfa root close below the crown. In many cases this alfalfa crown plowing is done late in fall. In either case, the land should be harrowed following the plowing to drag the crowns out of the soil where they will dry out and die. With either early spring or fall crowning, the land is plowed necessarily a second time. This plowing puts the dead crowns into the bottom of the furrow where they function both as fertilizer material and as a means of maintaining the desired texture of the soil.

In some districts where soils are not inclined to pack badly over winter, the practice of plowing under the last cutting of alfalfa instead of harvesting for hay has been found to be profitable. In this case the land is left rough over winter and disked and prepared in spring without replowing.

Deep plowing (8 to 10 inches) is more essential for the potato than for the most farm crops. The potato is best when grown in deep, loose, mellow soil; this condition is secured (at least temporarily) by deep plowing just previous to planting. It should be needless to

Figure 2.—Deep plowing (8 to 10 inches) is essential in preparing land for potatoes.

say that harrowing the land as fast as it is plowed each half day is a desirable practice, both in the way of avoiding the formation of clods and of preventing the loss of moisture.

One of the most common causes of poor stands of potatoes is that of planting in soil that is insufficiently supplied with moisture. While the necessary moisture can be supplied after the plowing, it is better if moisture previously supplied can be retained until the plants are well established.

Use of Fertilizers

If barnyard manure is applied to the potato land, it should be well distributed and preferably disked in previous to plowing.

Double plowing results in the manure being even better incorporated with the soil. Where this system is followed, but little danger from scab injury may be expected from the use of manure.

Up to the present, the commercial fertilizer problem has been given comparatively little consideration. Idaho soils are relatively high in most mineral elements with the exception of nitrogen. This latter element usually is supplied through a system of rotation with nitrogen gathering plants that largely furnish the necessary nitrogen, as well as the organic matter which is a necessary part of all good soils. During recent years there have been indications that many soils of the potato-growing areas are somewhat deficient in available phosphorus, as well as nitrogen. This has been demonstrated conclusively in many cases where available phosphate fertilizer has been applied. The same is true of nitrogen, which applied in the form of ammonium sulphate has resulted in definite increases in yields of potatoes. However, excessive nitrogen without being balanced with phosphorus has reduced yields. At the Aberdeen Branch Experiment Station tests have shown that available phosphorus applied to alfalfa a year or two previous to breaking for potatoes gave a favorable response by increasing the yield of potatoes as well as improving their type.

In some cases applications of 100 pounds of treble super phosphate per acre at planting time have resulted in increased yields as well as a higher percentage of No. 1 stock. In this case the fertilizer was applied in bands on either side of the row at about 2 inches from the seed and a little below the seed.

Responses to fertilizers have been variable, some soils responding favorably and others giving no results. All experiments so far in the potato-growing areas have given no response from the addition of potash, which indicates that this element is present in most Idaho soils in sufficient quantities.

Varieties of Potatoes in Idaho

The varieties of potatoes grown in Idaho include the Netted Gem (synonyms, Russet, Idaho Russet, Russet Burbank), the Idaho Rural (Charles Downing), Bliss Triumph, Irish Cobbler, Early Ohio, Katahdin, and occasionally other varieties that are standard in other parts of the country.

During the earlier years of potato growing in the State, many miscellaneous varieties of potatoes were grown. In 1916 the dominant variety of the irrigated districts was the so-called Idaho Rural (Charles Downing), with the Netted Gem (Russet) occupying a minor place. In the northern part of the State a variety called the North Idaho Rural was dominant, with a multiplicity of eastern varieties also in common use. This lack of standardization of varieties in that district caused marketing troubles that made the industry generally unsatisfactory. The North Idaho Rural was a good quality potato, but susceptible to attacks of virus troubles to an extent that caused it to be abandoned.

The true Idaho Rural was not adapted to conditions in the northern part of the State and was also difficult to keep disease-free; but it lost its popularity in the commercial growing districts largely because of a discrimination in price as compared with the Netted Gem, which commanded a premium of from 20 to 40 cents above the white varieties on the eastern markets.

At that time (the early '20's) growers were having difficulty in growing Netted Gems of desirable type, owing to the tendency of the tubers to become pointed, knobby, and off type in other ways. This variety is particularly sensitive to growing conditions in the way of excessive heat and lack of uniform soil moisture conditions. Later planting and more careful watering largely have overcome this difficulty in Idaho. This trend toward growing the more popular variety has continued until at present the Gem dominates the field to the extent that in the neighborhood of 90 per cent of all the potatoes grown in the State are of this variety. In fact, the enviable reputation of Idaho potatoes is based largely on the Netted Gem.

The Netted Gem is so exacting as to growing conditions that but few districts outside the arid sections of the mountain and northwest states can produce this potato successfully. An advantage enjoyed by this variety is that it is sufficiently distinctive in appearance that no other variety can successfully masquerade as the Netted Gem.

This variety is not well adapted to withstand the variable growing conditions of much of the timbered area of the northern part of Idaho, so that there is a field for some other good quality, main crop variety for those districts.

The Bliss Triumph still dominates the field as an early maturing potato, with Irish Cobbler being grown to a lesser extent.

Seed Potatoes

Good soil, proper cultural practices, and other desirable factors are of no avail unless seed stocks that are at least reasonably free from diseases are used for planting.

Just what constitutes good seed potatoes is a matter on which there is some difference of opinion. In comparing various lots of seed stocks of the same variety planted side by side, we find differences in size of plants, time of maturity, and frequently differences in yield, even though the plants show but little, if any, definite disease symptoms. The causes of these differences sometimes are difficult to determine. They may be variously attributed to adverse growing conditions the previous year, bad storage, etc., but the most probable cause is that of disease of some kind that may not be discernable in either the plants or tubers. We may well define good seed potatoes as those that are well grown, properly stored, and that are as free from all disease as can be obtained.

Experiments indicate that size of potatoes used for seed has little to do with their value as seed. Undersized tubers (less than 1 ounce) may not have sufficient plant food to induce vigorous growth, and large tubers that are cut have a higher percentage of cut surface—hence are more subject to deterioration from drying, disease attacks, etc., than the smaller tubers.

Providing they are from healthy plants and small because of late planting or lack of sufficient soil moisture, single drops—small whole potatoes—are preferred by many successful potato growers. Many growers also prefer immature potatoes for planting as these seem to grow more readily than well matured seed.

Storage conditions may very materially influence the quality of seed stocks. A too low temperature may devitalize seed stocks, and heating the stocks in storage is even more detrimental. A uniform temperature of around 40° F. is considered the most desirable for both seed and commercial stocks. Excessive sprouting of the seed stocks before planting necessarily reduces their vitality. Where it is necessary to hold seed stocks until hot weather before planting, the stocks should be kept in cold storage from early spring until about 10 days before planting, when they should be placed where they can warm up gradually so that growth activity starts before the potatoes are planted. When seed potatoes have sprouted to any extent previous to planting the sprouts should be removed about 10 days before planting. It takes about that time after sprouts are removed for new growth to start; hence, potatoes sprouted and planted immediately may lie more or less dormant in the ground for some time before starting to grow, and, in the meantime, the sets may rot. The same condition is likely to prevail when seed potatoes are treated with corrosive sublimate or hot formaldehyde just previous to planting.

Cutting Seed Potatoes

Experiments repeated many times with size and character of seed potato cuttings have shown that: (1) Normally, the number of stems produced and the vigor of the plant are determined largely by the size of the cutting used. This is true particularly of the Netted Gem which has an abundance of eyes, all of which are capable of producing more than one sprout if growing conditions are favorable. To state the fact in another way, only as many eyes produce sprouts as the plant food in the cutting can support until roots develop that can secure sustenance for the plant from the soil. Thus, the apical end of the Netted Gem has many buds but normally only one, two, or three develop into stems. (2) Other things being equal, the number of tubers set per plant is determined by the number of stems. In other words, the greater the number of stems, the greater the number of potatoes that are set on the plant. However, other factors enter into the problem as fungus diseases and insect damage to the tuber stems. Too few tubers per plant usually mean oversized, misshapen tubers, while a multiplicity of tubers per plant means small tubers, or at least a higher percentage of small potatoes than those of normal size.

Experiments show that the happy medium or the size that will produce the greatest tonnage of desirable size, good-type potatoes is the 2-ounce cut. While it is necessary to have at least one bud on the cut, it is not necessary to have equal numbers of buds per cut. In practice, the best method of cutting seed potatoes is to make the cuts of uniform size with as little cut surface as possible.

Where many acres are to be planted, much time and effort can be saved by the simple expedient of inserting a knife in a board in such a way that the potato to be cut can be pushed or pulled across the knife, thus making is possible to use both hands in the operation. Many modifications of this principle are used in the way of attaching knives to a hopper in such a way that the potatoes in the hopper feed down to the hand of the operator, and, when cut, fall into a receptacle below the knife.

As a general statement, a satisfactory system is to plant the potatoes as soon as cut.* A fairly common practice is to dust the freshly cut potatoes with some substance as air-slaked lime, sulphur, or road dust. So far as experimental evidence goes, each is of equal value as nothing seems to be accomplished other than to dry the cut surface and make the pieces handle better.

The so-called instantaneous dips of mercury compounds now are being used on freshly cut seed which apparently tend to prevent, at least to a certain extent, the rotting of the seed pieces, as well as prevent the spread of some of the fungus and bacterial rots.

Planting the Potato

The time of planting depends on whether or not the crop is intended for the early or late market. Early potatoes should be planted as early in spring as the soil can be prepared. If the temperature following the planting is too low to start growth of the sets, no harm usually results unless the sets freeze in the ground. The young plants occasionally are frosted off as a result of early planting, but in most cases this does not result in damage other than retarding the development of the crop. Better stands are more easily obtained from early than from late planting.

Early varieties planted early mature by midsummer. The Netted Gem requires a greater number of growing days from planting to maturity. The early varieties usually make sufficient growth before the excessive heat of mid-summer, so that the yield and type of potatoes are not affected seriously by the unfavorable growing conditions caused by the high temperature. The Gem is more susceptible to all unfavorable growing conditions; hence early planted Gems are more likely to develop misshapen potatoes than are most other varieties. The advantage of early planting—if there is any—lies in the hope of getting the stock on the market before the main crop is grown and in the earlier districts in getting the crop off in time for a late summer crop. The disadvantages are the uncertainty of market prices at that time and the difficulty in harvesting during hot weather without damage to the stock in the way of net necrosis as a result of excessive heat.

The main crop potato is planted in Idaho from early May until late June or early July. This is due largely to a difference in the altitude of the different districts. In the higher altitudes the object of early planting is to get the crop matured sufficiently for harvest before danger of frost injury to the potatoes.

* See MIMEO-LEAFLET NO. 70 *How to Obtain Better Stands of Potatoes in Idaho*, by James E. Kraus.

There are several factors involved in this problem of time of planting. The earlier planting is likely to make the greater yield, but generally at the expense of type of tubers. The best type stock is produced when the planting is done at such a time that most tuber growth occurs when the temperature is low, that is, after the high temperature period is past.

The earlier planted fields of main crop potatoes start forming tubers before the extreme heat of July and August is past. If sufficiently advanced during the high temperature period, tuber growth is likely to be checked, which results in a high percentage of misshapen stock. The later planting largely avoids this trouble but, in this case, the yield may be reduced by an early frost killing the tops, or, in case of delayed frosts, the crop may not be ripened until bad weather prevails or unseasonal cold freezes the potatoes in the ground.

For later planting greater care is needed to make sure that cut seed is planted in moist soil or poor stands are likely to result. In fact, it is more difficult to secure a high percentage of stand of plants from late planting when the soil is hot than earlier in the season. The matter of high per cent stand is improved greatly by the use for seed of uncut tubers which are less likely to rot in the ground.

Another factor that should be considered with late planting is that of size of seed piece. Large pieces or whole potatoes have more vigor in starting than do small cuts; hence large pieces are advantageous when the planting is delayed until the later dates.

Depth of Planting

The most desirable depth to plant depends somewhat on soils and soil conditions. For land that is to be irrigated, 2 to 3 inches below the level surface is sufficient, providing there is moisture close to the surface. For unirrigated fields where level culture is to be practiced, the planting depth should be 5 inches. Nearly all varieties of potatoes form most of their tubers no deeper than the seed was planted; hence, where shallow planting is practiced, there is but little soil where the new tubers are forming except on irrigated land where the ditching forms a ridge. Few machine planters put the seed as deeply in the ground as they are supposed to and in many cases lack of depth of planting is a cause of reduced yields. This lack of depth of planting, in most cases, is the result of lack of power or insufficient depth of soil preparation. In either case the results are the same in that there is not sufficient soil above the seed to insure moisture around the growing seed or to protect the tubers produced from undue exposure to sunburn, frost, etc.

Distances in Planting

The distance between rows is determined largely by the convenient use of the various machines used in the work. In general, the early crop needs less space than the main crop. Where soil moisture is a factor, rows are planted farther apart than for irrigated potatoes. Distances vary from 28 inches between rows for early potatoes to 36 or 38 inches for irrigated land and to 4 feet on un-irrigated land. The distance in the row also varies both with the variety and the fertility of the soil. Early potatoes usually are planted closer in the row than the main crop, but the fertility of the soil or availability of moisture more commonly are determining factors in the distance of plants in the row.

Distance between plants in the row for early potatoes varies from 8 to 12 inches, while late potatoes are planted from 9 inches to 15 inches for irrigated land and 15 to 24 inches or more on lands that have a limited moisture supply.

Size of seed cuts also is a factor in distance between plants in the row. Small sets (1-ounce or less) need less space than do larger sets. The larger cuts planted at greater distance should give better results since the larger pieces produce stronger plants.

Planters

Most Idaho potato crops are planted with machine planters. The advantage of the machine, other than speed and economy, is that by its use the seed is, or should be, deposited in moist soil and covered with moist soil.

Many makes of planters are used. These are divided into two general types; i.e., those that feed by pickers that stab the potato and carry it to the planting tube, and the type that conveys the pieces without stabbing them. Most of the latter type require a man on the back of the planter to check the planting by taking out the surplus if more than one piece is brought up by the conveyer or fill in if none appears. This type adds somewhat to the cost of planting but insures practically a 100 per cent job. Most planters need some adjustment to fit Idaho conditions where, for the most part, soils are heavier than those of districts where the planters are made. The most common defect is that of inability to get the seed planted as deeply as is desired. Trouble also is encountered frequently in getting the planters to handle as large sets as is desirable. These troubles usually can be remedied by the operator by making a more effective furrow opener and enlarging the throat of the delivery tube.

Cultivation of the Potato

No definite rule can be given that will cover the subject of cultivation. The objectives to be attained by cultivation are to prevent weed growth, keep the soil loose and mellow during the early part of the season, and, where irrigation is to be practiced, to ridge the rows to form the irrigation furrow.

Harrowing with a spike-toothed harrow after planting will aid materially in keeping weeds from gaining a foothold. However, harrowing results in more or less packing the soil; hence, it may be necessary to cultivate rather deeply to offset this condition. In this case, or for heavy type soils, deep cultivation close to the rows may be advisable if the work can be done before the roots have extended far enough from the plants to be cut by the cultivator. Harrowing can be continued after the plants have reached considerable height if the work is done during the heat of the day when the plants are more or less limp and wilted, rather than in the morning when the plants are turgid and easily broken.

So-called blind cultivation is practiced by many successful growers. This means cultivating before the plants have emerged from the ground and must be done before any harrowing is done that would obliterate the ridge left by the planter. This cultivation always should be followed immediately by the harrow to break the clods and re-establish a soil mulch.

If the crop is not to be irrigated, it is better to leave the land level, unless it is found desirable to ridge the rows slightly the latter part of the season to aid digging and prevent frost injury and sunburn of the potatoes. For fields that are to be irrigated, each cultivation should increase the height of the row ridge and deepen the inter-space between the rows.

After the plants have attained a height of approximately 1 foot, deep cultivation is likely to do more harm than good. In fact, late cultivation of either unirrigated or irrigated potatoes is more likely to lower the yield than to increase it because of root pruning, as the potato plants fill the soil with roots from near the surface to 2 or more feet deep. Inasmuch as water frequently needs to be applied while the plants are yet small, ditching closely follows the cultivator. This is done sufficiently early to avoid excessive root pruning. When this is done early in the growth of the plants, it avoids root pruning and tends to cause roots to grow deeper in the soil than they otherwise would.

Preparation for Irrigation

The depth and type of ditch that is best for irrigation depend primarily on the contour of the land and also the character of the soil. Steep slopes need ditches only sufficiently deep to carry the water without flooding the rows. On the other hand, lands with but little slope need deep ditches and of sufficient width to carry a large head of water.

Irrigation furrows usually are made with some type of double moldboard plow or with ditching attachments that replace the shovels of the cultivator. If the irrigating is commenced while the plants are yet small, it may be desirable to re-ditch the field as soon after an irrigation as the land is sufficiently dry to work. This prevents the soil from packing and kills weeds that are likely to start as a result of the water application.

How and When to Irrigate

Theoretically, irrigation is a simple process. In its simplest terms, it merely is supplying artificially the water that is needed to keep plants in the best growing condition. In practice it is largely a matter of good judgment on the part of the irrigator as to when and how much water to apply.

Possibly the inefficient use of water is a more common cause of poor yield and quality than any other of the details of cultural practices. A too liberal supply tends to compact the soil, shuts out the air, and will stop growth as effectively as lack of water. The tendency with many growers is to water heavily, then wait until the plants indicate need for water before another application is given. This practice results in uneven growth of the plants and particularly is harmful during the tuber forming season. Some varieties of potatoes withstand this condition with little effect other than a probable loss in yield. Uneven growing conditions, from any cause, will induce irregular growth with the Netted Gem in the way of pointed ends, dumbbell type, and second growth protuberances.

Until the idea was proved wrong by careful experiments, many growers believed that water should be withheld from the plants until they had reached a certain stage of growth. It now is proved that a better practice is to apply water sufficiently early to prevent

Figure 3.—The ideal moisture condition for the potato is to have the soil under the plants moist at all times without wetting the ridge at the base of the plants. This is best attained by frequent, light irrigations, rather than heavy applications at long intervals of time.

any retardation of growth of the plants. In fact, the best results are obtained both in yield and type of tubers where the plants have sufficient moisture to maintain a continuous and uniform growth from the start until they ripen naturally or are killed by frost.

No dates can be set for applying water or for intervals of time between applications. Each field is a problem of irrigation in itself and this will vary with the season of the year and weather conditions. As a general statement, we may say the steeper the slope, the smaller the irrigation stream, the longer the time of application, and the less time between applications. In other words, steep slopes erode easily, take water slowly, and dry out quickly.

Slightly sloping or flat land requires a large head of water to get it through the furrow before the upper end becomes too wet. In practice many fields of this type should have cross ditches cut so as to make shorter runs. Failure to do this causes much loss in our potato fields each year because so much water is applied it saturates the soil, causing the ground to pack, which not only tends to retard growth until the excess water is drained away, but produces misshapen potatoes.

Intervals of time between irrigations vary from 4 or 5 days to possibly 10 days or two weeks. Less water applied at each irrigation with shorter intervals between applications would do much in the way of increasing the yield per acre and very materially improve the type of Idaho irrigated potatoes.

In applying irrigation water to potatoes, the best results are obtained if the water can be kept sufficiently low in the irrigation furrow so that the top of the ridge will remain dry. The water in the furrow tends to go down, but at the same time spreads laterally. As the soil becomes saturated, the water fans out until it meets that from the next irrigation furrow under the potato row. When this point is reached, the water will rise; and if the flow continues sufficiently long, all the soil to the top of the ridge will become wet. This results in driving all of the air out of the soil which causes a compaction of the soil when the excess water drains away. Good irrigation of potatoes, then, means cutting off the water short of this saturated condition.

The best method of determining when sufficient water has been applied is to use the shovel to find if the water has reached the desired point *under* the potato row. In fact, the shovel is the best instrument with which to determine whether or not irrigation is needed. Occasionally growers maintain that they can determine by the color of the plants whether or not water is needed. This is true except that it is a few days too late, as a change in color of the plants indicates that they already are affected by lack of water.

Whether or not to irrigate potatoes late or when to make the last irrigation is largely a matter of judgment. If the season is late and there is litttle prospect of wet weather, it may be necessary to apply water one or more times during September. On the other hand, there is a possibility that this watering may do more harm than good. The best quality potatoes are produced when the crop ripens normally in a fairly dry soil. Too much moisture tends to produce soggy tubers. In this case, the skin of the tubers is likely to be made unsightly from the enlargement of the lenticels or pores of the skin which show as white flecks. Again, late watering, particularly if followed by much rain, makes harvesting difficult and, of course, earth adheres to the tubers more than where the soil is only slightly moist.

In considering this subject, we should take into account the fact that the tuberization of the potato is largely a matter of transferring the food material already produced from the part of the plant above ground to the tuber, which is the part of the plant that lives over to the next season. This being true, but little, if any, actual growth of the foliage needs to take place in the forming of the potato crop and during this process less water is needed than during the warmer weather. In fact, unirrigated fields that have stopped growth because of lack of water during the hot season resume growth without rain when the temperature becomes lower in September. For these reasons, many successful potato growers reduce the amount of water used during the latter part of the season.

Harvesting and Handling the Crop

One of the weak spots in the potato industry is lack of care in harvesting and handling the crop. No data are available in Idaho from which we can determine the loss sustained from cuts, bruises, etc., incident to harvesting and handling the Idaho potato crop. Investigations in other states have determined that more than 18 per cent of tubers were injured by the digger.

Figure 4.—Possibility of bad weather makes it essential to harvest the main crop as rapidly as possible after the crop is sufficiently mature to dig without injuring the potatoes.

Digging machines are designed to operate under adverse conditions. With wet, sticky land it is necessary to have eccentric agitators to separate the earth from the potatoes as they are being elevated over the digger chain. This process skins and bruises the potatoes, and such agitators should be removed when their use is unnecessary. Rubber covered chain links now are being used to some extent. Their use cuts down the percentage of injury quite materially. The more modern diggers are being built with lower angle elevation, which reduces the tendency of the potatoes to roll back while being carried over the digger.

Growers are becoming more conscious of potato injury and greater efforts are being made to avoid injury to the stock in harvesting. Rubber dipped or burlap lined baskets are being used to some extent in gathering the crop, and, in general, greater care is being exercised in hauling the potatoes to the storage. The practice of pouring the potatoes through chutes in the roof of the storage is not so common as in years past and, where practiced, some system of preventing the stock from falling to the bottom of the cellar, such as canvas conveyers, is coming into use.

Cutting and bruising of potatoes in harvesting may not be of much consequence when the stock goes immediately to the market. On the contrary, stored stock is likely to suffer severe loss from dry rot where the skin is in any way broken in getting the stock from the field to the cellar.

Harvesting is always an expensive item and, particularly with the main crop, seasonal conditions make it imperative that the work be done in as little time as possible. However, if special care is not exercised in the way of avoiding injury to the stock, the percentage of loss may go a long way toward absorbing any profit there might be in the project.

Mature stock is less easily injured in harvesting and handling than immature stock, and long potatoes are less injured in digging than round ones. However, with late potatoes, the grower frequently is compelled to choose between harvesting immature stock or taking the risk of frost injury before the stock is dug.

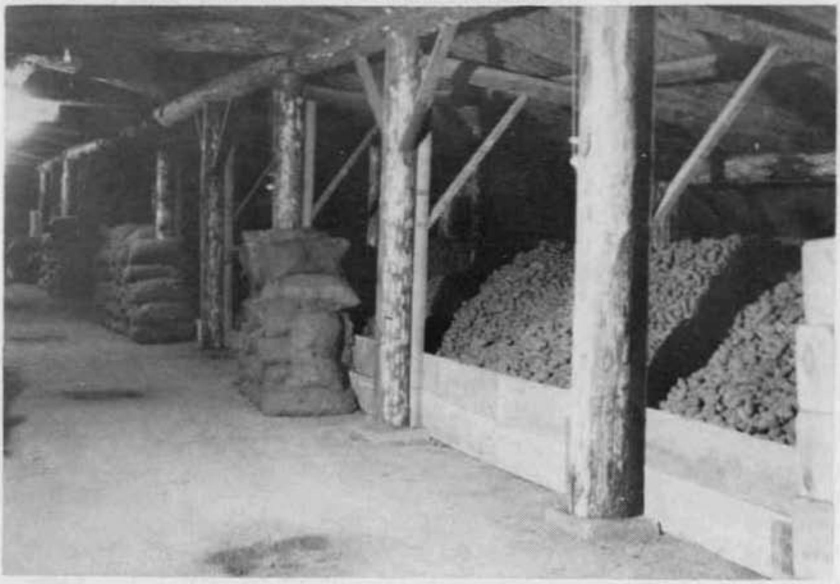

Figure 5.—An inexpensive but efficient storage that is particularly adaptable to arid climate districts.

Storage of Potatoes

It is obvious that the whole potato crop of the country cannot be marketed at time of harvest. Each grower has the question to settle each year as to whether he will sell from the field or store his crop and put it on the market during the winter or spring. It hardly is possible for any grower, except one who grows only early potatoes, to get all of his crop sold 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.

The larger part of each year's crop of potatoes must be held in storage from 1 to 6 months before being put on the market. So far as quality of stored potatoes is concerned, that storage is best which most nearly approaches the natural condition of the potato over winter—that of being left in the ground where it grew. Inasmuch as the potato will not endure freezing, some place must be provided where the main crop can be kept until it can be marketed.

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: the cost of handling is increased; the crop cannot be reached when the weather is cold; and, the grower never can know whether the potatoes will be too warm to keep during the winter or will freeze.

Efficient storages differ with the character of the climate. In the humid districts any frost-proof warehouse is more or less satisfactory. Such storage in the arid districts is open to the objection that excessive loss of water by evaporation leaves the stock badly shriveled and less attractive the longer it is in storage.

The Western Underground Cellar or 'Dugout'

The need for humidity and temperature control has given rise to the western-type storage or dugout. This, in its simplest form, consists of an excavation in the ground covered with poles, straw, and earth. The advantage of this type of storage is that the humidity is relatively high and uniform, the storage is easily made frost-proof, and the cost of construction is less than the above-ground storage.

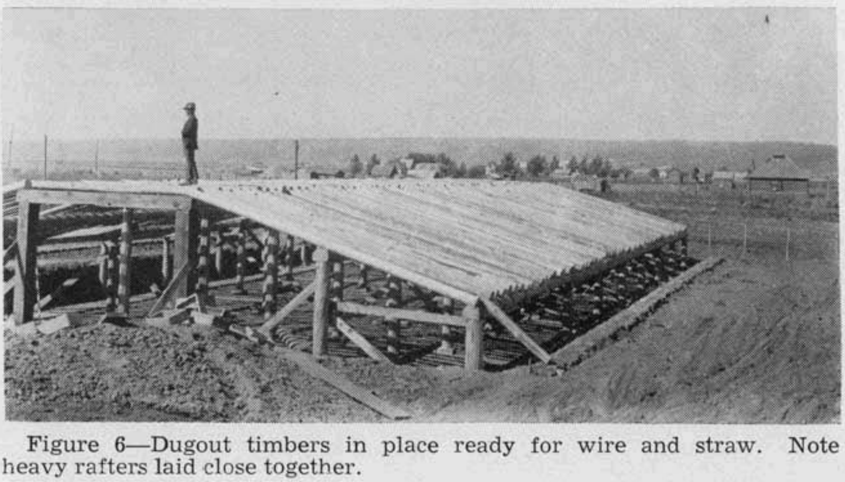

Figure 6—Dugout timbers in place ready for wire and straw. Note heavy rafters laid close together.

In detail there is much difference of opinion as to the need of ventilation, etc. Well-constructed storages frequently are filled to capacity from the date of digging until late spring with no detrimental effects on the stock. However, it must be borne in mind that potatoes, like all other living organisms, generate some heat and that the center of the bins will be several degrees warmer than the top or sides.

The most desirable temperature for stored potatoes is around 40° F., although the potatoes actually will not freeze until the temperature drops to 28° or 29° F.

One fact of vital importance in storage of potato stocks which frequently is overlooked, particularly in retail stores and in the home, is that potatoes are injured by exposure to light. The skin of the potato naturally contains a certain amount of bitter material. Exposure to light increases the amount of this material, both in the skin and cortex of the tubers and, if in sufficient amount, makes the tubers unfit for eating purposes.

It should be noted that artificial light, particularly strong electric light, is as harmful as sunlight to the quality of potatoes. Hence, whether the stock is stored in quantity in a storage house, exposed for sale in the retail store, or kept in the apartment kitchen, it should be protected as far as possible from all light.

The most satisfactory storage cellars found in Idaho are those of typically western or arid country origin and development. The 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 rapid decay of the timbers. Under the moisture conditions that prevail in the irrigated 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 cellars 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 as a tool house during the summer. From the standpoint of construction, a low knoll gives the greatest advantage. Perfectly level upland can be used almost as well, however, and is much better than the side of a hill, which, though sometimes used, is not desirable. Other things being equal, an east and west direction, particularly if a driveway goes clear through the dugout, is to be preferred as it gives the greatest ease of ventilation and greatest protection during the winter.

Size of the Dugout

Each square foot of floor space will carry 40 pounds of potatoes piled 1 foot deep. With good, sound potatoes there is no harm in storing at least 6 feet deep; hence, one can safely estimate the capacity of a cellar at 240 pounds per square foot of floor space. Thus a cellar 36x50 feet with a 12-foot driveway will have a capacity of 288,000 pounds or about 2,800 sacks. With the driveway filled to the same depth, as frequently is done, this size of house will hold 4,200 sacks. Recent investigations have shown that sound potatoes stored to a depth of 14 feet were not injured except for the bottom layer which was somewhat flattened by contact with the floor.

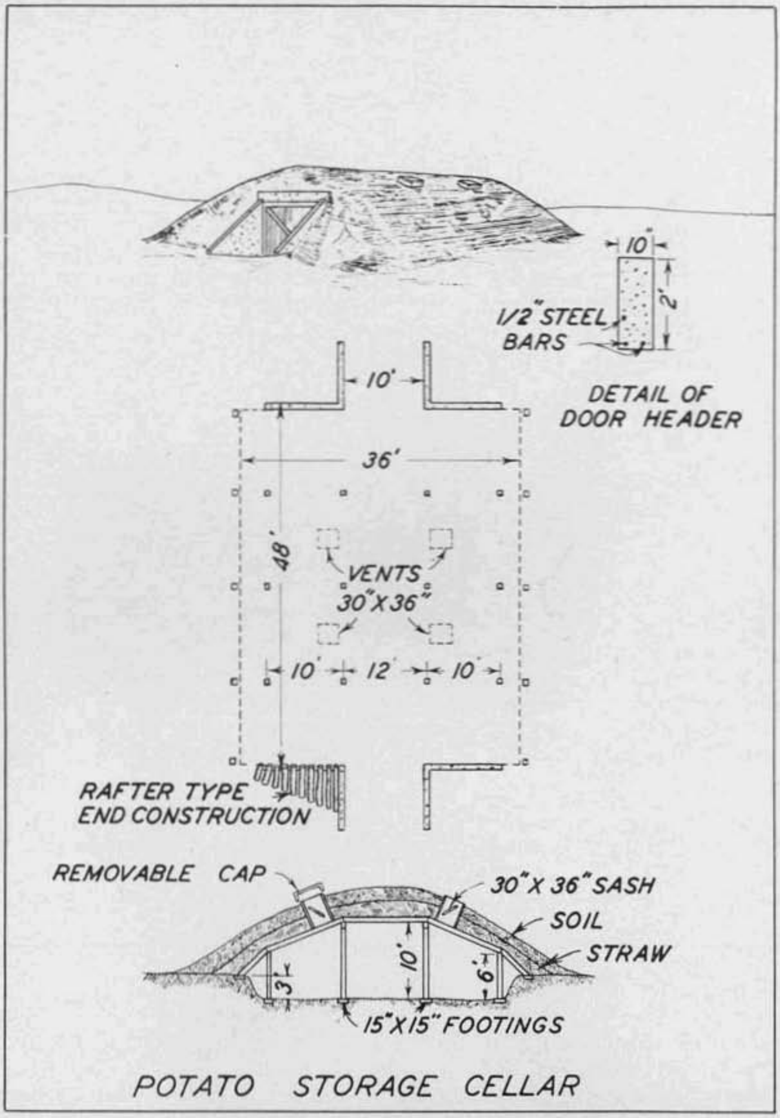

Figure 7.—Potato storage cellar.

Dugouts are made with various dimensions. Cellars of 36-foot width have two rows of bins and a driveway, each 12 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 backwalls. But the greatest objection is that if the total width of the dugout is greater than 36 feet, it is necessary to have four rows of supporting posts, whereas up to 36 feet but two rows are required. Because of this and also because the narrower cellar is easier of construction, the 36-foot cellar generally is preferred.

Depth of Cellars

Though dugouts are of various depths, a close study of the subject has shown there is seldom any advantage in making the excavation more than 3 feet deep. A greater depth nearly always is undesirable, as it tends to make the cellars more difficult to ventilate and more humid than is desirable. A still greater objection is that it necessitates either a steep pitch in the vestibules or an unnecessarily long covered vestibule. Thirty inches to 3 feet of excavation usually will 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 sometimes is necessary to build the cellar mostly above the ground, in which case the soil for covering must be obtained elsewhere.

It always is best to have the driveway clear through 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 most locations other than in sand, side walls are not necessary. 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 of the excavation sloped, for by so doing there is less likelihood that the earth will cave.

Some cellars are constructed by placing the plates for the foot of the rafters on the ground. This method is not recommended. A better method is to set a line of 5-foot posts, or if the purlin is to be mortised into the posts, 6-foot posts, in lieu of an outside wall. These posts should be not less than 8 inches in diameter at the small end, in case of round timbers, or 8 inches square if sawed timber is used. Place these posts not more than 10 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 come in contact with the ground. If the cellar is not more than 36 feet in width, two more lines of posts 6 feet either side of the center are all that will be needed to support the roof. These should be of the same thickness as the outside posts but 11 feet long. If the cellar is more than 36 feet wide, intermediate lines of posts on each side are needed.

Framing the Roof

When good round timber is available, it may be used for rafters, posts, and purlins. Rafters should be sound poles not less than 5 inches in diameter at the small end, and purlins should be not less than 1 foot at the small end. If sawed timbers are used, three 2″x12″ planks nailed together make good purlins. Sawed lumber 2″x12″ also makes good rafters where poles are not convenient. Place the rafters no farther apart than 15-inch centers. If posts are used instead of sidewalls, short rafters must be extended from the purlin 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 2 or 3 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.

Figure 8.—Construction of dugout. Note line of 6-foot posts in place of sidewall, also short rafters running from plate to sill on ground level.

The ends of the cellar may be constructed in the same manner as the sides but, as greater difficulties are encountered here, 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 in a right angle turn 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; otherwise rain or snow falling in the approach will run directly into the cellar.

Covering the Roof

The roof is covered with straw and earth. This is not entirely a matter of economy, as straw and earth make the best available material for insulation. Where rainfall is more than 8 or 9 inches, it is advisable to use an impervious roof over the earth and straw as eventually sufficient moisture goes through the earth cover to cause the straw, and with it the rafters, to decay or even permit the accumulation of water in the cellar. Where a water-impervious roof is used, it also is possible to use less earth on the straw covering which materially reduces the weight on the rafters. This roof may be of boards, shingles, or iron roofing.

Over the rafters is placed hog fence, poultry fence, plain wire, or willow brush to support the straw and earth. Roofing boards sometimes have been used for this purpose, but wire or willows are to be preferred, as boards tend to hold any moisture that gets into the straw, and early decay of straw, boards and rafters is encouraged. On this covering, 3 or 4 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 constructed cellar, a team may be driven over the earth covering after the work is started, as there should be no danger of the roof breaking through. This soil covering need not be more than 6 or 8 inches deep.

Ventilators

Ventilators or chutes should be provided when making the cellar, though the importance of ventilators, from the standpoint of ventilation, usually is overestimated. These ventilating shafts are made in various ways. If it is desired to unload potatoes into the cellar through chutes, such chutes may take the place of ventilators and should be placed near the outside walls of the cellar at intervals of 15 or 20 feet. It may be well 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 cold weather.

These shafts may well be made 2½ x 2½ feet and should project at least 1 foot above the soil covering. Tight board caps are made for both top and bottom as precautions against freezing.

Doors

Frequently the doors are the weakest part of a dugout. If the doors are not properly made or do not fit tightly, freezing is quite likely to occur. 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 halves can be opened while the lower parts are closed, it will aid in ventilation.

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 therefore is well insulated. Ventilation should be largely for the purpose of letting out the heated air and letting in colder air. If the cellar has doors at both ends, this may be accomplished quickly as there is at nearly all times enough current to change the air quickly in the building by opening the doors. Sometimes it may be desirable to change the air in the cellar in winter, which may be done during the middle of the day when the temperature is above freezing. It usually is 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 29° F. However, a fall of the temperature to 35° F. should be a signal to guard against possible frost damage. Fall and spring are the times when closest 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 until 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 of any particular value. Some growers use a rack floor, made of narrow strips on 2″x4″ supports. This allows a circulation of air under the potatoes. In case potatoes are stored in sacks, it also prevents, to some extent, the rotting of the sacks which takes place rapidly where sacks are in contact with the earth. Other than this, there seems to be little difference in the keeping of potatoes, provided they are kept dry and cold.

One of the difficult problems of potato storage is that of holding seed potatoes for late planting. It normally is difficult to keep potatoes from sprouting after the first of May, even in the higher altitude districts. Sprouting necessarily devitalizes the seed stocks to a greater or lesser extent; hence, it has seemed that some method of holding the temperature of the storage down during the spring months should be advantageous.

With an efficient storage cellar as described in the previous pages, a comparatively small cooling element would hold the temperature of at least a portion of a cellar at the desired point, probably 40° F.

Improving the Idaho Potato

Everyone who is interested in Idaho's potato-growing industry is interested in improving the Idaho potato. The Idaho potato crop is the sum total of the production from many farm units. Other than cultural practices, the vitality of the seed stocks used in planting has a direct influence on both the yield and quality of every field of potatoes.

The program of the individual grower should be to take such measures as will tend to improve his potato production. Theoretically, every lot of seed stocks can be improved. At the present but little more than 10 per cent of seed stocks planted in Idaho are certified seed.

Of the remaining 90 per cent of seed stocks planted, part may be comparatively free from disease. However, it generally is conceded that a large part of the seed stocks planted are inferior seed and that the average yield and quality of Idaho potatoes are reduced by the use of such seed stocks. It is a well known fact that seed stocks tend to degenerate unless drastic measures are adopted to prevent such degeneration. Disease undoubtedly tends to increase in a given stock from year to year. This is tacitly admitted by the grower who claims that the seed stock he is planting is out of certified seed one, two, or more years.

Figure 9.—Plots of seed stocks, having a minimum of disease, provide foundation seed stocks which tend to improve the average of production.

Seed stocks can be kept from degeneration, or in many cases improved, on any potato farm in Idaho only if conditions are such that contamination from other sources do not offset the efforts of the grower to prevent deterioration. In any case, the question is whether it is more worthwhile to attempt to improve the existing stock or secure other stocks that are presumably better.

It is an unfortunate fact that the appearance of potatoes in the bin cannot be relied upon as evidence of their freedom from virus disease. In fact, seed harboring the virus diseases that are most commonly instrumental in causing degeneration of stock produce potatoes that are often of better type, smoother, and with shallower eyes than healthy stocks. Rough potatoes often are more desirable seed stocks than some better type tubers. Few diseases of potatoes cause, or are directly responsible for, poor type tubers, as this condition is much more frequently the result of cultural or seasonal conditions. In any case, the appearance of stock in the storage should not be relied upon in judging the value of stocks to be used for planting.

In case bin selection seems advisable in securing stocks for planting, there is less probability of selecting tubers that carry virus disease infection if the larger tubers (10 to 12 ounces) are used for planting.

Several methods of improving seed stocks may be employed. The hill selection and tuber unit method is applicable to any grower who can isolate a plot where re-contamination will not nullify his work. However, the experiences of many growers who have attempted to improve their stocks by field selection have shown that when the percentage of transmittable diseases, such as the various virus diseases in the field, is more than 4 or 5 per cent, the selection avails but little in reducing the per cent of disease. This is because of the number of plants that have become infected but, at the time of selection, do not show symptoms of the trouble.

Where selections of apparently healthy plants are made for improving the stock, the product from the individual plants should be planted the following spring in either hill or tuber units. By hill units, we mean the several tubers of each hill, separately saved, should be planted by themselves so a comparison can be made with the product from other hills. Tuber unit planting is even better as individual tubers may show the infection when other tubers from that plant may be healthy.

Tuber uniting consists of dividing a tuber into a definite number of equal sized cuts (usually four) and planting in a unit that is separated by a space in the row so that each unit of four can be recognized. The practice of tuber unit planting to improve potato stocks is based on the assumption that all plants in the unit will show the character or diseases carried by that individual tuber. If this is carried to the hill selected unit, the sameness of plant character and disease, or freedom from disease, as the case may be, will not follow to the extent that usually is observable in the tuber unit. However, if many hill units are planted there usually will be quite a marked difference in the various units compared. A general lack of difference between units indicates that the stock from which the selection was made was above average in freedom from disease. Such work is worth while not only as a means of securing better seed stocks, but also as a demonstration of the variation in plants of which most fields of potates are composed.

Growing Seed Potatoes

Growing potatoes that are intended for seed rather than the commercial market is in most cases a project apart from commercial production. While it is possible to grow seed satisfactorily in all the potato growing districts of the State, most of the seed growing is done in the higher altitude or cooler districts. Some of the reasons for this are that disease-producing agencies seem to spread more readily in areas of high temperature and more difficulty is encountered in isolating the seed fields from commercial fields. The requirements, in the way of late planting, greater distance between plants, etc., make seed growing in areas that can produce high acre yields, unprofitable to the grower other than on a small scale for local use.

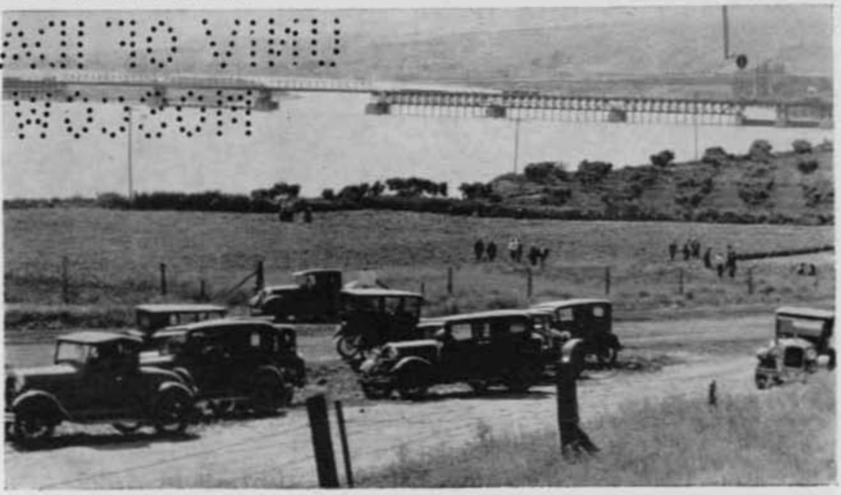

Figure 10.—Studying seed potato test plots in the field where samples of the seed to be used for growing seed stocks are tested.

As a result of these factors, seed potato growing as a business is confined largely to the high altitude districts of the eastern part of the State and to the unirrigated lands of the northern half of the State.

Seed potatoes that are planted with the expectation of having them certified by the Idaho Crop Improvement Association in co-operation with the University of Idaho Agricultural Extension Division are grown under regulations promulgated by that authority. These regulations are subject to change from time to time and may be secured from the Extension Division of the University of Idaho at Boise.

Cull Potatoes

Potato growing never can be brought to such a point of perfection that a certain proportion of the crop will not be low grade stock or culls. It is to the interest of every grower to grow his potatoes in such a way as to reduce the percentage of culls to the lowest possible figure.

Where small acreages are grown and where the farm operation is balanced with livestock growing, the problem of culls is of relatively little importance as all the low grade potatoes can be used to good advantage in the feed ration.

With the present status of the potato-growing industry in Idaho, even a 10 per cent cullage brings the total amount of culls well up into the millions of bushels. A small percentage of these at present are utilized as potato flour, for alcohol production, etc.; but for the great mass of potatoes produced that are too low in quality for human use, there is no satisfactory means of disposal other than through use as stock feed.*

The difficulty in utilizing cull potatoes as stock feed is that great quantities of cull potatoes are centered where there is comparatively little livestock so that the factor of transportation enters into the problem.

* See Idaho Extension Bulletin 134, *Feeding Potatoes to Livestock*.